The WIRELESS AGE

"America's Foremost Radiophone Review"

May
25 Cents

"Everything For Which We Fought Has Been Accomplished"

Cunningham

Tubes for Every Requirement

Vacuum tubes are used for two distinct individual purposes in a receiving set—as DETECTORS and as AMPLIFIERS. The qualifications of a tube for these two uses are so different that for maximum efficiency tubes of entirely different design must be used.

This point was one of the chief considerations of the research engineers who designed Cunningham tubes in the great laboratories of the General Electric Company. After years of research and experimental work, the Cunningham C-300, a SUPER-SENSITIVE DETECTOR, the Cunningham C-301, a DISTORTIONLESS AMPLIFIER, and the Cunningham C-301A, a LOW FILAMENT CURRENT AMPLIFIER AND DETECTOR were developed. These three tubes, now nationally recognized as standards for all types of receiving sets, are responsible for the highly perfected results obtainable in radio phone reception.

The trade mark GE is the guarantee of these quality tubes. Each tube is built to most rigid specifications.

TYPE C-300
Super-Sensitive
DETECTOR
$5.00

TYPE C-301A
¼ Amp. Fil-Current
Amplifier and Detector
$6.50

Patent Notice— Cunningham tubes are covered by patents dated 11-7-05, 1-15-07, 2-18-08 and others issued and pending. Licensed for amateur, experimental and entertainment use in radio communication. Any other use will be an infringement.

E. T. Cunningham

Home Office:
248 First Street
San Francisco, Calif.

Eastern Representative:
154 West Lake St.
Chicago, Illinois

Brandes

Used by over 500,000

THE so-called amateur in radio is, in fact, an expert. Experimenting is the very breath of life to him.

When it comes to the radio headset, however, you can't experiment. The headset requires precisional manufacture in every detail and painstaking study of acoustics to assure the matched tone quality in both receivers. A Brandes *Matched Tone* Headset can be depended upon as a basic requirement of successful experiment in getting radio from near and far distances.

¶ Send ten cents in stamps for the "Beginner's Book of Radio." It explains radio in terms that anyone can understand.

Distributors in Australia and New Zealand: International Electric Co., Wellington, N. Z.

Made in Canada and England by Canadian Brandes, Limited, Toronto and London

Distributed in Canada by Perkins Electric Limited, Toronto—Montreal—Winnipeg

C. Brandes, INC. - 237 Lafayette St., N.Y.C.

Matched Tone

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

Radio Headsets

Volume 10 *Edited by* J. ANDREW WHITE *Number* 8

May, 1923—Contents

PUBLISHED MONTHLY AT WIRELESS PRESS, INC., 326 BROADWAY, NEW YORK
GREAT BRITAIN, 12-13 Henrietta St., London. AUSTRALIA, 97 Clarence St., Sydney, N. S. W.

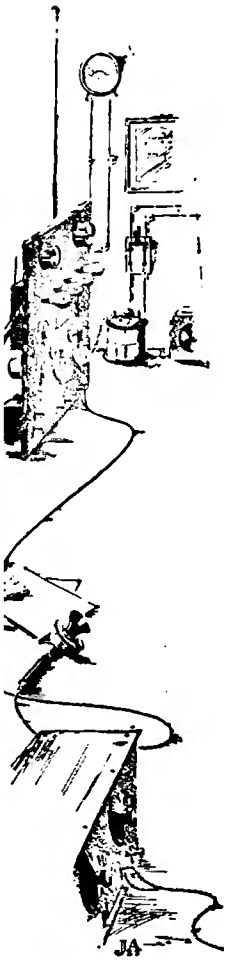
BOSTON, MASS., 18 Boylston St. Guy R. Entwistle
CHICAGO, ILL., Marquette Bldg. Wheeler & Northrup
LOS ANGELES, CALIF., 456 So. Spring St. Coast Publishers Co.

Yearly subscription in U. S. A., $2.50—Outside U. S. A., $3.00; Single Copies, 25 cents. Entered as second class matter Oct. 9, 1913, Post Office, New York, N. Y., under the Act of March 3, 1879. Wireless Press, Inc. When subscription expires you will find a renewal blank enclosed. Return with remittance promptly. Notify us of any change in your address, giving both the old and new location.

James G. Harbord, Pres. J. Andrew White, Vice Pres. L. MacConnach, Secy. George S. DeSousa, Treas. J. O. Smith, Business Mgr.

Printed in U. S. A.

In Our Opinion



THE outlook for the approaching summer is far better and more interesting than ever before to the radio enthusiast.

Broadcasting Without Interference

In years gone by interest in radio during the warm months invariably lessened, for one reason or another, but the increasing appreciation of the programs of the broadcasting stations seems sufficient to keep the public listening throughout the coming summer. And if additional inducements were needed, it might be pointed out that a big thing has been done for radio in the recent decision of Herbert Hoover, Secretary of Commerce, to re-allocate wavelengths for practically all types of stations using wavelengths below 3,150 meters. The few exceptions made are those where the wavelength is fixed by international law.

Greatest interest is centered in the broadcasting stations, which under the new arrangement of wavelengths will be placed in a position to transmit with little, if any, chance of the objectionable interference brought about by many carrier waves on one wavelength. The new arrangement provides a separate and individual wavelength for each Class B station. To do this, three bands of wavelengths are to be used, one between 288 and 300 meters, another between 300 and 450 meters, the third between 450 and 545 meters. This gives a total of 258 meters available for assignment to the various stations in that classification, or sufficient leeway to enable the Department of Commerce to assign wavelengths far enough apart to preclude interference.

Existing Class A stations will eventually be assigned to wavelengths in a band between 222 and 286 meters, although this will not be done immediately. Meanwhile, these broadcasters will continue on 360 meters, and will be known for the time being as Class C stations.

The Radio Conference has done a good job. The end is in sight of the troublesome and annoying interference which has prevailed in broadcasting for many months, following which there will be greater public interest in a satisfactory year-round service, with a small number of high-class stations efficiently delivering programs to the greatest possible number of listeners.

* * *

THE old method of the sneak thief, who gains admission to houses or apartments by posing as an "inspector," is being used to prey upon radio fans, according to S. H. Foster, a burglary insurance expert.

A New Version of An Old Game

The latest development calls for the representative of the light-fingered fraternity to represent himself as a "radio" inspector. He looks over the installation gratis, just to make sure that everything is all right. While doing so he also looks over and becomes greatly attached to anything of value that may be within reach.

Water, gas, electric and insurance companies provide their inspectors and meter readers with badges and other credentials, as well as with more or less definite uniforms. The radio inspectors of the Department of Commerce, who, by the way, inspect only transmitting installations, wear a badge with Uncle Sam's authority on it.

And so, Mr. and Mrs. Reader, when the next "radio" inspector comes around, be sure he's fixed up with proper credentials before you extend to him the freedom of your home.

* * *

GREAT increases have been registered in trans-oceanic business both by radio and cable during the past year. These facilities have never before been used to so large an extent in conducting the world's commerce. Cross-ocean messages once were looked upon as luxuries, or considered only in emergencies; but today they have a new status with the business world. When a quick turn is called for, or speedy presentation of a proposition, or when quick acceptance or refusal is necessary or desirable, industry automatically turns to radio or the cable.

Radio and the World's Business

That this new order of things has found ready acceptance in international business is undoubtedly due to lower message rates. Lowering the cost has been radio's job. And the task has been accomplished through the development of many trans-oceanic radio circuits in competition with the cables, and to the adoption of cipher codes which express whole commercial sentences in single code words.

The near future promises the development and perfection of more and more international radio circuits, and it is a reasonable assumption that some day all trans-oceanic business will be conducted by radio, the mails being used as a supplementary service for confirmation of messages and for necessary details.

* * *

FORTY-SIX years ago a fire in the United States Patent Office destroyed many valuable records, particularly what are known as the "file wrappers" of patent proceedings. In consequence, protection of patent rights by recourse to the records prior to 1877 has been greatly hampered. This concerns the radio industry little, if at all, as its growth has taken place entirely within the last twenty-one years. But the same conditions that made the fire possible nearly a half-century ago still exist, and hundreds of thousands of irreplaceable patent documents at any moment may be destroyed.

Inadequate Patent Storage

The records are stored under conditions of extreme fire hazard, being kept on open wooden shelves in tiers on the top floor of the Patent Building, which is of the central-court type. A blaze once started in this mass of paper and wood would readily sweep the interior.

Considering the vital nature of patents in a new and revolutionary industry such as radio, it is evident that the situation is one of serious concern. The risk of irreparable loss cannot be contemplated with an easy mind. Any further delay in providing proper facilities for preservation of these unique and invaluable records is inexcusable, for the required appropriation is infinitesimally small in proportion to the financial losses this situation makes possible.

VIRGINIA PEARSON could have spoken of beauty by radio, but instead she told plain truths about Hollywood. "Movie people are just like everybody else," she explained, "only their faults are magnified. The trouble is that—" but read about it on page 36

As Diverse as Life Itself Are Radio's Many Uses

"You had a close call, young man," says Dr. John Irwin of the "President Harding." Joseph LaRue was blinded at sea; help was called by radio, and Dr. Irwin cured him

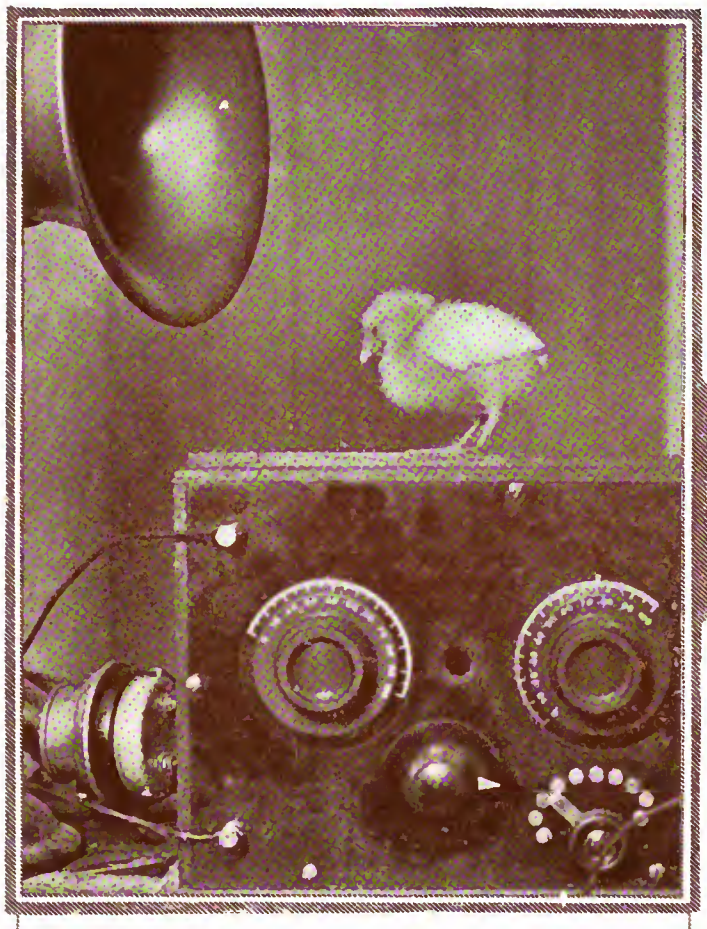
To the old song about "rings on her fingers and bells on her toes" must be added a verse putting "radio in her hat." This is Miss Marie Fleming wearing "The Tuner" hat, and a smile of enjoyment, the latest in fashion

The last years of the fast-thinning ranks of the G. A. R. are being cheered by radio. Think what this Army has seen developed—the telephone, electric light, autos, airplanes, and radio

Another radio automobile—this time containing Paul Van Beekman, Mrs. R. V. Pell and C. F. Stillson. They listen in when awaiting their turn at the traps on the grounds of the Westchester Biltmore Gun Club, Rye, N. Y., shutting out the wails of the clay pigeons and the barks of the guns

The pop-eyed young man can hardly believe his ears—they are hearing broadcasting inside the bank vault of the Stratford (Conn.) Trust Company. The test conducted by the company's officials proved that radio waves can penetrate steel and cement walls and electric wiring

Chicks, Children and Actors Succumb to Radio



Pete has just spied a radio bug—or does that introspective glare in his eye mean that he has just turned into one? Pete is a regular chick, no cluck stations for him!

Here is "Uncle Robert," known to thousands of children as just that. He is holding Evelyn Kriloff, aged 8 and blind, during a radio concert. Broadcasting helps him bring joy to all

If you go to the Permanent Radio Fair in New York City you need not fear that you will be expected to behave like this—oh, no! These are movie antics. When Johnny Hines, Charlie Murray and five-year-old Russell Griffen, film stars, visited the Fair they yelled "Camera!"; that faithful slave winked his eye—and there (and here) you (and they) are!

Intimate Views of Those Who You Have Heard

LEO ORNSTEIN is a composer of modern music, yet he thinks radio should teach the classics. See page 35 for his message

JOHANNA GADSKI, the famous operatic soprano, thinks that radio serves best the unknown singer. But, as told on page 33, she herself has broadcast to the radio audience

ROGER KAHN, son of the international banker, Otto Kahn, is only 16, but he has been heard on the air in saxophone solos. He is a radio fan, of course, and uses his radio sets for his own entertainment and that of his guests

DOROTHY FRANCIS, formerly of the Chicago Opera Company, and Leopoldine Damrosch, daughter of the famous Walter Damrosch, tell on page 29 what radio means to musicians—and how music aids operators of receiving sets throughout the country

THE "IDEAL PROGRAM"

I would like to hear daily by radio:

.....Hours.....Minutes Classical and Operatic Music

.....Hours.....Minutes Jazz and Popular Music

.....Hours.....Minutes Market and Weather Reports

.....Hours.....Minutes Speeches and Lectures

.....Hours.....Minutes News, Including Sports

8 Hours 48 Minutes Total Time Daily

Here is my idea of the value of broadcasting {Educational [3] Entertainment [1] Information [2]}

(Use the numerals 1, 2 and 3 to show relative importance. If you think Educational value is first put a 1 in that square, etc.)

I would like my nearest stations to Transmit More [\] or Less [ ] (mark which)

I prefer music produced (mark how) {Personally [1] By Phonograph and player piano [ ]}

REMARKS: .....

.....

.....

.....

.....

.....

Have we your permission to quote your remarks in THE WIRELESS AGE?

The Community I live in is (mark which) {Industrial [ ] Agricultural [\] Big City [ ]}

Name ..... Age..

Address .....

.....

Mail to THE WIRELESS AGE, Program Editor
326 Broadway, New York City

(If you do not wish to mutilate your copy by tearing this out, write your program on a plain sheet of paper, or send us a postcard and we will forward a duplicate blank for you to fill out.)

Giving the Public What It Wants

Broadcasters Spend 34 per Cent of Their Time Transmitting Operatic and Classical Music—"Average Program" Shows Interesting Facts

By Ward Seeley

When the vacuum tubes are turned off for the night—and sometimes before—the listener writes his applause or criticism. That is how the programs are really directed by the radio audience

WHAT does the public want? Does it want jazz? Or does it prefer classical and operatic music? What value does it get out of market and weather reports? Does it really like to listen to lectures and speeches? Does it discriminate against mechanically reproduced music, or does it prefer the reproduction of the talent of a first grade artist to the performance of a second or third grade local celebrity?

If there are any persons in this country who are capable of answering these questions, and answering them accurately, they are the program directors of the various broadcasting stations. They are intimately in touch with the state of public opinion concerning their programs. Radio fans have in the course of two short years earned a wonderful reputation as letter writers. If a feature pleases them exceedingly they have a habit of writing to the station, and telling it so, and they do as much if it displeases them. The radio audience reacts in the mail.

This is really an extraordinary advantage for broadcasting. A man who is running a theatre or moving picture house knows very quickly by the box office receipts whether what he is producing meets with public approval, but he very seldom is able to learn exactly why something is liked or disliked.

The people either buy tickets or do not, and the rest is just rumor.

The broadcasters, however, get it all down in black and white.

They know.

THE WIRELESS AGE has undertaken to perform a valuable service for both the broadcasting stations and the radio audience by preparing a symposium of the public's reactions to the broadcasting programs. The data was secured through questionnaires sent to every broadcasting station, asking for details of their programs and information as to the reaction from the radio audience. The facts given in this article are drawn from those questionnaires.

The basic facts revealed in this matter may be summarized very quickly. Some of them were, to say the least, unexpected, and they will surprise many people.

First, despite the current popular opinion that the great majority of the American people prefer jazz to all other music, American broadcasting stations devote only 25% of their time to that type of entertainment.

Classical and operatic music takes more of the average broadcasting station's time than any one item.

Jazz is in second place.

Market and weather reports are in third place, occupying 23% of the time, and speeches and lectures are fourth, taking 18% of the time.

THE "AVERAGE" PROGRAM

Is put on the air with a power of .....203 Watts

Each week it contains:

Classical and Operatic Music	3.0 Hours	34%
Jazz	2.2 Hours	25%
Market Reports and Weather	2.0 Hours	23%
Speeches and Lectures	1.6 Hours	18%
Total per Week	8.8 Hours	100%

It is produced:

Personally, in Studio or by Remote Control	6.3 Hours	72%
By Phonograph or Player Piano	2.5 Hours	28%
Total	8.8 Hours	100%

The average length of transmission time per week is 8.8 hours, which will surprise those who live in the big cities and are accustomed to having at least two powerful stations occupying the air for four or five hours daily.

The taste of the American public is decidedly in favor of personal performances in the studio, for 72% of the programs are thus transmitted, and only 28% consists of reproducing the music of a phonograph or player piano.

The composition of the radio audiences has puzzled a great many. Nobody knows just how numerous they are or where they live. But 44% of the broadcasting stations estimate that the farm audience outnumbers the city, 39% of the stations say that the city listeners are more numerous; and 17% make it a 50-50 straddle.

The questionnaires from which these figures are drawn of course came from every part of the country and include broadcasters of all types, from the tiny 5-watt transmitter to the powerful 1,000-watt station with a trans-continental and trans-oceanic range. Some of the questionnaires were accompanied by letters of great interest, many of them revealing that the lot of the program director is not as happy—or as easy as it may seem to those who merely listen. He has some real problems, and in the strenuous business of solving them has come to hold very firm opinions.

For instance, station KGB at Tacoma, Wash., comments in a striking

manner upon the difficulty of pleasing everybody:

The question, "What the public wants," is one we have been endeavoring to answer ever since we began broadcasting. We are ever and anon searching for what the people want. And it's a hard job, believe me! I have often before, and I think it is fitting here, compared a broadcasting station with a newspaper. The same necessity for pleasing everyone is present in both cases. Just as a newspaper must endeavor to please both the minority and the majority, so a broadcasting station must cater to the likes and dislikes of every class of people.

For instance: There is a class of people who absolutely abhor jazz and go in strongly for music of a more classical nature. On the other hand, there is a class just diametrically opposed to the first sort. They are strong for syncopation and too much of the music they term "high brow" elicits only some very choice expletives of abuse. Consequently, it is necessary to so arrange

SPORTS?

It's a raw November day at the Yale Bowl, from which the Yale-Harvard football game is being broadcast

the program so that there is a preponderance of neither and a sprinkling of both. Manifestly, there will always be someone who will be displeased. You can't please 'em all, is the cry every program director in the nation is wailing to high heaven. Perhaps some day some hitherto and undiscovered genius will discover some way of pleasing everybody. Until then, however, in the words of a well known cartoonist, "try and do it!"

When I mention novelties as the feature of greatest popularity, I mean anything new or novel pleases the radio fans. I am always on the lookout for something new and unusual. Since these are nearly always music, it means that music comes under the category of a feature of first importance on our programs. We are pulling stunts of all sorts. They are the sort that make the fans talk about them afterward and KGB is getting a better and more widespread reputation every day.

Let me illustrate what I mean by a novelty. Late in July KGB broadcasted a complete marriage ceremony from the bridal march and the soloist to the marriage vows and the nuptial kiss. We presented a trip around the world with records. That was a hit. The other night we gave a record minstrel show with a lot of novel effects and every mail brings us more letters of congratulation on the affair. Shortly we are to present a debate via radio and a bunch of new and novel features. The same old thing grows tiresome and if a broadcasting station desires to keep its auditors it must keep them interested.

I shall be interested to learn the opinions of the other broadcasting station operators of the country. My observations have been

THE RADIO AUDIENCE

44% of the broadcasting stations report the farm audience outnumbers the city one.

39% of the stations say the city listeners outnumber the farmers.

17% make it "fifty-fifty."

earned by dint of cruel experience. It's a mean thing to say, but there is no audience in the world so unappreciative as a radio audience, it seems to me. They are more prone to complain than to praise and criticize more often than they endeavor to help. But still, I don't suppose it really is because they are unappreciative that we seldom hear from most of them, but that they are merely undemonstrative. I wish they could come to know that a broadcasting station gets no other return for its work, in 99 cases out of a hundred, but the scant praise and kind words of appreciation it gets from some of its auditors.

Hardly less determined is the attitude of KFED of Billings Polytechnic Institute, Billings, Montana, which got a license, listened in, and from the simple experience of using its ears, decided not to say anything at all.

First of all, let me say that our own broadcasting station, KFED, is no more. By the time this reaches you, the license will have been returned to the Radio Inspector, and cancelled at our request. We never broadcasted a single program, mainly because the public does not want the kind of programs we could offer. If some five hundred other owners of broadcasting stations would follow this example and return their licenses, leaving a few of the very best stations to do the broadcasting, then the public would be pleased. Broadcasting by small local stations is detested by all except the few small boys who are experimenting with crystal sets.

Of all the many things put out onto the ether today, the following are mentioned among those least desired: Advertising, direct or otherwise; long drawn out announcements (not more than 5 per cent. of total program should be thus consumed), acknowledging cards, addressing individuals, sermons, and other religious services. The churches will be far better off if they will confine their services within the walls of the church itself, rather than send them out into the air mixed with the racket of the jazz band.

I shall not try to enumerate the many good things which can be sent out from a broadcasting station, but I will try to answer your question in regard to the most important economic service. In my opinion the greatest service rendered in broadcasting lies in the good wrought by virtue of the pleasure and entertainment afforded isolated peoples, such as farmers and ranchers in sparsely settled districts, etc. Radio brings these people into touch with the outside world, and so is a godsend to them.

The broadcasting stations which send out programs after 10:30 P. M. are doing a great deal of harm by encouraging people to stay up until the wee small hours to listen to their jazz music.

OPERA RECITALS?

Thomas McGranahan, Regina Vicarino and Percy Hemus, giving a studio performance of an opera

KFED was to have been operated by an educational institution, and it is essential to note that many colleges and schools in all parts of the country are operating broadcasting stations on an educational rather than an entertainment basis. As WCAS, The William Hood Dunwoody Industrial Institute, Minneapolis, Minn., says, "The educational side of our service seems to be the most important phase of it. We are looking forward to this with growing interest, and feel quite sure that it will be one of the most important services rendered by radio transmitting stations. We believe that the people will tire of the common music, in fact it is hard to get something new, whereas the educational features contain useful information and this is what many people desire."

WBAA, Purdue University, Lafayette, Ind., gives most of its time to lectures, engineering and agriculture, and makes it plain that it has "made no attempt to develop entertainment side of broadcasting, but find that there are

SCIENCE?

Hudson Maxim thinks man may be banished by insects, and has broadcast his alarm by radio telephone

many listeners who are interested in educational features."

Station WHA, University of Wisconsin, Madison, Wis., has a bolder spirit because it violates what many people consider to be the essential rule of success in any endeavor, namely "give the people what they want."

Says WHA, "we are guided not so much by what the public wants as by what the public needs in our broadcasts. The University of Wisconsin believes there is a large field for serving the citizens of Wisconsin and adjacent states by disseminating educational and informational talks by means of the radio telephone."

That station transmits no music.

Diametrically opposite is the attitude of WOAN, The Vaughan Conservatory of Music, Lawrenceburg, Tenn., which confines itself almost entirely to music, with only about half an hour a

week of jazz. WOAN notes as its most important service "the inculcation of a spirit of cooperation in the communities covered by the concerts. Market and weather reports are to be broadcast as soon as the station can make arrangements to secure them."

Still another angle of the educational service of the radio telephone is seen by WCAL, St. Olaf College, Northfield, Minn., which prefers to educate by transmitting the classics, rather than placing emphasis on lectures by teachers or other authorities. The most popular program that this station has transmitted "was the broadcasting of Shakespeare's 'As You Like It' by a student cast which had previously transmitted the play in the college auditorium. Our reports of athletic contests and scores are eagerly awaited, it seems. Reports indicate that listeners appreciate classical music. Religious services from this station are greatly enjoyed. In response to insistent demands, the Shakespearian play is to be repeated."

CHARITY?

Mrs. August Belmont, society leader, broadcasting an appeal for the Red Cross, which drew many contributions

Other institutions of learning consider that the broadcasting of college games appeals most to the radio audience.

KFDJ, the Oregon Agricultural College, Cornwallis, Ore., ranks college sports as first in popularity, college musical clubs as second, and lectures third. Station WSAJ, Grove City College, Grove City, Pa., last winter broadcast its championship basket ball games, play by play, and as the team of this college led the league in percentage of games won, its broadcast reports were filled with intense interest for Pennsylvanians.

WCAZ, Carthage College, Carthage, Ill., did exactly the same thing and says, "the basket ball games, play by play from the gym, with rooting, band and noise have brought hundreds of answers from all parts of the country."

The University of Colorado, KFAJ, at Boulder, Col., places its athletic reports first in popularity, and is almost alone among the stations in mentioning "late releases of Edison and Brunswick records" as having attracted public commendation.

On a different basis is WCN, operated by Clark University, Worcester, Mass., which, while five out of its twelve hours a week are given over to jazz, outlines its policy as follows: "It has been the intention to develop the Clark Station in so far as possible along lines of permanent value. For this reason we have been particularly interested in such government reports as crop, market, commerce and weather reports, as far as circumstances would permit, in putting on the air worth while things in literature and music, as well as lectures of some educational value."

Still another policy, and a new one in broadcasting is explained by WHAZ, the famous station operated by the Rensselaer Polytechnic Institute at Troy, N. Y., which has been heard in every State in the Union, in the Pacific ocean and even in New Zealand. "We are trying to give all the social units in this district an opportunity for self expression, artistically and emotionally, through music, intellectually and morally through the medium of lectures," explains WHAZ.

There are a number of broadcasting stations operated by newspapers and on the surface it would appear that the one person most fitted in all the world to ascertain the wants of the public, would be he who publishes a newspaper and operates a broadcasting station. But the newspapers themselves are highly individual in type and so are the broadcasting stations owned by various dailies all over the country.

WGF, the *Register & Tribune*, Des Moines, Iowa, devotes half of its time to jazz and 40% to classical music. These percentages may reverse themselves, for the program manager says "we broadcast considerable high grade music, and the demand for it is increasing. 90% of the programs are personally produced." WGF explains "we work only Tuesday and Friday evenings, and a church service Sunday. We operate thus on the theory that it would be impossible to present first class programs every night, and because persons in the locality of a broadcasting station grow very weary of daily and nightly broadcasting by the same station, which cannot be tuned out to get distant stations. Many stations, we believe, are making a great mistake in an effort to get their money's worth out of their investment in a transmitter."

MARKET NEWS?

Herschel Jones, Director N. Y. Office of Farms and Markets, furnishes daily agricultural news to everybody

Station WMAQ, operated by the Chicago *Daily News* and The Fair, located in The Fair Store, Chicago, gives three-fourths of its time to classical music and says "we have found from our vast correspondence that the general tendency of the public is a demand for the higher class in music and along educational lines. We give one popular

JAZZ?——————BAND MUSIC——————OR MILITARY?

Many like to trip the light fantastic to jazz music furnished by radio from some such organization as is shown at the left; others prefer the steadier rhythms and more moving strains of the military brass band

program a week, on Saturday night, when we generally have a dance orchestra."

The *Morning Oregonian*, operating KGW in Portland, Ore., is another newspaper that finds that classical music is apparently more popular, but it carefully points to a flaw in its method of drawing its conclusion. "The response from concerts of classical music is greater than that from concerts of dance music, but this is because the people who appreciate it are such that will take the trouble to write or telephone."

WIAR, The Paducah *Evening Sun*, Paducah, Ky., is not at all critical of the writing ability of any parts of its audience, and reports its surprise "at the number of persons who write in about the programs preferring old time, sentimental music to jazz and operatic numbers. The majority of our letters come from persons in the small towns and the country proper."

None of these newspapers place any particular emphasis on market reports or news, which some people might consider entirely natural. There are at least two stations, however, that make a dissemination of news, and particularly market reports, their main reason for being. Station WMAJ, operated by the *Daily Drovers Telegram*, Kansas City, Mo., gives its entire time to market reports. It is on the air for ten minutes of each hour, from 8 a. m. to 3 p. m., giving the latest quotations as received from the markets in Chicago, St. Louis, and Kansas City. "That these reports are appreciated are shown by the letters stockmen and farmers send, thanking us for the service," says WMAJ.

Another station that devotes most of its attention to markets is WJAG, The Norfolk *Daily News*, Norfolk, Neb. It only gives 1% of its time to music, equally divided between opera and jazz, and the rest of its attention is devoted to current events and market reports. WJAG says of its listeners that "They do not listen to educational programs. We receive hundreds of cards, telling us that our service is preferred on account of the markets and current events. We are in an agricultural community and do not try to compete with the larger stations at night. All our broadcasting is done in the daytime. We are out to serve the farmers, and do seem to be giving them what they want. Our station seems to be more of a commercial plant than one of entertaining."

The rest of the broadcasting stations do not fall easily into set classifications. About every kind of firm and type of individual has a broadcasting station of one kind or another.

That it is quite possible to go from one extreme to another in trying to please the public, is indicated by KGO, Altadena Radio Laboratory, Altadena, Cal., which it describes as follows:

> When we started broadcasting last July, the local broadcasting was too jazzy and of poor quality, so we put on old time songs and classical music with Edison records, giving better results than the personal artists. Now the complaint is that the Class B stations are too highbrow and have turned to us for lighter music. The old jazzy stations have practically all quit. In our opinion, people do not want education, lectures, etc., by radio and when the other stations are giving lectures they tune us in for dance.

This station now divides its time equally between dance music and classical music, and uses its phonograph practically exclusively.

Station WLH of Indianapolis, Indiana, is just going through the process of cutting down the percentage of jazz. It reports "our listeners are very tired of jazz and mediocre music or programs. We are trying to furnish only the best. Our patrons say they will raise a fund for high class talent. This is our next move."

A station that feels that it has gone through the situation from the start to a satisfactory finish is WRK of Hamilton, Ohio, which now transmits no jazz and divides its time equally between classical music and lectures. The lectures include talks prepared by the Department of Health but "the audience does not like them very well. The only kind of lectures that seem to take are those on radio for city dwellers, Department of Agriculture for rural and farm people. All like the musical programs."

Just one station confesses, whether boldly or reluctantly it cannot be said, that it is operated for business purposes. WEAP, Mobile, Ala., says the "station so far has been used principally as a feeder for trade at our store to stimulate sale of sets and parts."

One of the surprising facts developed by this questionnaire is the number of transmitters of exceedingly small power, some of them having only 5 watts, others ten, fifteen, twenty and fifty. Because the large stations of 500 watts power have the greatest audience, probably most people think that most stations are that type, but this is far from being the case. Even when to the 500-watt stations are added the 1,000-watt plants such as KDKA, WJZ, and WIP, the number of low power stations is sufficient to draw the average down to 200 watts.

Out of the great pile of questionnaires from all over the country, received from the weakest and most powerful stations, we have drawn the conclusion that music of a jazzy type is declining in popularity, and that classical music and market reports are in the ascendancy in the broadcasting programs.

Also it has been concluded that the radio audience prefers to listen to personal performances, either in the studio or by remote control, and that the phonograph and the player piano are falling behind in popularity. These conclusions have been drawn not direct from the radio audience, but indirectly from a study of reported programs, on the theory that the broadcasting stations are giving the public what it wants.

Are they doing so? Are the broadcasting stations obeying the mail and telephone requests of their radio audience, or are they editing the desires of the public according to their own ideas of what the programs ought to be?

You can answer the question finally. You can check up on these questionnaires that were filled out so completely by the broadcasting stations.

On page 22 you will find a blank form on which you can indicate your preference in the way of a program.

Fill it out and send it in to THE WIRELESS AGE.

What is the ideal program?

TIME SIGNALS?

Everyone knows where time goes—here is where it comes from; the Naval Observatory time signal office in Washington, D. C., the ticks of whose standard clock are heard all over the country by wire telegraph and by radio

When "All the Air's a Stage—"

And the Radio Audience Joins the WGY Players in Creating the Illusion of the Spoken, but Invisible Drama—Success of Schenectady Station in Presenting Plays—How It's Done

By Charles H. Huntley

ROW after row of faces; evening gowns that give touches of color, here and there, under the light from shaded lamps; the hum of conversation, the rustle of programs, the music of the orchestra, the curtain whose raising is impatiently awaited—all within the four walls of a hall which, at the most, is not very large.

Such is the usual picture of the home of the acted and spoken drama—a very familiar one and, until a short time ago, the only one.

But now there is another. Fancy a theater two thousand miles and more across, with some of the theater-goers miles from the occupants of the next chair. Visualize an audience of business men, of factory workers, of professional men and of farmers; of grandmothers and granddaughters, of society leaders and of maids; some in vigorous health, some confined to their beds by illness; some dressed for the cold of a northern winter, some in front of windows opened to admit the breezes of a semi-tropical night. Imagine them not as assembled in any one room, but in thousands of rooms scattered through the immense domain that lies between the two oceans and extends from the Great Lakes to the Gulf of Mexico.

This is the picture of the great theater that broadcasting the drama has has brought into existence. Station WGY has reversed Shakespeare's observation that "all the world's a stage." It has made not all the world, but that very considerable part of it comprising the United States, a theater of which this station is the stage.

One night of each week there goes radiating out from it the sound of a voice, borne by radio waves, announcing, "Station WGY, General Electric Company, Schenectady, New York. Our program for this evening will consist of the drama—," and then follows the title of the play.

Doubtless many of the thousands who listen to the broadcasting of these dramatic productions have often tried to visualize the actual "staging" of the plays. Do the players, they wonder, appear in costume; do they commit their parts to memory; are the scenes acted as on a real stage?

The questions are easily answered. They do none of these things, and there are excellent reasons why. For instance, were the play to be acted, scene by scene, there would be many times when, the faces of the actors necessarily being turned away from the direction of the transmitting apparatus, it would be difficult for the audience to hear them.

The actors who are taking part in the scene are grouped in front of a microphone, the women being closer to it than the men because their voices are lighter.

The parts are not committed to memory, but are read from manuscript; hence there is no forgetting of parts, no delay in responding to cues. It is not to be assumed from this, however, that there has not been very careful preparation. There has been. Long in advance of the presentation each of the principal actors has had a copy of the entire play and those taking lesser rôles have had their individual parts.

These parts have been studied with the greatest care. It is to be remembered that in broadcasting a drama the actors have to rely on the voice alone to convey the impression they wish to create. The aid which acting gives on the actual stage is lacking. Exceptional skill in declamation is called for, therefore, as well as clear enunciation and careful modulation, to say nothing of that quality of voice which lends itself to transmission by radio.

The plays are carefully rehearsed before the actual presentation takes place. Here it may be said that the practice of reading the parts is not followed merely because it is easier than to commit them. It is because it makes for smoothness and promptness, and these features have been remarked by those who compose the WGY audience. There are no breaks in the continuity of the dialogue, no slowness in responding to cues, no forgetting of parts, which not even the best-managed productions on the actual stage are proof against. These things are obviated by reading. It is interesting to note, as showing what care is taken to avoid the transmission of any sound except the voices of the players, that the paper on which the parts are written is of such a quality that rustling is for the most part eliminated.

One might naturally think that the "stage manager" must have a peculiarly difficult task in presenting a play in this way. In some respects he does. How can he tell, for instance, how the voices of the actors sound a thousand miles or so away; how can he coach them, since their heads are often bent over the manuscript from which they are reading?

The solution is not so difficult, after

In the early experimental days of radio drama, the WGY Players tried the costume idea, thinking it might aid their vocal impersonations, but later the make-up was done away with as unnecessary

all. He uses a head set the phones of which are so carefully covered externally that he cannot hear a sound from the room itself. This set is attached to the transmitter apparatus, and he actually hears the play as though he were miles distant. He is in a position to know how it sounds—approximately, at least—in Chicago or Minneapolis or Atlanta. The phones are attached by a long lead which permits him to move around a considerable area. If an actor's voice sounds weak to him, he walks over to the speaker and gently pushes him nearer the microphone; if it is too strong, he moves him back. Occasionally, when an actor not accustomed to broadcasting is included among the players, the director uses signs reading "Louder" or whatever the occasion may require.

Then there is the question of "properties." Since only sound enters into play-broadcasting, these "props" are necessarily limited to those which make a noise. For example, one scene in a play given recently was supposed to be laid in a railroad station, and a touch of realism was given by the clicking of a telegraph instrument installed in the broadcasting room for the occasion. The sound of a train was simulated by the use of the familiar metal device employed on the stage for that purpose. The supposed entrance of an actor on the "stage" is signalized by the closing of a door—and the closing must be plainly audible. Telephone conversations are heralded by the ringing of a telephone bell, and a door bell announces the coming of a caller, as on the real stage. Since the picture has to be created by sound alone and without the aid of sight, some ingenuity is required in this matter on various occasions.

Clearness in transmission is being aided now—as in the case of all WGY programs—by the employment of a pick-up or microphone using the principle of the Pallophotophone reproducer as described in these pages in the December issue.

WGY is now experimenting with the use of two microphones instead of one, placing one at each end of the row of players so that the voices will seem to come from the opposite ends of a stage in accordance with the position of the actor.

Those taking the principal parts in the plays given have had actual stage experience, a fact which aids greatly in the presentation. They constitute a company, known as the WGY Players, of which the personnel remains practically the same, others for minor parts being obtained as required.

Station WGY was the pioneer in broadcasting plays. Its initial effort met such an enthusiastic response from the radio public that what was an experiment last Fall, when it presented Eugene Walters' "The Wolf," has become a regular feature of its program. A play is given each week, dramas and comedies alternating. Since this feature was instituted, WGY has given such plays as: "The Wolf," "The Garden of Allah," "The Sign of the Cross," "Way Down East," "Are You a Mason?" "Within the Law," "Under Cover," "Bought and Paid For," "The Witching Hour," "The Man From Home," and "Miss Lulu Bett." Zona Gale, writer of the last named, was a listener-in when the play was presented. The light operas, "Pinafore," "The Mikado" and others have also been given.

The conventional stage director walks in his shirt sleeves, yells loudly, and swears fluently when things go wrong—but by radio it's much different! The radio director wears evening dress and ear muffs, and shuffles cards bearing the words "Excellent," or "Louder," or "Softer"

Actors see in the popularity of play broadcasting by radio a promise of the restoration of the spoken drama to the prestige and popularity it had before the "silent drama" of the motion picture theater became a contender in the field. This seems reasonable; and if it proves true, one of the noblest of the arts will receive a needed and timely encouragement.

In at least one respect the field for broadcasting is vastly greater than that of either the legitimate stage or the motion picture. The opportunities of the two latter must always be limited by the necessity of providing elaborate and expensive accommodations for an audience. In broadcasting, the audience provides its own, and a man in Portland, Maine, another in San Francisco and still another in New Orleans may hear a play simultaneously. The audience of the largest playhouse may be increased many hundredfold.

Furthermore, thanks to the Pallophotophone, the presentation of a play may be preserved, if desired, and repeated from the same film any number of times. Had this device been in existence in the traditionally glorious days of the stage, we might now in our own homes hear classic drama as interpreted by Garrick, Booth, Mrs. Siddons, Ellen Terry and others who have made Thespian history.

Does someone say that "it must take a deal of imagination to get any sense of realism from a dramatic presentation which appeals merely to the ear and not to sight also?"

It takes no more than it does to make a motion picture film a living story, and the popularity of the "movies" is sufficient proof of how possible that is.

Realism? When "The Wolf" was broadcasted by WGY, a policeman in Pittsfield, Massachusetts, heard shrieks from a house on his beat. He immediately investigated and found that the cries came all the way from Schenectady by wireless. They were so lifelike, as reproduced by a loud speaker, that he thought it an actual call for help from the house from whence the sound came. It is no uncommon sight to see tears trickling down the cheeks of listeners-in as some pathetic drama grips their heart and an appeal for sympathy comes from out the silence.

Of course broadcasting relies on imagination; so does the motion picture and so, likewise, does the staged drama. What, indeed, is all dramatic art, however expressed, but an appeal to the imagination?

Honolulu Hears Brazil

A NEW distance record in broadcast reception has been established, station SPC at Rio de Janeiro having been heard by one of the United States government stations in Honolulu. This is an air-line distance of about 8,000 miles.

"WE owe it to humanity to be unselfish. People who have talent certainly can give a small part of it to the public"

Is the Opinion of

Dorothy Francis

As Expressed to Edwin Hall

Dorothy Francis

ONE question uppermost in the minds of radio listeners is the surprising fact that some of the most famous and talented artists have given their services without compensation to audiences whom they cannot even see.

"How is it that eminent artists who are accustomed to receiving important sums for their public appearances will sing, play or speak for the radio without charge?"—that was the question put to Miss Dorothy Francis while she was waiting in the little reception room just outside the Waldorf-Astoria studio of WJZ.

And this was Miss Francis's reply: "Well, you know there has been quite a difference of opinion about that. Some people feel quite strongly about it, very strongly. It is really amusing how excited they will get if you talk to them about radio. Then there are others who are quite the opposite. I think that each one judges things according to what he or she needs. Some people think they can get what they want in one way, and some another."

"Yes, I suppose most people do look at things from the point of view of their pocketbooks," was suggested. This led to a still more careful analysis.

Money Is Not Everything

"No, I don't think we are all like that," said the singer, with a smile. "I really don't. No, money is not everything; not by any means. There is publicity, for instance. Even the biggest often are only too glad to get in the public eye (or ear, I suppose you would call it) by radio.

"Too, radio goes into so many homes where nothing else ever would make it possible for the best to go. I mean, without the radio, the greater part of the people who live in the country would never hear these artists at all.

"Everyone has a kind spot somewhere, and some of those spots are bigger than others. And the biggest spots are found in the biggest people. Isn't it a fact? I think we all owe something to others; we owe it to humanity to be unselfish. People who have talent certainly can give at least a small part of it to the public. Especially when they stand an excellent chance to gain something in the giving!"

"Spooky" Radio

Just then Announcer A. W. N. came in and conducted Miss Francis and her pianist, Leopoldine Damrosch, into the studio. Miss Damrosch, it may be noted, is the youngest daughter of Walter Damrosch, the famous composer and orchestra conductor. Miss Francis sang two numbers, "Young April" and "Bonnie Doone," from Rita Coventry.

"It's spooky," she observed as the microphone was switched off after the last number.

"I wonder if any of my little nieces or cousins in Boston or Chicago were listening to that," continued the singer. "Gracious, I rather hope not, for their mothers' sakes. I can just see them jumping up and down, just wild, and yelling 'Mamma, Mamma, that was Aunt Dot, wasn't it, Mamma?'"

I wanted a word with the accompanist. "I've heard you know all about radio, Miss Damrosch," I interjected.

"Oh, no, I never could learn anything about condensers and variometers and all those things. My teacher at the Y. M. C. A. was a most patient man, I assure you, for I was a poor pupil. I only wish I could be a real radio engineer, but it's too mathematical for me."

Music and Mathematics

I remarked that I had understood that musicians were good mathematicians, usually.

"I'm sure I don't know," replied Miss Damrosch, who was now the center of interest in the studio—a young woman who had studied to be a radio engineer. "I got so I could receive code quite well indeed. That wasn't at all difficult. It was the technical end that floored me."

The ease with which the code was acquired raised an interesting point. The letters of the telegraph code have definite rhythms; they are really a form of music. That is what made their mastery easy for the musician.

Rhythmic Code

A radio operator who had come into the studio at the close of the program here volunteered the information that the code experts, those who are able to read 30 words a minute and more, probably owe their ability to something that is quite akin to the musical ear. The average person who listens to code transmitted at a high speed hears nothing but a sound that seems to flutter irregularly. He cannot distinguish the dots from the dashes.

By Ear

Nor does the expert seize upon each character as it comes along, and reason, for instance, that because he has heard a dot followed by a dash and another dot, that it is the letter R. Instead, his ear catches a certain rhythm that automatically means R to him, and so on with all the other letters.

The operator who is expert doesn't think of the structure of the letters at all, no more than we in speaking think how each word is spelled; we translate ideas directly into word sounds and vice versa, and it is just like that with the radio expert.

All this the operator explained to the two musicians, and Miss Damrosch had just started on an anecdote that evidently had to do with her father's musically sensitive ear, when——

Here a photographer interrupted the interested little group about the piano, posed the artists, a bar or two was sung, a picture snapped, and the studio was darkened for the night.

When Radio Lifted the Veil of Silence

Striking Experiments in Station WCX, Detroit, Demonstrate How Deaf Mutes Can Be Enabled to Hear and Taught to Speak—A Modern Miracle of Great Promise

By J. Andrew White

LEO KUEHN, now 28 years old, has been deaf since babyhood, for at the age of 18 months, scarlet fever left a veil of silence over his ears. So he had never learned to speak. On March 24, in the WCX transmitter room, he heard the spoken word for the first time. He was startled at first, then his eyes opened wide and a thankful smile spread over his features. In an involuntary attempt at response a guttural sound issued from his throat; it was meaningless; unintelligible; yet more emotional than the utterance of a dramatic masterpiece. I felt myself in the presence of a modern miracle.

A half-hour of thrills . . . and then! —he had succeeded in repeating what he heard! He had spoken for the first time.

Radio had revealed itself in new guise as the servitor of mankind.

The first word that Kuehn heard was "Ford," which was chosen because he works in the Ford plant. He had seen the word in print and he could write it; he knew its significance and meaning; but nothing of how it was pronounced or its sound. As this single word became audible to him and his face reflected his joy in the achievement, we who composed the small group assembled to conduct merely an unusual test found tears welling in our eyes, and we spoke in whispers of the marvel of witnessing the rebirth of a man's hearing. Kuehn's ears had been raised from the dead.

The word meant nothing to him at first. It was just a sound. Then "Ford" was written down on paper. He nodded with a new burst of comprehension, watched the speaker's lips, listened as the word was repeated, and then spoke it himself, slowly and with painful effort, achieving only a pitiable imitation on the first dozen trials but eventually forming the single syllable clearly and distinctly. A deaf mute was mute no longer.

For more than an hour he worked arduously and painstakingly with a small list of words, given him one at a time, including the numbers from one to ten. Each word was written out for him, and then spoken into the amplifier system so that he could hear it. After a little drill he was able to point each word out on the paper as it was spoken. "Eight" gave him much trouble,

Leo Kuehn

and also "hello," which had to be separated into its two syllables. Other words that he caught and quickly repeated were: apple, box and boy.

When he was able to repeat these from memory the microphone was placed in front of him, and then he was able to hear his own voice, for the first time within his memory. No one will ever be able to describe the look upon his face then, nor will those who saw it ever forget it.

"I want to try to sing," he wrote on paper.

This is what he endeavored to sing:

Holy, Holy, Holy.

It was his hymn of thanksgiving.

Following the successful outcome of the experiment performed by M. R. Mitchell, radio engineer, and C. A. Kushler, chief operator of WCX, Kuehn was examined in the laboratory of Dr. C. C. McClelland, a noted ear and throat specialist of Detroit.

The doctor stated, as had other famous surgeons, that the trouble lay in the middle ear, where the mechanism that vibrates with sound waves in the normal ear had been destroyed. The auditory nerve, however, reaching from the middle ear to the brain, is intact, and it is through that that Kuehn hears, when the sound is loud enough to penetrate the flesh and vibrate the bones of the skull through which the nerve passes. Only a power amplifier, as used in radio work, produces enough volume of sound for this purpose.

With the aid of the radio device it is assured that hearing will be possible for many thousands of deaf people who are suffering from exactly this condition.

"A whole new world is opening up to this young man," remarked Dr. McClelland at the conclusion of his examination of Kuehn. And very worth while seemed that service, even to a single individual, but far more stirring was the realization that deaf mutes by the thousands will be able to hear first, and then speak, because of radio's latest miracle. The radio apparatus that they can use for hearing and practicing speech consists of any receiving set with a powerful amplifier, and a microphone into which they can repeat the broadcast speech as they hear it. The microphone may be connected either to a separate amplifier, or by means of a switch may be connected in or out of the radio set's amplifier.

Kuehn is now building a set of this kind, and with its assistance he is learning to speak. He hopes to realize a long-cherished ambition to attend the University of Michigan. It is to be hoped that this desired goal will be attained, for in spite of his affliction he already has completed three years in the Cass Technical High School, and has supported himself at the same time, laboring as a tool maker's apprentice from 3:30 p. m. until midnight at the Ford plant, and attending the Cass school from 8 in the morning until 2 in the afternoon. His physician has ordered him to stop this strenuous life in order to save his eyes, and he will not be able to go back to school until fall.

But in the meantime radio will have taught him to talk!

Experiments that are as conclusive as they are moving have demonstrated that radio broadcasting holds forth the possibility of teaching deaf mutes to speak. That high power amplifiers have enabled the deaf to hear, has been reported in various items in the daily press of America and Europe, but it remained for station WCX, operated by the Detroit "Free Press," to prove the value of broadcasting in training the tongue as well as the mind of the deaf who cannot speak.

In practically every case of deaf mutism, the inability to speak is due to the impossibility of hearing; it is seldom that physical defects are present in the vocal organs. Learning to speak is a matter of imitating sound.—THE EDITOR.

Prison Wardens Want Radio

Heads of Penal Institutions Endorse Appeal to Public for Radio Receivers—Call Radio "Worth While," a "Helpful Adjunct"

By Mrs. Maud Ballington Booth
(Famous Leader of the Volunteers of America)

Mrs. Maud Ballington Booth

LAST month the Editor did a kindness to "my boys" within prison walls by printing my appeal for radio receiving sets for them. In this issue I want to let others speak for me, and for them.

I will let the wardens of the prisons tell you how they need radio; for close as I am to the prisons, there are others still closer—those in actual charge, who want to utilize the marvelous benefits of radio.

But first let me anticipate a question which may have occurred to many readers—that the state should supply radio equipment to the prisons. Perhaps it should, and perhaps at some time in the future it will, after the use you will have made possible has proved itself, as we know it will. State officials and state boards of prison control are most reluctant to spend money, and sometimes absolutely necessary improvements are long in being made. There is little hope in that direction for a long time to come, and meantime radio's great field in the prison is lying uncultivated.

I feel that the touch of interest and goodwill from the public means a great deal to the prisoner. To know that he is not altogether damned and forgotten because of his wrong-doing makes a man desire to prove worthy of trust and kindness. Personally I believe it is a great chance and privilege for the happy, the free and the fortunate of the Christian world to have a chance to do something for those who have been unfortunate and unhappy in life.

Editor's Note.—This issue goes to press a month before its date; there has not been sufficient time since the mailing of the April number for contributions to reach this office in response to Mrs. Booth's appeal in the April number. All contributions received up to May 1 will be acknowledged in the June issue.

I must again emphasize the fact that radio is not being given as an amusement. These messages from the outside world will make it easier for the men to return to normal life by keeping them in touch with the world they have left and the educational and inspirational value of the messages received will, we believe, open to them new and better lines of thought and understanding.

Now I will let the wardens tell you how much they want your radio help.

Warden Jennings of Sing Sing writes:

"In reply to your letter in which you state that you are trying to get radio installed in the prisons with the object of the men having the opportunity of hearing the concerts and other education and interesting things that are broadcast, I will state that this is a wonderful idea of yours and we are heartily in favor of it and if we should get such an outfit would see that it is used properly. Incidentally we have several experts who know how to set up, adjust and operate radio outfits."

From New Jersey, Warden Joseph Hoff says:

"It seems to me that there can be no possible objection to the installation of a first-class receiving set. One of the difficulties of enforced confinement is that a man loses his contact with the outside world and often drops behind and loses the trend of things. A radio on the 'inside' would do much to keep the men informed as to the progress of current events, and as you say, would afford an opportunity at self improvement through educational lectures and spiritual betterment through well-delivered sermons."

Warden Thomas, who has done so much for Columbus Prison, Ohio, answers as follows:

No Question as to Value

"It would be very nice to have something of this kind installed in the various prisons of the country. I am sure it would be the means of spreading among the inmates a variety of splendid lectures, etc., that they are unable to now enjoy. We have no funds here for this purpose and if through some channel this might be provided, there would be no question as to its installation and appreciation."

In Florida they have a wonderful prison farm. Great things are being done there by Superintendent J. S. Blitch. One day last March I spoke to the entire prison population before sunrise and I wish you could have seen the earnest, eager faces in my audience. In his letter Mr. Blitch says:

"I can think of nothing that would be more appreciated and that would furnish better and more wholesome entertainment for the prisons than a good up-to-date receiving set. I cer-


Prisons have bands, if they are lucky, as is Fort Leavenworth, Kans., the U. S. Army prison

tainly hope you will be successful in interesting your many supporters in this subject and that you will be able to 'put the proposition over.' "

One of the first prisons to which I want to send a radio receiver is Great Meadows. It is the most modern and in many ways the best prison in New York State, but it is out of the way and they get less touch from the outside world than do our other prisons. Warden Hunt writes about this very fully as follows:

BEHIND THE BARS—physically and mentally. His body is fed and exercised, but the mind that directs the acts of his muscles needs the mental food that can be given by radio

"I agree with you in not viewing the radio as an amusement in prison and that is not a thought that I have entertained at any time and I know you haven't, but good wholesome entertainments during the cold weather, after the day's work is over, or a good baseball game during the summer is very beneficial to these men. They do not expect or want coddling of any kind. They appreciate the manly attitude and the honorable way of being treated. Prisons in locations such as Great Meadows and Clinton Prisons are not very much burdened with entertainments of any kind so there is no danger now or in the future of that part being overdone.

A Helpful Adjunct

"I absolutely agree with you that radio, wisely used, would be a very helpful adjunct to the work done for the men."

From the state of Virginia comes another cordial acceptance:

"On the subject of radio equipment to be installed in the prisons, I wish to state that I agree with you, and if you are successful in installing machines with a loud speaking device that could be used in the chapel, I think it would be a splendid idea and I would like to go on record as endorsing the plan very heartily."

From the state of Kansas comes this message from Warden Amrine, who is very hopeful that the listeners-in of the radio field in that state will help. (It must also be remembered that the great Leavenworth prison and the Disciplinary Barracks where many of our army boys are shut in, are in the state of Kansas.)

Wanted in Kansas

"I am very much interested in this matter; I think we can arrange to use radio service to advantage. We have been talking of a central radio system from which the chapel and all cell blocks could be supplied with a separate loud speaker. The figures on this run too high, however. Some day I want to go down to the Kansas City *Star's* station and ask listeners to send us a dollar toward a radio outfit. Perhaps we could install it only in the chapel."

From far away California, in the old gray fortress of San Quentin, Warden Johnson writes:

Has Special Uses

"Your letter relating to radio especially, and touching generally upon the question of education, entertainments, concerts, lectures, etc., in prisons, so nearly coincides with my own ideas on the subject that there is nothing really to add. I feel as you do about the use of radio, that if we could have a radio, just for receiving, of course, and could use it not often—not regularly, but for things special and worth while, it would prove a very helpful adjunct."

Warden H. K. W. Scott has had long prison experience, and now in Connecticut, at Whethersfield, he is doing many good things for the "boys." I quote from his letter:

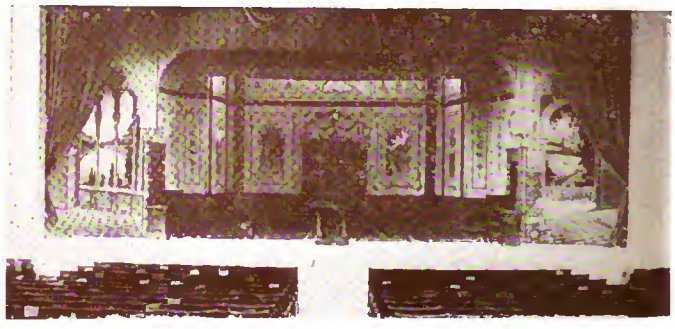
"Your proposed plan to reach the man in prison through the medium of radio is a splendid one and I am sure will be very much appreciated by the inmates of the various prisons. I am frank to say, however, that I sincerely trust your plan will not prevent your coming personally to the prisons, where the men may have the pleasure of hearing you from the platform as in the past. I assure you of our hearty support and coöperation in your efforts to better conditions in the prisons, which have proved a great help to me personally in these many years."

There are many other letters like these that I could show you, but I think I have quoted enough of them to indicate how the wardens regard radio, how they want it. With their enthusiastic support you may be sure that the radio equipment you provide will have the best possible use and care.

Would you say: "Leave all hope behind, ye who enter here," or do you realize that the prison must rouse new hope in the breasts of its inmates if it is to serve them and society?

And so I ask again that all who can do so contribute to THE WIRELESS AGE-Volunteers of America Radio Fund.

Sun and air make this cheery—it is the main tubercular ward of Clinton Prison, New York



The Chapel at Fort Leavenworth can be and often is a theater too. This assembly room should have radio

"IF I could be sure that only poor people would listen by radio, who cannot afford to pay me, I would sing often"

Said

Johanna Gadski

Famous Soprano, to Her Interviewer, Paul S. Gautier

Johanna Gadski as Brünnhilde

GADSKI needs no introduction to the public. This great artist has been heralded the world over for many years as a concert singer, but chiefly is she known as a star of the first magnitude in German operas. She is accustomed to demand and secure large prices for her appearances. Yet she has sung for the radio telephone that thousands might hear her for nothing.

Picture her seated in her New York City apartment, very straight in a plain chair, a gracious hostess; aristocratic hauteur in her attitude, but also a patient endeavor to make things plain during a visit that but adds to the endless confusion and turmoil incident to packing for a summer abroad. She speaks with a slight German accent, which will not be reproduced here, and occasionally halts slightly in search of the word she wants—

Led by Curiosity

"Why did I sing for the radio? Well, it was then so new (true, it was over a year ago) and I was curious to see this new thing that had come. I wanted to know how my voice would carry, how good it would seem to those who listened. I had all my friends listening for me, people scattered here and there, and it was really very interesting. Some said that it was very good, and others that it was not me at all, not Gadski that they heard. I guess that was because of their instruments, maybe. And so you see I sing for the radio just to see how it goes. I wish now that I had waited a year, for it is now much better done than it was then, they tell me."

"Well, you can sing again, any time you want," was the reply.

"But why should I?" was her quick query. "I think of all the rich people with expensive things to hear with, people who can afford to pay money to hear, and they do not have to pay anything to listen by radio. Why should I sing for them for nothing? They have money, and a singer must live. They do not do things for nothing, oh, no. My voice is what I live by, and if I gave it always away for nothing, how would I live then?"

"But," it was explained, "think of all the people with cheap receiving sets, many of which they have built themselves. They haven't enough money to buy tickets to hear you sing, many of them can't even buy your phonograph records. Think of all the sick, the cripples, the shut-ins, the people in hospitals, and over on the East Side, and out on farms and in the woods. They will never hear you at all except by radio. It is their only chance. Surely you will sing for them?"

For the Poor

"For them, yes, always. I do not think that there is another singer in America who does more charity than I do. Always I have sung when people ask me. They ask my manager and he says No! but I say, 'Ah, I will see. Cannot I fit it in somewhere?' And I do it, free. If I could be sure that only those people you speak of, the poor people who cannot pay, would listen by radio, then I would sing often, and gladly.

"The First of These . . ."

"No singer has done more for charity all her life than I have, and sometimes I wonder what I have gotten out of it. It is all very nice at the moment. It gives you a fine feeling at the heart when you do those things, but after, what have you left?" Mme. Gadski shrugged her shoulders in a helpless sort of way, and a bit resignedly, too.

"Think of what happened during the war, how people talked, and the terrible things they said about me! As if a woman, a woman, could do anything in this country in the war! Ah, they still talk, and what can I do?"

"Things of that sort always die away gradually."

"Do you think this is dying away?" She leaned forward a bit, her expression one of painful interest and even anxiety.

"People talk, and talk, and I think they will never stop, maybe. But perhaps next Fall when I come back to this country I will again sing for the radio, but you must be sure that a lot of poor people are listening.

"I think radio is like this: for the great artist, he gives. It is the singer who is unknown who gets. I think we all look at it whether we get or give. If we get something from it, then it is fine for us, but when it is all give and nothing given in return—" Another shrug of the shoulders.

Beginners Benefit

"It is the beginner that radio is for. Yes, it is a wonderful thing for him. He sings, or he plays for the radio, and thousands of people hear him. How many are there to listen, do you know? No? Well, it must be a great number. If a beginner who sings for the radio is good, he has just that much better chance of success. If he is good he will make a success in time, of course, the radio just will make it shorter, because the more people that hear him the sooner he is known."

Captain Tauscher, dressed for dinner, had come in. It was late. Mme. Gadski was tired. One could see that the strain of a day of packing had not been lessened by the tearing away of the bandage over an old wound, even though that had been done by her own hand. So the interview closed.

Her interviewer was escorted to the door of the apartment by Gadski's daughter, whose approaching marriage was one of the reasons for the trip to Europe. It was the daughter who had arranged the interview in the first place, who had even answered the door bell at the appointed time. During the entire conversation she was darting about with efficient energy, sparing her mother as much as possible, admitting dinner guests, arguing with people over the telephone in German, disappearing down the hall in the direction of the kitchen. Once she told someone over the phone, quite curtly, that Frau Gadski was too busy to talk to a reporter; that was flattering, and seemed to indicate that radio has a special place in her regard. It was the daughter who seemed to be the spirit of the apartment. Tall, graceful, a blonde, speaking perfect English, and presumably equally good German, she stood at the door. "Goodbye," she smiled.

Listening-In Hotel and Hospital

GUESTS of the Commercial Hotel in Bridgeton, N. J., see a radio set when they arrive at the desk to register. Sometimes it is speaking with the radio voices from Philadelphia, New York and Pittsburgh, and sometimes it is silent. But there it is, and whether it is vocal or not it speaks volumes for the progressiveness of the hotel and of Mr. W. Flavell. "Sometimes I listen to it until one or two o'clock in the morning," said he. "A lot of the guests like it, and it sure does help me pass the evenings." Bridgeton is a small town of some 15,000 people, with rather indifferent train service from Philadelphia, but since the advent of the automobile the hotels, of which there are three, with a new one under construction, have to stay open late to accommodate those who arrive on tires instead of rails.

The Commercial Hotel, Bridgeton, N. J. Insert—W. Flavell at his receiver

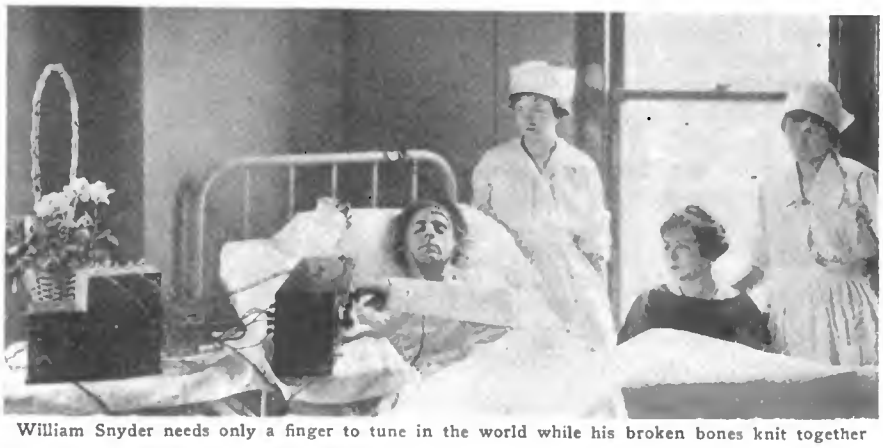
The Commercial Hotel happens to be near the local powerhouse, and Mr. Flavell had a great deal of trouble finding a set that would bring in the programs instead of the hum and buzz of the powerful generators and transformers just around the corner. He finally found one that did the trick very nicely, though there still was an annoying noise every once in a while, about which he complained to Mr. Myers, the manager of the electric light plant. "Why, I can tell you every time you turn on a different circuit," he told Mr. Myers, "and I know which one is the noisiest."

Mr. Myers didn't believe it at first, but he finally was convinced, and after listening to a terrible noise from one circuit in particular, sent out a trouble crew along the line. They discovered a grounded wire to be the cause not only of the noise in local receiving sets, but also of a considerable loss of expensive current, some of which has to be bought from a central station in Wilmington, Del. This Commercial Hotel set, therefore, must be credited not only with entertaining guests who gather about the open fireplace in the lobby, but also with effecting a material saving to the electric light company.

William Snyder Enjoys Radio in Hospital

IT is not the pleasantest thing to lie in a hospital bed with both arms and both legs broken. True, science has developed methods making such injuries much less painful than they used to be, but according to William Snyder, of Meyers Lake, Ohio, the best thing that science has provided for the relief of a man in such a fix is to be found in radio receiving apparatus.

Snyder is a repair man for a telephone company, and was injured by a fall from a pole. He spent six weeks in the Mercy Hospital in Canton. Friends among his fellow workers knew that radio would help pass the hours that would be so tedious to such an active man as is Snyder, and so a two-stage receiving set belonging to Harry Hammen of the telephone company, was installed in his room at the hospital. Three other telephone repair men, N. V. Crozier, T. H. Findlay and Marion Whisner, helped in the work.



William Snyder needs only a finger to tune in the world while his broken bones knit together

This attracted much attention in Canton. As soon as the receiver had been installed station WWB of the Canton *Daily News* transmitted a special greeting to Snyder on behalf of his associates, explaining to the radio audience that this was a striking instance of the mission of radio to those who are separated from the world by illness or other unfavorable circumstances.

On the following Sunday, station WWB transmitted a service from Snyder's own church, whose minister, the Rev. P. H. Welshimer, addressed him personally. Snyder is now out of the hospital, completing his recovery at home and is exceedingly grateful to radio, which he says helped him pass many weary hours.

"WE ought to have educational courses by radio, in all the arts and sciences; lectures on the old masters in music, for instance—"

Leo Ornstein

Said That Modern Player and Composer

Leo Ornstein

When Interviewed by Claire Bell

ULTRA-MODERN music, the extraordinary, usually puzzling music of the concert stage, written by contemporary composers for piano, orchestra and voice—what is it? Is it mere eccentricity, discord instead of harmony, carelessness substituted for knowledge, ugliness for beauty; is it mere confusion created to conceal lack of inspiration and want of a message? Is it meant to impress the audience by baffling and mystifying them?

There are many who will bring such charges against the modern works of such men as Scriabine, even against Cyril Scott, and against Leo Ornstein. Yet musicians and music lovers who are thoughtful will find much that is penetrating and true in the music of the modern composers. And at least one of them, who happens to be both a composer and concert performer, has found in the radio telephone a new medium by which the best of modern music and musicians can be brought understandingly before people who now do not comprehend them.

He is Leo Ornstein, Russian, pianist and composer, who is frequently heard in recital, playing his own and others' works, and who entertains in thousands of homes daily through recordings for the reproducing piano. One evening recently he played for the radio audience.

Letter From a "Clark"

"I really didn't know what it was all about," he said. "I know nothing about radio. The Ampico people asked me to play for the radio, and I did it for them; you see that I am frank with you. I received many letters during the next few days, and they taught me all I know about broadcasting. One came from a bank clerk; (Mr. Ornstein pronounced it "clark," thereby revealing his early years in London) the bank is at North Conway, New Hampshire. I have a little camp near there, and of course have to keep a small deposit there in the summer, and that is how the clerk knew me. He wrote me that he had heard me by radio, and that that was the first time that he had heard me play, after all the years that he had been seeing me in North Conway.

"Now there is a man who knows nothing about music, and it set me thinking. What a wonderful thing radio is for people like him! But how much more wonderful it would be if the present hodge-podge of everything under the sun could be done away with, and a constructive policy put into effect in arranging the programs."

Here Mr. Ornstein leaned forward in his enthusiasm, almost spilling a bowl of antiseptic in which he was holding a finger that had been opened by an especially powerful blow on the keys during a concert. He spoke rapidly, even nervously.

Musical Course by Radio

"Why can't we have over the radio an educational course in music, and in all the other arts and sciences? It is so encouraging to think of all the young people being listeners. Think what could be done if once or twice a week some authority in music were to give a talk on music, illustrated by appropriate selections. He could start with Mozart and Haydn, and not only play their music, but tell the stories of their lives, and explain the meaning of the music itself. Then he would go on with Bach, and on and on into Beethoven and Brahms, the 'Three B's,' and so on down to modern times. The classics are the foundation of music. The old masters were the start of it all, and how can one appreciate the moderns without a knowledge of the classics?"

Studying the Masters

That is a revealing idea. Most people on hearing modern "high brow" music think that it has no relation to anything under the sun, but here is one of the writers of that music eagerly clamoring for a wider public understanding of the works of the masters of the seventeenth and eighteenth centuries, in order that his own compositions and those of his brother music writers may be better comprehended and more widely liked.

"It is like this," he continued, "if a Chinaman should come into this apartment and begin to talk to us in his own language about the most weighty matter possible, and the most important to him and to us, we might listen in amazement but all we could hear would be sounds that could mean nothing to us at all. It might be that he was telling us something that we would like to know, but how could we understand it without a knowledge of his language, and of the history and tradition that have resulted in the formation of the words and ideas and turns of expression in that language?

"That is how it is in music, we must know the idiom, have a foundation on which to build, something more than a mere pair of ears. That is where radio comes in, and I do hope it will do something in that line. The possibilities are marvelous, utterly staggering to think of. I played some Chopin by radio, and one of my own compositions in the classic rather than the modern style. I had the most gratifying responses in my letters, particularly from the farmers. You see I didn't expect the majority of the audience would appreciate the really modern music, even by such men as Debussy.

Millions Are Interested

"Millions of people are just beginning to grasp at music, at good music, I mean. The radio is giving them little bits of it now and then. Its great possibilities never will be realized until some really educational talks are broadcast, instead of just the present terrible mixtures of everything under the sun, nothing with any relation to anything else.

"I know that one of the early stations, WDY I think it was, started with rather well-balanced programs. They had an evening of jazz for dancing, a 'party evening,' and so forth. That is the idea I'd like to see carried out further, with educational as well as entertainment subjects. Then I think that radio broadcasting will be fixed to carry on for the rest of time."

Virginia Pearson

"GOD bless radio! It is the best way in the world to reach the people with a message. That's why I wanted to use it in telling the world the truth about Hollywood's people, the movie actors"

An interview with

Virginia Pearson

By R. M. Clarke

IN an article by Marion Davies in the April issue of THE WIRELESS AGE, the photoplay star pleaded for a "movie interpreter" whose duties would consist of broadcasting the latest news of the screen world. Miss Davies pointed out that much mutual benefit could be derived by dispelling in this manner the ignorance of the public concerning the motion pictures and the people who make them; that misunderstandings could be corrected; injurious and untruthful rumors killed; and fact substituted for fancy.

INTERPRETING HOLLYWOOD

The article was still on the presses when another motion picture actress, Miss Virginia Pearson, assumed for an evening the rôle of just such an interpreter, or "Radio Movie Editor," as Miss Davies named the part. Miss Pearson secured some 20 minutes on a WJZ program, and this time, instead of waiting until she had "appeared" before the radio audience, we made an appointment for an interview only an hour before she was scheduled to talk.

We were delighted with Virginia as she outlined to us the gist of her talk for her wireless début. She was having dinner in her apartment at the Claridge.

"You are going to talk on the art of being beautiful, are you not, Miss Pearson?" At the very first glance we had seen that that is a subject about which she knows much. But she had in mind a subject with much greater community value, or rather world-wide value.

JUST LIKE OTHER PEOPLE

"Oh, no; oh, no! I want to tell that big public, the biggest one I ever had at one time, that theatrical folk, both of the legitimate stage and the movies, are very much like any other class of people, that they are no better and most certainly no worse.

"Hollywood is like any other community, where we have our homes and 'homey' interests like other folks. I feel that the public is somewhat prejudiced. If one of ours makes a mistake the whole world, so to speak, hears of it. The public does not seem to realize that publicity is an integral and necessary part of the theatrical profession, one of its foundation pillars. A spotlight is flashed upon any fault in the life of an actor where the same fault in the conduct of a private citizen would go unnoticed. The actor's every move is a center of interest.

"And I want to say how much I esteem my profession, what a great art I think it is.

"But, my dear, isn't this just too wonderful an age to live in!" Miss Pearson exclaimed, as she suddenly realized the marvel of broadcasting. It was through the air that her message in behalf of her art and its exponents was to travel to the vast unseen audience who would appreciate the rich timbre and sincerity of her voice. "It is the age of wireless wonders—'The Wireless Age.'" The inflection of her voice expressed it in quotation marks.

SCREEN LIFE IS BETTER

We asked Miss Pearson if she preferred the screen to the stage, for she had achieved fame in "the legitimate" long before the movies claimed her services. Thousands of the theater-going public remember her spectacular work as the Vampire in the play of that name, and she has starred in other popular productions, too.

"Oh, yes, the screen is much the best; much," replied Miss Pearson to our question. "There is not that endless travel from one lonesome city to another. In the movies one has more time for oneself. It is much better, one can make a home and have some leisure to enjoy it. You see I am rather a lover of my home. Even in this hotel these lovely pictures you see on the wall, these cushions (she waved her arm appreciatively), are all mine and when I have them about I feel much happier, more complete, shall I say?

"You know I wonder if the general run of people realize what stage professionals do for humanity. They supply the public with the diversion and entertainment that the individual requires in order to accomplish his life work. I don't think that the actor gets the credit he deserves for his contribution to life. He is one of the lubricants on the cogwheels; he is necessary to the proper running of the machinery."

A CONVINCING SPEAKER

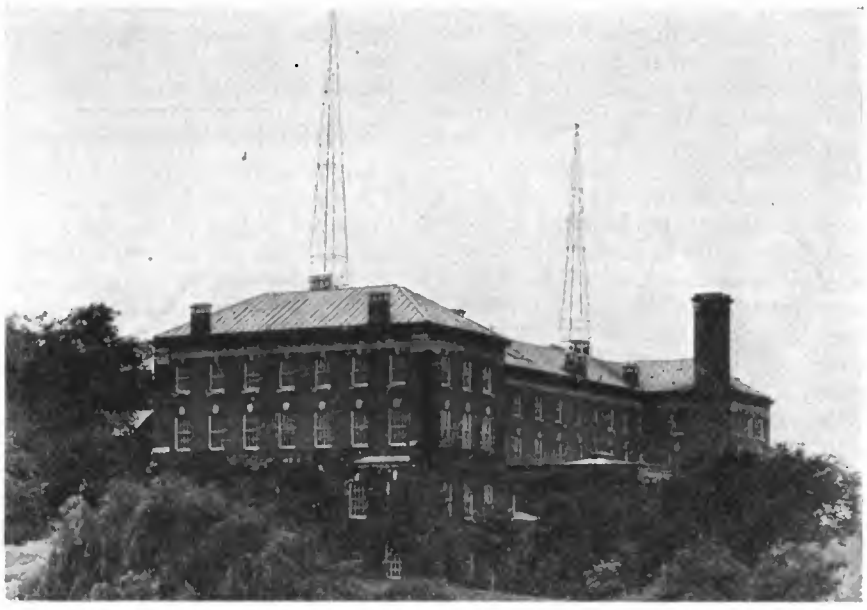
One of Miss Pearson's greatest charms is the unusual combination of seriousness and gaiety. She is a woman and an artist and a speaker of dynamic force and yet she has the light touch. She is convincing without being overpowering.

In spite of Miss Pearson's notable accomplishments in her profession she thinks she still has her highest goal to attain—the true sign of the artist: never satisfied with what has already been done.

Miss Pearson's good will to the world is tremendous. Her many friends all over the United States and the many thousands of others, both movie fans and radio enthusiasts, could not have failed to be impressed with the last words from the studio, so characteristic of the speaker: "God Bless You All!"

As she turned from the microphone and the switch was thrown, cutting off the transmitter, Miss Pearson smiled at the announcer and said: "God Bless Radio, Too! It's a tremendous force. Thank you so much for letting me use a little bit of it for the benefit of the movies."

"This Is Station WHAZ the Rensselaer Polytechnic Institute, at Troy, N. Y."



When a station has a country hill, tall towers, and a powerful transmitter, it is no wonder that it is heard at the ends of the earth

EDUCATORS the world over place great emphasis on the importance of practical work in instruction in all subjects. For instance, take the man who studies literature, doing so not only by reading, but also by writing. Schools and universities everywhere have expensive laboratory equipments for the carrying out of practical experiments in physics, chemistry and electricity. "Learn by doing" is the motto of the hour in educational circles.

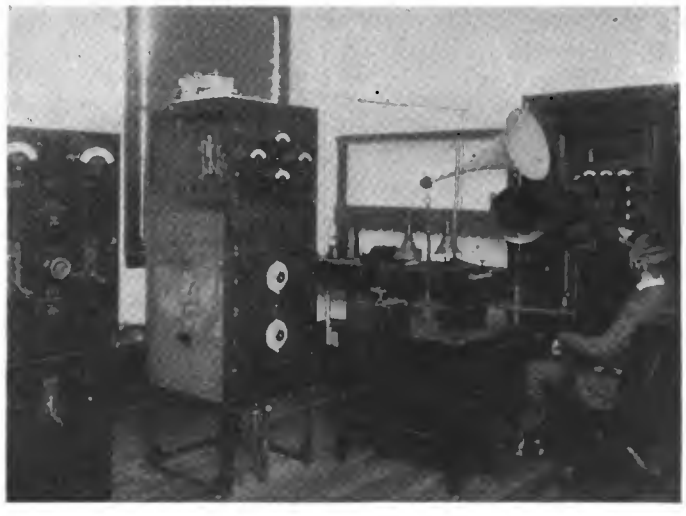
So it is that students in the Rensselaer Polytechnic Institute at Troy, New York, are learning in the classroom the theory of radio telephony, and its practice through the operation of broadcasting station WHAZ. This station was established only last Fall, through the gift of $50,000 for the purpose. A Class B broadcasting license was obtained, permitting operation on 400 meters.

When it is considered that the famous institution at Troy has on its faculty a number of radio engineering experts, it will not be found strange that the transmitter is noted for its exceptional work. WHAZ has been heard in all parts of the United States, in the Hawaiian Islands, about 5,500 miles away, in France, Canada, Mexico, Cuba, Porto Rico and the Panama Canal Zone. Regular programs are broadcast every Monday evening at 8:15 p. m., Eastern Standard Time, for the benefit of broadcast listeners, but the transmitter is active in other days of the week, in the interests of research. A recent test at WHAZ, as reported in these pages, was heard in New Zealand.

The station is located on the third floor of the Russell Sage laboratory. Those who visit the studio find that the ceiling is covered with a thick layer of felt. One inch below this felt, suspended from the ceiling, is a perforated oil-cloth covering. Sound waves passing through the holes in the oil-cloth are quickly absorbed by the felt. The floor is covered with a heavily padded carpet. The treatment given the walls is somewhat different from that in the ordinary studio. The heavy curtains of friar cloth covering the walls are movable, thus permitting acoustical research and allowing the studio director a means of varying the amount of reverberation produced by the walls for different kinds of musical selections.

The operating room joins the studio. The transmitter uses what is known as the Heising system of modulation, which is so successful in many other broadcasting transmitters. A 50-watt amplifier tube is used as a power amplifier, before the modulator tubes, which are two 250-watt units connected in parallel. Two other 250-watt tubes in parallel form the oscillator. Direct current at 1,600 volts is used for the plates of the tubes, supplied by a motor-generator set consisting of two D. C. generators driven by a 5½ horsepower 110-volt D. C. motor, which is fed from the Institute's power line. One generator provides current at 16 volts for the filaments, while the other is the source of plate potential.

The reason the hangings hang ao far from the floor is that they are meant for easy handling. A special drapery system makes it possible to change the size and shape of the WHAZ studio at will



Control of the radio telephone transmitter at the Rensselaer Polytechnic Institute is exercised in this room, which contains the transmitter itself, switch and control boards, wavemeter, and loud speaker

The antenna is of the T-type and consists of four stranded wires, each 125 feet long with a fan-shaped lead-in from the center point. The antenna is supported on two 80-foot steel towers on the roof of the Russell Sage laboratory, which is 64 feet above the ground. The ground system consists of the water pipes, the steel frame of the building and the roof. The latter is made of sheet copper, and also is connected to a number of points on the water pipes and steel frame, so that the entire ground system is linked together quite thoroughly.

Rensselaer Polytechnic has other transmitters as well as the one used for broadcasting. The others are used for experimental work, with the call letters 2XAP and 2CPC. One is a 1-kilowatt spark transmitter, using 15,000 volts from a transformer, and a non-synchronous rotary gap. Another is a 100-watt C. W. telegraph set, using the Colpitts circuit. It may also be used as a 50-watt telephone transmitter.

WHAZ is completely equipped with receiving apparatus of practically all kinds, for short and long waves, including standard regenerative sets, radio frequency receivers, and an Armstrong super-heterodyne that is being used for long distance reception.

One of the most interesting bits of receiving apparatus is the Poulsen telegraphone, which is represented by two models. This is a rather old invention that has been adapted to a new purpose. By means of it, speech and music from a distant transmitting station are electro-magnetically recorded on a spool containing six miles of fine steel wire. The record may then be clearly reproduced as often as desired, and can be erased at will. When reproduced, it can be amplified for reproduction in a loud speaker and could even be rebroadcast by the radio if desired.

The telegraphone is also used to record programs transmitted by WHAZ or words spoken into the telegraphone itself. This instrument records radio telegraph signals and when these are reproduced they offer an ideal opportunity for code practice as everything is recorded, including interference and static. The reproduction can be made faster or slower than the original. Experiments have been made with different methods of operating relays by radio signals, and a device has been constructed for counting up the number of dots in the Arlington time signals and ringing a series of bells with the twelve o'clock dash.

In the Electrical Engineering Laboratory are operating models of the various types of radio equipment used in the past. One of the original "singing arc" telephone sets is possessed by Rensselaer Polytechnic. There also is an early Marconi radio telegraph receiver (coherer type) and two complete Telefunken installations.

Criticise English Programs

ACCORDING to the London daily papers, including the *Evening Standard* and the *Daily News*, the British public is not entirely satisfied with its broadcasting situation. One paper states: "There is a great and growing dissatisfaction among the buyers of listening-in wireless sets with the service of broadcasting now being given." The trouble seems to be that the public has been expecting to get much more

A Radio Politician—Mrs. John J. O'Brien recently delivered a political speech by radio in Philadelphia, Pa. She has been mayor of Moore Haven, Fla., for several terms

than it has been receiving and the disappointment is more or less apparent among those who have purchased sets not for the romance of hearing music without wires, but in order to enjoy and profit by the matter that is heard.

The Britishers point out that their sets are licensed by the Government and that half the license money goes to pay the cost of broadcasting. After they have figured out the hundreds of thousands of pounds that the broadcasting companies must receive they wonder why they cannot hear better programs.

Some of them cast envious eyes at the United States with its flood of excellent programs, by day and night. The Government and the broadcasting companies on the other side complain that Rome was not built in a day and that broadcasting cannot grow into full flower over night. They also are greatly exercised over the apparently increasing number of unlicensed receivers, made at home and used in violation of the law, thus depriving the broadcasting companies of revenue.

Broadcasters Assist in Storm Disasters

NEW instances of the value of co-operation between broadcasting and amateur stations were revealed during the severe storms that swept the Middle West during the second week of March. High winds, accompanied by heavy snow or rain, resulted in the death of some 40 people, swept away telephone and telegraph wires over a wide area, stalled railroad trains and cut off thousands of people from the rest of the world. Trains running into Chicago were hours late and some of them were even "lost," the railroad companies being unable to locate the points at which they were stalled. A plea for help from the radio amateurs was broadcast by radio telephone, the request being that the amateurs ascertain whether any trains were stalled in their vicinity and if so, to advise Chicago by using their radio transmitters. In this manner a number of trains concerning which there had been considerable worry, were reported to Chicago with details as to their location and condition.

Parisians Eat by Radio

BECAUSE the French Government has seen fit to increase its tax upon orchestras, Parisian cabarets, restaurants and dance halls are doing away with their fiddlers and instead are installing radio receiving sets. The result is a considerable saving to the restaurant in its cost of operation, while it achieves considerable favorable publicity through using radio to entertain its patrons. True, there is a French Government tax upon radio receivers, but the French restaurant proprietors shrug their shoulders and say that while they may have to pay a tax to pick up the receiving concerts, they do not have to pay the artists and musicians. Some restaurants have even found it possible to reduce their charges following the substitution of radio for the orchestra.

What's Your Name?

IN England, as in the United States, there has been some confusion as to the proper name to apply to one who listens to broadcast programs. In order to settle the question, the London *Daily News* conducted a prize competition for the most appropriate word, which turned out to be "broadcatcher." As yet there is no indication that the prize winner has come into general use. Other names suggested were: radiolist, auditor, harker and Noah. The man who presented the latter explained, which was kind of him, that it was "because they 'Ark."

Roger Kahn

"IT is wonderful . . . An old lady visitor was astonished and thought that radio came down the chimney"

An Interview With

Roger Kahn

By Sam Loomis

SOME weeks ago the radio audience heard this from station WJZ:

"We take pleasure in introducing Roger Kahn, son of Mr. Otto H. Kahn, the famous financier. Mr. Roger Kahn, though only 16 years old, is an expert player of the saxophone, and he will now entertain you with a number of selections."

There followed piece after piece in quick succession. In half an hour Roger played all the latest hits from the musical comedy stage and the dance halls.

Evident Contrast

This was interesting. The son of a banker of international fame known the world over as a patron of the arts, and particularly of music; the son of a man who has helped many struggling artists to achieve their musical educations and win high places on the concert and operatic stage—and instead of the classics he plays jazz! It seemed worth looking into.

So I made an appointment with Roger, to meet him at his own apartment in the Kahn house on Fifth Avenue. As the door was opened I was greeted with a burst of jazz. There sat Roger, playing a saxophone with the same zip and vim that I had heard by radio. And with him was his older brother, Gilbert, raising seven or more different kinds of rhythmic noise from an assortment of drums, bells, gongs and all the contraptions of the professional trap-drummer. A trio was completed by a reproducing piano, syncopating away all by itself at somebody's "Blues." It was like stepping into a Broadway cabaret.

This was on a Saturday morning. Gilbert had come home from Princeton for the week-end, and Roger's studies were finished until Monday. The recreation hour—and were they enjoying it? I'll say they were!

In front of Roger hung a collection of saxophones of all sizes, and there was a ukulele, a banjo, a violin, a clarinet. He plays them all, and J. Kasner, his teacher, says that he shows extraordinary promise as a saxophonist, which fact the radio audience has had the opportunity of judging for itself.

People wonder how wealthy men become so, what it is that gives them more than ordinary success. I have never met Mr. Otto Kahn, and probably if I were to do so the vitality and power that seems to flow from most signally successful men would prevent me from seeing more than mere externals; but I have met two of his sons, and noted in them qualities that must have been inherited.

They are nice boys, natural, enthusiastic, unspoiled, cordial and hospitable, "regular fellows," such as you will find in thousands of homes. But underneath the ease that is common enough in any comfortable family there is something that quite defies analysis, yet is unmistakable. It is something like a spark. Its most obvious outward manifestation is the ability to do the thing of the moment surpassingly well. It may be due to a natural versatility, or to an inborn special bent in one direction; the results are just a little bit, and sometimes a great deal, better than the common run.

"What are you going to be when you grow up?" I asked Roger. "A banker like your father?"

A Future Engineer

"Oh, no, I'll leave that for my brother. I want to be an engineer." He is much interested in mechanics, and shows skill in that direction, especially in his automobiles, which he can drive and repair himself. He has several cars, including a Rolls-Royce, a Bugatti, a Mercedes, and a remodeled Ford. It is the latter, especially fixed up for power, that he gets the most fun out of, he says, and he delights in driving it 'cross country on his father's golf course, just as if it were a horse. It can do everything but jump fences.

Of course he is a radio fan. He has a six-tube radio frequency set in his bedroom, with a loop and loud speaker, and he has started to build a set himself; diagrams and various parts lay about on a table in the music room. An antenna has just gone up on the roof, and I have a hunch that Roger, before he gets through, will want to be not simply an "engineer," but a radio engineer. He is 16, so there are a number of years ahead of realization of that particular wish. Just now he is studying with a private tutor, preparing to enter Harvard.

Many people, when they comment on radio begin like this: "It is wonderful, just wonderful!" And then their powers of expression fail. The subject is too big. Their thoughts end in a gasp.

Roger Kahn is among them. When I asked him what he thought about radio, he said: "It's wonderful!" Then he said it again, then repeated it in several different ways, and finally threw the switch and let radio speak for itself.

After a few moments he went back to the subject. "There was an old lady who came to see us one evening," he explained, "and she was astonished. She looked around and saw all the windows closed, and then she said: 'Do you mean to say that it comes right through the walls? Doesn't it come down the chimney?' And she looked up the chimney to see!"

That was when he had just the radio frequency set, using only a loop. Since then a Radiola Grand has been added to the radio equipment, using the outside antenna, and so it is not as startling to the uninitiated, for it seems fairly reasonable to hang up a wire in the air and catch something with it.

The New Radio Regulations

Secretary Hoover Accepts Conference Report and Puts It Into Effect—Future Broadcasting to Be Done Between 222 and 545 Meters—Every Class B Station to Have Exclusive Wave Length—Plan Expected to End Interference

FUTURE interference between broadcasting stations was made practically negligible when the Second Radio Telephony Conference called by Secretary of Commerce Hoover met on March 20, and recommended the re-allocation of broadcasting and other wave lengths. The report of the Conference, allocating certain wave lengths between 222 and 545 meters for telephone broadcasting was accepted by Secretary Hoover, and at the time this issue went to press he and the chief radio inspectors of each district were working out the application of the new plan.

It seems reasonable to expect when the new allocations are placed in effect it will be possible for anyone who is provided with suitably sensitive and selective receiving apparatus to tune in any of the Class B high power broadcasting stations without interference.

Considerable time will be required, however, to bring the change about, due to several considerations. One is the fact that to change the wave length materially sometimes means extensive alterations in the transmitter, and it is the desire of the authorities to avoid imposing hardships on the broadcasters.

Another cause of delay lies in the necessity for reconciling the plan with the existing radio law. It will be remembered that Congress failed to pass the White bill at the last session and the present attempt at solution of the broadcasting interference problem, therefore, must be conducted according to the provisions of a ten-year-old law.

Therefore it cannot be predicted when the new plan will go into effect; certainly there is no immediate prospect of its full realization, in view of the fact that the desired number of 50 wave lengths for the high power stations is, at present, cut to some 38 by the necessity for having consideration for the small amount of ship traffic now going on within the projected broadcasting bands.

An idea of the complication involved, however, may be gathered from the fact that the chief radio inspectors of the various districts spent two weeks following the close of the conference in constant discussion in Washington, endeavoring to work out a tentative schedule of wave lengths for the broadcasting stations. No new licenses for broadcasting will be issued except under the new distribution of wave lengths.

Herbert Hoover, Secretary of Commerce, whose efforts to bring order out of chaos in the broadcasting situation have resulted in the new regulations for government, commercial, broadcasting and amateur radio stations. The new regulations are the result of many conferences at Washington in which the leading radio authorities of the country participated, at the Secretary's invitation

NEW REGULATION STOPS AMATEUR TRANSMISSION 7:30 TO 10:30 P. M.

Herbert Hoover, Secretary of Commerce, by means of an executive order to the chief radio inspectors of the various districts, has directed that all amateur radio stations of the United States must stop transmission between the hours of 7:30 and 10:30 P. M., daily, local time. In accordance with this ruling the radio inspectors have been instructed to note the following on all amateur licenses:

"This station is not licensed to transmit between the hours of 7:30 and 10:30 P. M. daily, local standard time."

In addition to this ruling Secretary Hoover has notified the chief radio inspectors of the various districts that beginning May 15, 1923, special amateur stations will be authorized to transmit on wave lengths between 150 and 220 meters only, the power not to exceed 500 watts in the antenna. Stations using pure continuous wave transmitters will be authorized to use wave lengths above 200 meters, amateur spark transmitters in all cases being required to use wave lengths which do not exceed 200 meters. Technical and training school stations will also be required to observe these regulations.

The entire matter is in a state of flux, the effort being to make practical the recommendations of the Conference. No sudden changes are to be expected, it being evident that the use of the new waves for broadcasting will be assigned gradually.

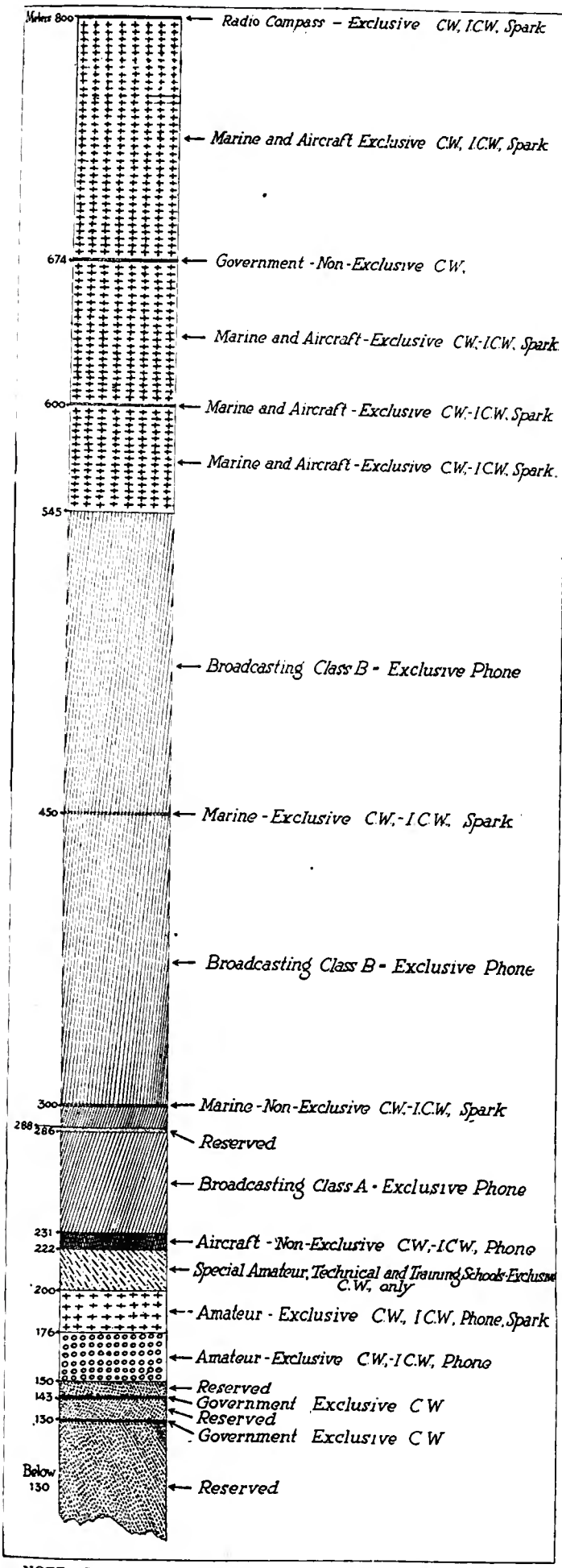
The following is the membership of the Radio Telephony Conference Committee: Maj. Gen. George O. Squier, War Department; Com. D. C. Bingham, U. S. N., Navy Department; W. A. Wheeler, Department of Agriculture; John W. Sutherin, Post Office Department; F. P. Guthrie, United States Shipping Board; Edwin H. Armstrong, Columbia University, New York; Dr. Alfred N. Goldsmith, Secretary, Institute of Radio Engineers; Prof. L. A. Hazeltine, Stevens Institute of Technology; John V. L. Hogan, Consulting Radio Engineer, New York; C. B. Cooper, C. B. Cooper Company, New York; Hiram Percy Maxim, President, American Radio Relay League; Prof. C. M. Jansky, University of Minnesota; A. H. Griswold, American Telegraph and Telephone Company; Leo Fitzpatrick, Radio Editor, Kansas City Star; D. B. Carson, Department of Commerce, Bureau of Navigation; W. D. Terrell, Department of Commerce, Bureau of Navigation; J. H. Dellinger, Department of Commerce, Bureau of Standards; L. E. Whittemore, Department of Commerce, Bureau of Standards: L. J. Heath, Treasury Department.

In order to have the latest advice possible on the subjects of interference, broadcasting, amateur activities and a practical assignment of wave lengths, Secretary Hoover also called in seven of his nine district radio inspectors. The inspectors called in were: Charles C. Kolster, First District, from Boston; Arthur Batcheller, Second District, New York; R. Y. Cadmus, Third and Fourth Districts, Baltimore; Maj. J. F. Dillon, Sixth District, San Francisco; S. W. Edwards, Eighth District, Detroit; and E. A. Beane, Ninth District, Chicago.

These seven experts cooperated in outlining the difficulties locally in enforcing regulations, and discussed methods, complaints, and the needs of the several kinds of radio service.

Previously all broadcasting was concentrated on three wave lengths, 360,

(*Continued on page* 42)



NOTE—Since this chart was drawn indications are that some slight changes may be made when the new regulations are put in effect.

Wave Frequency, Kilocycles Per Second— (Above)	Wave Length, Meters— (Below)	Service
2300	130	Reserved. (See note 1.)
2300	130	Government, CW, exclusive.
2300	130	Reserved. (See note 1.)
2100	143	
2100	143	Government, CW, exclusive.
2100	143	Reserved. (See note 1.)
2000	150	
2000	150	Amateur, CW, ICW, Ph., exclusive.
1700	176	
1700	176	Amateur, CW, ICW, Ph., Spk., exclusive.
1500	200	
1500	200	Special amateur, and technical training schools, CW, exclusive.
1350	222	
1350	222	Aircraft, CW, ICW, ph., non-exclusive.
1300	231	
1350	222	Class A broadcasting, Ph., non-exclusive.
1050	286	
1050	286	Reserved.
1040	288	
1040	288	Class B broadcasting, Ph., exclusive.
1000	300	
1000	300	Marine, CW, ICW, Spk., non-exclusive. (See note 4.)
1000	300	Class B broadcasting, Ph., exclusive. (See note 3.)
667	450	
667	450	Marine, CW, ICW, Spk., exclusive. (See note 5.)
667	450	Class B broadcasting, Ph., exclusive. (See note 3.)
550	545	
550	545	Marine and aircraft, CW, ICW, Spk., exclusive.
500	600	
500	600	Marine and aircraft, CW, ICW, exclusive. (See note 4.)
500	600	Marine and aircraft, CW, ICW, Spk., exclusive.
445	674	
445	674	Government, CW, non-exclusive.
445	674	Marine and aircraft, CW, ICW, Spk., exclusive.
375	800	
375	800	Radio compass, CW, ICW, Spk., exclusive.
375	800	Marine, Ph., exclusive.
315	952	
315	952	Government, CW, ICW, Spk., exclusive.
315	952	Reserved.
300	1000	
300	1000	Radio beacons, CW, ICW, Spk., exclusive.
300	1000	Reserved.
285	1053	
285	1053	Marine, Ph., exclusive.
275	1091	
275	1091	Government, CW, ICW, non-exclusive.
275	1091	Marine, Ph., exclusive.
250	1200	
250	1200	Government, CW, ICW, non-exclusive.
250	1200	Marine, Ph., exclusive.
235	1277	
235	1277	University, college, and experimental, CW, ICW, exclusive.
230	1304	
230	1304	Government, CW, ICW, Spk., exclusive.
190	1579	
190	1579	Marine and point-to-point, non-government, CW, ICW, Spk., exclusive.
120	2500	
95	3158	Government, CW, ICW, Spk., exclusive.

The wave allocations recommended by the Conference were as follows: (It may be noted that a kilocycle is 1,000 cycles.)

Note 1—Available for special licensing.

Note 2—Not more than six CW amateur stations to be licensed to use wave frequencies above 1,050 kilocycles (wave lengths below 286 meters) for communication across natural barriers.

Note 3—A Class B broadcasting station is a station of sufficient power to serve an extensive territory. Fifty territorial wave frequencies, approximately 10 kilocycles apart, are to be assigned by the Department of Commerce to local areas throughout the United States without duplication. The ten such areas within each of five national zones are to have wave frequencies separated by approximately 50 kilocycles.

Note 4—The 1,000 and 500 kilocycle (300 and 600 meter) waves are for calling and distress purposes with a minimum of traffic.

Note 5—Mobile service on the 667 kilocycle (450 meter) wave is to be stopped between 7 and 11 p. m. local standard time, and to be transferred in so far and as soon as practicable to wave frequencies below 500 kilocycles (wave lengths above 600 meters).

The New Radio Regulations

(*Continued from page* 40)

400 and 485 meters, but the Conference recommended a new field extending from 222 meters to 545 meters be created for the purpose. Within that field stations can be assigned individual wave lengths and divided into two or more classes, according to power; the higher powered stations, known as Class B, to be separated by several meters in wave length, and stations operating on neighboring waves to be widely separated across the country.

This will enable the higher power stations distributed in 50 localities and comprehensively covering the United States, to be within the reach of every listener. Suitable wave lengths are provided in the recommendations for the more than 500 existing lower power stations.

The report urges that the field of amateur activity be extended by alloting a band extending from 150 meters to 222 meters in place of the waves up to 200 meters now used. The band from 200 to 222 meters can be reserved for high grade continuous wave telegraph transmitting stations operating under special license. Technical and training school licenses can also occupy this band. The report confines spark amateur radio telegraph stations to the band 175 meters to 200 meters.

It also includes the provision that ships using 450 meter waves keep silent between 7 and 11 P. M. and, as soon as possible, readjust their equipment for transmission on wave lengths above 600 meters.

The following resolutions were adopted by the Radio Conference:

That this conference, and the Department of Commerce subsequently, follow the practice of expressing wave frequency in kilocycles per second, with wave length in meters in parentheses thereafter.

That in assigning a wave band of 10,000 cycles to each Class A broadcasting station they be distributed over five zones throughout the country such that no stations in adjacent zones are closer together in frequency than 20 kilocycles, and that within each zone there be ten stations separated by 50 kilocycles.

That only one wave frequency be assigned to a Class A broadcasting station, which should transmit exclusively on the wave frequency designated and reserved exclusively for that station.

That every broadcasting station should be equipped with apparatus such as a tuned circuit coupled to the antenna and containing an indicating instrument or the equivalent for the purpose of maintaining the operating wave frequency within 2 kilocycles of the assigned wave frequency.

That the Department of Commerce establish qualifications for Class A broadcasting stations, including a general minimum and locally suitable maximum power and a quality of program that will warrant assignment of a territorial wave frequency to each particular station, and that the qualifications be similar to those required of the present Class B broadcasting stations.

That the Department of Commerce in its discretion assign Class B broadcasting station licenses in which wave frequencies shall be specified and in which the power ratio between the Class A and B stations shall be at least 2 in so far as is practical for a given locality.

That in granting licenses it is recommended that the Department of Commerce limit the use of power where undue interference would otherwise be caused.

That reading of telegrams or letters by broadcasting stations be not construed as point to point communication so long as the signer is not addressed in person and so long as the text matter is of general interest.

C. Wylie Bergman, an amateur of Dwight, Ill., who is the defendant in a suit to restrain him from transmitting because of claimed interference with broadcasting. The new regulations will prevent future conflicts of this kind and as no further reason exists for continuing the present legal action it will probably be withdrawn

That simultaneous re-broadcasting shall be permitted only on a broadcasting wave frequency, and with the authorization of the original broadcaster and of the Department of Commerce.

That the Department of Commerce be requested to insist upon the suppression of harmonic and other parasitic radiation from all radio stations, as for example, by requiring the installation, if necessary, of coupled circuit transmitters at the earliest feasible date.

That spark transmitting apparatus be replaced as rapidly as practicable by apparatus which will produce a minimum of interference.

That the amateur organizations of the United States study the time requirements of the broadcasting of religious services on Sunday and by mutual arrangement with the broadcasters determine upon silent periods which will make possible the reception of such religious services in any given locality.

That when the government conducts services similar to commercial services for which waves or wave bands have been assigned, the government stations shall use the said waves or wave bands.

That the government have the exclusive use of a band one kilocycle wide centered at each of the following frequencies, 92, 83, 81, 78, and 76 kilocycles, so far as is consistent with public service generally.

That where a line-radio installation produces interference with the reception of signals from beyond the state such line-radio station shall require a license from the Department of Commerce.

That the subject of interference caused by devices not used for radio communication purposes and which are not subject to the present radio law be referred to the projected Sectional Committee of the American Engineering Standards Committee and that in the meantime the members of the conference offer to the Department of Commerce their co-operation in the solution of such immediate problems as may be of a character in which their aid could be of value.

That, in the judgment of the Second National Radio Conference, the prevention of "willful or malicious interference," as provided for by Section 5 of the Act of August 13, 1912, and the minimization of interference, as provided for by Article 8 of the International Convention, require that the Department of Commerce shall, in its discretion, withhold or rescind station licenses to transmit on specified wave frequencies, at certain times, and on definite powers, and with certain types of transmitters and when, in the judgment of the Department of Commerce such interference would result or does result; and that it is the clear and manifest intent of Section 1 through 4, and Regulations 10, 12 and 18 of Section 4 of the said Act to give the Department of Commerce such authority to withhold or rescind licenses where such interference will result or does result; and that the Second National Radio Conference believes that a decision by the Courts validating the above views will be greatly in the public interest; and that the Second National Radio Conference expresses its willingness to advise and assist the Department of Commerce in the support of the above resolutions in the event of litigation.

That a copy of the foregoing motion be sent to each concern, organization or association engaged in manufacture of radio equipment, or broadcasting by radio or otherwise interested in radio communication with a request for an expression of approval or disapproval of the motion and an agreement to abide by its provisions.

That the Second National Radio Conference desires to emphasize the limited facilities available for radio broadcasting, and the uneconomic and tentative basis of present-day broadcasting, and that the Conference urges the consolidation in each locality of those desiring the establishment or maintenance of broadcasting and those interested in broadcasting in that locality; to the end that broadcasting conducted in each neighborhood by such a local association will receive public support and be handled in an economic and permanent fashion.

That the great expansion of radio communication has not been accompanied by a proportional increase in the radio personnel and facilities at the disposal of the Bureaus of Navigation and Standards of the Department of Commerce, and that the resulting strain on the inspection and technical forces of the Department of Commerce has been excessive, and has even forced the omission

of important activities and investigations, and that the Second National Radio Conference strongly recommends that additional appropriations be granted to the Department of Commerce for its radio inspection personnel and equipment and for its research personnel and facilities. That a committee of three be appointed to wait upon the Secretary of Commerce to present the urgency of this need and the importance of the early provision of funds for these Bureaus.

That the present conditions of radio interference with non-local reception and the resulting public dissatisfaction urgently require that the recommendations of the conference be accepted by the Secretary of Commerce and put into early operation by the Department of Commerce.

In accepting the report of the Conference, Secretary Hoover said:

"The recommendations by the radio conference represent a step in ideal development of measures for the prevention of interference in public broadcasting.

"The department fully accepts the recommendations of the conference, but there are a number of difficulties in placing the plan abruptly into action. First, the hardship that it may cause to various stations to move arbitrarily to new wave lengths; second, the difficulties introduced by the ship to shore communication which are now working to some extent on 300 meters and also on 450 meters.

COMMERCIAL STATIONS

"The conference recommended that the ultimate development for ship communication be to assign for the general purpose of shipping the whole wave area from 600 to 800 meters, different bands being allotted within this area for different shipping purposes. The distress signals from ships now work on 600 meters and the radio compass works on 800 meters. The ship to shore communications on 300 and 450 meters are altogether commercial traffic and would be more advantageously carried on with less interruption than today if these services were given the entire field around 700 meters.

"In order to make progress in this direction of developing the area from 600 to 800 for ship communication, it is proposed that all ships and all shore stations used for ship communications shall cease using 450 meters between the hours of 7 and 11 P. M., but may use 700 meters at this or any other time. The 300-meter wave length now assigned under the International Convention is very little used and will be used for inland broadcasting and it is not expected that the ships will avail themselves of the international agreement in this particular, as it has not proved of practical advantage except to a limited extent.

NEW CLASSIFICATION OF BROADCASTING STATIONS

"For internal broadcasting the department proposes to co-operate with the various stations with a view to developing a systematic assignment of wave lengths to the various stations within the broad confines of the recommendations of the conference.

"In order to carry this out without hardship the following classification of stations will be made:

CLASS A STATIONS, 222 TO 300 METERS

"Class A Stations—That is, stations equipped to use power not exceeding 500 watts. In this class it is proposed that the radio inspectors, in co-operation with the station owners, shall assign distinctive wave lengths to each station so far as is possible in the area from 222 to 300 meters. No station will be required to change from 360 unless it so desires.

CLASS B STATIONS, 300 TO 545 METERS

"Class B Stations—That is, stations equipped to use 500 to 1,000 watts. In this class it is proposed to similarly offer

The new regulations provide exclusive wave lengths for essential government services such as the aerial mail, where formerly they had to take chances with interference from several classes of stations. The photo shows a new 100-watt radiophone with a range of 200 miles, undergoing inspection by Second Assistant Postmaster General Henderson, in charge of the air mail service, and Postal Pilot L. Hamilton Lee

to license these stations on special wave lengths from 300 to 450 and from 450 to 545 meters, having regard to the maintenance of some ship work on 450 meters as outlined above, and again no station will be required to change from 360 unless it so desires.

CLASS C STATIONS (PRESENT CLASS A), 360 METERS PENDING REASSIGNMENT

"Class C Stations—Comprising all stations now licensed for 360 meters. In this class no new licenses will be issued for stations on 360 meters until the plan is entirely released. Stations which do not plan to move under the general plan may remain at 360 meters but they will necessarily be subject to some interferences at best. It is thought that by the above plan the stations can be gradually brought into accord without hardships.

AMATEUR STATIONS

"Under the plan amateurs are given the whole area from 150 to 220, instead of being fixed upon 200, with special licenses at 375. The special licenses hitherto issued for amateurs at 375 will now be issued at 220. Certain special cases will be taken care of otherwise. It is proposed, in co-operation with the amateur associations, to develop an assignment of wave bands in classification so as to somewhat relieve the present interference among amateurs. It will be remembered that the number of wave bands which can be used among the short wave area assigned to the amateurs is greater in proportion than among the longer wave lengths, and these arrangements extend the area hitherto assigned to amateurs."

Music Versus Noise

"WHAT is music?" and similarly abstruse questions, including this one: "Is music noise if it annoys a noisy city?" came up recently in St. Louis, Mo., because a radio shop there had turned the horn of its loud speaker out of a window. An adjoining law school thereupon brought suit, claiming the KSD grand opera classics were interrupting the classes, and adding insult to injury by saying that the stuff wasn't music, anyway.

Such musical experts as traffic cops, newsboys and law students got up in court to say that they did or did not like the stuff; some said that KSD was fine but the saxophone "college" next door to the radio shop was terrible; a neighborly doctor testified that he and his patients enjoyed the radio programs; and the only thing that any agreed upon was that something—music or not—was to be heard above the clatter of traffic at the busy corner of Grand Boulevard and Olive street.

After an alderman, a detective, a probation officer, two teachers, four surgeons, a correspondence school manager and the proprietor of the radio shop had added their names to the list of musical and radio experts the judge sighed and announced that he would "take the matter under advisement"; and there it rests.

WOC Delivered Messages

STATION WOC at Davenport, Iowa, was one of the scores of radio transmitters that demonstrated the ability of radio to respond to emergencies. On March 12 and 13, while wire communication in the West was halted throughout the large territory by sleet and snow, WOC abandoned its program and gave its entire time to emergency message work. Messages were transmitted for the railroads, for the telephone and telegraph companies, and for private individuals, all of them of an emergency nature. Many messages of this kind were able to get as far as Davenport by wire and from there were relayed by radio telephone, being picked up by listeners nearest to the addressee and delivered by them.

Distant Broadcasting Stations Heard

Broadcasting fans daily surprise themselves and others by reaching out across hundreds of miles by a turn of the wrist. Often the most simple bulb equipment will produce astonishing results, as reported below. What have YOU done?

HAROLD CARAWAY, Clifton, Texas, installed a new set and in a week joined the list of DX fans with the following list:

WGY	Schenectady, N. Y.	1,700 Miles
WWJ	Detroit, Mich.	1,100 Miles
KWH	Los Angeles, Calif.	1,200 Miles
WHAS	Louisville, Ky.	1,000 Miles
WFAT	Sioux Falls, S. D.	1,000 Miles
KHJ	Los Angeles, Calif.	1,200 Miles

Mr. Caraway adds this postscript to his letter. "I live in *the largest small town in Texas*—Clifton."

DONALD BUSINGER, Springfield, Obio, reports as just a few of the distant stations he has heard tbrough a single tube set, the following:

KHJ	Los Angeles, Cal.	1,800 Miles
PWX	Havana, Cuba	1,600 Miles
KLZ	Denver, Colo.	1,000 Miles
KNJ	Roswell, N. M.	1,100 Miles

PAUL YETTER, Denver, Colo., bas heard the following stations out of 70 nearer ones:

KGM	Portland, Ore.	1,000 Miles
WCX	Detroit, Mich.	1,200 Miles
WWJ	Detroit, Mich.	1,200 Miles
WCAE	Pittsburgb, Pa.	1,300 Miles
WHAS	Louisville, Ky.	1,100 Miles
WGY	Schenectady, N. Y.	1,700 Miles

P. HANSTILL, New Haven, Conn., listens to practically all the eastern states and also the following:

PWX	Havana, Cuba	1,400 Miles
WKN	Memphis, Tenn.	1,200 Miles
WOC	Davenport, Iowa	1,050 Miles

G. E. TALLMAN, Seneca Falls, N. Y., tbinks that the handicap of his location near tbe Eastern Coast has been well overcome by bis single circuit regenerative receiver. Using a detector alone, he has beard 85 stations. He says, "I am wondering bow many stations I would get if I had my set in one of the middle states."

KHJ	Los Angeles, Cal.	2,300 Miles
KFI	Vancouver, B. C.	2,230 Miles
PWX	Havana, Cuba	1,475 Miles
WGAB	Houston, Tex.	1,400 Miles
KLZ	Denver, Col.	1,500 Miles
WBAP	Ft. Worth, Tex.	1,350 Miles
WFAA	Dallas, Tex.	1,300 Miles
WAAB	New Orleans, La.	1,175 Miles
WBL	Anthony, Kans.	1,200 Miles
WCAJ	University Place, Neb.	1,035 Miles
WNAX	Normon, Okla.	1,235 Miles

JOSEPH J. OSWALN, Trenton, N. J., up to February 25th had listed 143 stations heard througb his single tube receiver, all verified at least three times and "all can be received wbenever broadcasting. I would like to see if they could be beat for long distance reception."

WKY	Oklahoma City, Okla.	1,200 Miles
WKAF	Wichita Falls, Tex.	1,400 Miles
WLAL	Tulsa, Okla.	1,200 Miles
WOS	Jefferson City, Mo.	1,100 Miles
WBL	Anthony, Kans.	1,200 Miles
WBAP	Ft. Wortb, Tcx.	1,300 Miles
WOC	Davenport, Iowa	1,000 Miles
PWX	Havana, Cuba	1,300 Miles
WDAF	Kansas City, Mo.	1,000 Miles
WHB	Kansas City, Mo.	1,000 Miles
WGAF	Tulsa, Okla.	1,200 Miles
WGF	Des Moines, Iowa	1,000 Miles
KHDJ	Corvallis, Ore.	2,800 Miles
KFCK	Colorado Springs, Col.	1,500 Miles
KLD	San Altos, Cal.	2,400 Miles
KHJ	Los Angeles, Cal.	2,500 Miles
KFI	Los Angeles, Cal.	2,500 Miles
KLS	Oakland, Cal.	2,600 Miles
KLZ	Denver, Col.	1,500 Miles
WDAY	Fargo, N. D.	1,200 Miles
WOI	Amea, Iowa	1,000 Miles

R. ALTON JOHNS, Tyler, Texas, writes that be takes great interest in reading the distance records and submits his own, made witb a bome-made single tube regenerative set. He has beard 75 stations in 26 states, Canada and Cuba, sometimes twenty of them in a single night, without sitting up until 1 A. M.

WGY	Schenectady, N. Y.	1,400 Miles
CKCK	Regina, Sask., Canada	1,390 Miles
WEAF	New York, N. Y.	1,340 Miles
KHJ	Los Angeles, Cal.	1,340 Miles
CJCG	Winnipeg, Manitoba, Can.	1,270 Miles
NAA	Arlington, Va.	1,160 Miles
PWX	Havana, Cuba	1,000 Miles
WWJ	Detroit, Mich.	1,000 Miles

PERKINS BENNEVAN, Fresno, Cal., who has appeared in this column before, sends a second list with some still better records, all made on a single detector tube. His street address is 637 Poplar Ave., and he states be will be glad to hear from any one interested in his records.

WSB	Atlanta, Ga.	2,025 Miles
WWJ	Detroit, Mich.	2,000 Miles
WMC	Memphis, Tenn.	1,625 Miles
WLAL	Tulsa, Okla.	1,300 Miles
WSD	St. Louis, Mo.	1,650 Miles
WKY	Oklahoma City, Okla.	1,225 Miles
WEAF	New York, N. Y.	2,500 Miles
WOR	Newark, N. J.	2,500 Miles
WGV	New Orleans, La.	1,800 Miles
KYW	Chicago, Ill.	1,775 Miles
WDAP	Chicago, Ill.	1,775 Miles
WBAP	Ft. Worth, Tex.	1,300 Miles
WOC	Davenport, Ia.	1,600 Miles
WCAE	Pittsburgh, Pa.	2,150 Miles
WHA	Madison, Wisc.	1,650 Miles
WGM	Atlanta, Ga.	2,025 Miles
WDAJ	College Park, Ga.	2,025 Miles
WLW	Cincinnati, Ohio	1,900 Miles
WCX	Detroit, Mich.	2,000 Miles
WOAI	San Antonio, Tex.	1,350 Miles
WHB	Kansas City, Mo.	1,400 Miles
WHAZ	Troy, N. Y.	2,500 Miles
WLAG	Minneapolis, Minn.	1,500 Miles
WMAT	Duluth, Minn.	1,600 Miles
WGY	Schenectady, N. Y.	2,500 Miles
KFBB	Havre, Mont.	1,025 Miles
KDYX	Honolulu, T. H.	2,300 Miles
WOS	Jefferson City, Mo.	1,500 Miles
PWX	Havana, Cuba	2,400 Miles
CFCN	Calgary, Alta., Canada	1,100 Miles
CHBC	Calgary, Alta., Canada	1,100 Miles
WOI	Ames, Iowa	1,475 Miles
WSY	Birmingbam, Ala.	1,925 Miles
WFAA	Dallas, Tex.	1,350 Miles
WGF	Des Moines, Iowa	1,475 Miles
WFAT	Sioux Falls, S. D.	1,300 Miles
CJCE	Winnipeg, Man., Canada	1,450 Miles
WPAC	Okmulgee, Okla.	1,325 Miles
WDAF	Kansas City, Mo.	1,400 Miles

GEORGE M. LAY, Golden, Col., built a regenerative tuner, bougbt a WD-11 tube, and since then has received over fifty stations. He says "I would like to bear from some other WD-11 dry cell tube records as I am convinced they are the goods for home entertainment and are very efficient."

PWX	Havana, Cuba	2,000 Miles
WGY	Schenectady, N. Y.	1,700 Miles
WAAJ	Boston, Mass.	1,900 Miles
KDKA	Pittsburgh, Pa.	1,300 Miles
WSB	Atlanta, Ga.	1,300 Miles
WWJ	Detroit, Mich.	1,200 Miles
WCK	Detroit, Mich.	1,200 Miles
WCAE	Pittsburgh, Pa.	1,300 Miles
WHAS	Louisville, Ky.	1,100 Miles
WLW	Cincinnati, Obio	1,100 Miles

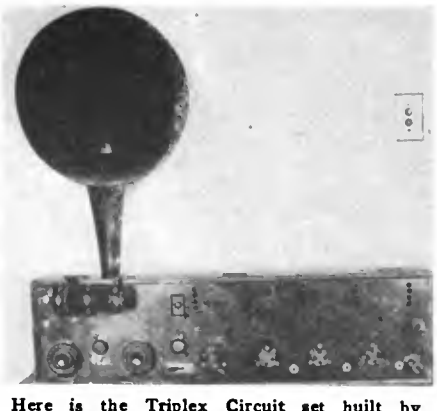
O. J. NELSON, Rockford, Ill., uses a honeycomb tuner of a single detector, and has beard:

WHB	Kansas City, Mo.	350 Miles
WOAG	Minneapolis, Minn.	300 Miles

without either antenna or ground. When he connects his set to the antenna and ground system the following come in:

KFI	Los Angeles, Cal.	1,600 Miles
KHJ	Los Angeles, Cal.	1,600 Miles
KWH	Los Angeles, Cal.	1,600 Miles
KPO	San Francisco, Cal.	1,750 Miles

D. MARTIN CHEEVER and BRUCE B. CHEEVER, age 10 and 7 respectively, of Chicago, are delighted



Here is the Triplex Circuit set built by A. S. Mawhinney of 801 Riverside Drive, New York, on which he has consistently worked DX broadcasting stations across the continent. One of the unusual features of Mr. Mawhinney's records is that he uses a common iron fire escape for an antenna. This is a 2 radio detector and 2 audio set

with their Aeriola Senior, and asked Dwight B. Cheever to write THE WIRELESS AGE that they had heard the following stations:

WAAJ	Boston, Mass.	1,011 Miles
KFZ	Spokane, Wash.	1,800 Miles
KFI	Los Angeles, Cal.	2,231 Miles
PWX	Havana, Cuba	1,621 Miles
WDAL	Jacksonville, Fla.	1,083 Miles
WDAE	Tampa, Fla.	1,200 Miles
KON	San Diego, Cal.	2,300 Miles

J. H. WALL, Rensselaer, N. Y., uses a honeycomb tuner with a two-step amplifier, has heard 120 broadcasting stations, of which the following are over one thonsand miles distant:

KNF	Aberdeen, Wash.	2,425 Miles
KOB	State College, N. M.	1,925 Miles
PWX	Havana, Cuba	1,500 Miles
WBL	Anthony, Kans.	1,350 Miles
WPA	Ft. Worth, Tex.	1,450 Miles
WBAP	Ft. Worth, Tex.	1,450 Miles
WLAJ	Waco, Tex.	1,400 Miles
WFAA	Dallas, Tex.	1,400 Miles
WNAF	Enid, Okla.	1,325 Miles
WDAV	Muskogee, Okla.	1,250 Miles
WEAP	Mobile, Ala.	1,125 Miles
WOK	Pine Bluff, Ark.	1,125 Miles
WNAK	Warbolton, Kans.	1,175 Miles
WHB	Kansas City, Mo.	1,100 Miles
WDAF	Kansas City, Mo.	1,100 Miles
WEAK	St. Joseph, Mo.	1,100 Miles
WWC	Memphis, Tenn.	1,025 Miles
WFAW	St. Cloud, Minn.	1,025 Miles
WOI	Ames, Iowa	1,000 Miles

DONALD BLACKIE, Ingelwood, Calif., hears not only the Pacific Coast and Middle West, but has also picked up Havana, Cuba, with a single WD-11 tube:

KDYS	Great Falls, Mont.	1,000 Miles
CKCN	Calgary, Alberta	1,200 Miles
WBAP	Fort Worth, Tex.	1,200 Miles
WOAI	San Antonio, Tex.	1,200 Miles
WHB	Kansas City, Mo.	1,350 Miles
KDS	St. Louis, Mo.	1,600 Miles
WOC	Davenport, Iowa	1,600 Miles
KYW	Chicago, Ill.	1,750 Miles
WWJ	Detroit, Mich.	2,000 Miles
PWX	Havana, Cuba	2,350 Miles

JOHN V. N. BEAGEN, Port Jefferson, N. Y., who has amateur license call 2GT, bas heard the following broadcasters on one tube:

PWX	Havana, Cuba	1,400 Miles
WHB	Kansas City, Mo.	1,200 Miles
WDAF	Kansas City, Mo.	1,200 Miles
WBAP	Fort Worth, Tex.	1,500 Miles
WOAF	Tyler, Tex.	1,450 Miles
WFAA	Dallas, Tex.	1,450 Miles
WMC	Mempbis, Tenn.	1,050 Miles
WLAG	Mineapolis, Minn.	1,100 Miles
CFCC	Edmonton, Alberta	2,000 Miles

EDITOR'S NOTE: The following records made with crystal sets are printed as submitted by readers. It is important to note, however, that in some cases distant reception of broadcasting by crystal sets is to be attrihuted to re-radiation from a nearby regenerative vacuum tnbe receiver. While there are fully authenticated instances in whicb an exceptionally efficient crystal receiver has picked up distant stations itself without such assistance, it is impossible, however, to determine the facts in eacb case without very careful investigation carried out at the time when the distant stations are heard.

GEORGE B. SMITH, Grove Ciy Obio, emphatically refutes the current impression that a crystal detector cannot receive bro- casting more distant than 15 miles. He hears not only local stations with his bome made crystal set, but also the following:

KDKA	Pittsburgb, Pa.	175 Miles
KYW	Chicago, Ill.	300 Miles
WOC	Davenport, Iowa	425 Miles
WGY	Schenectady, N. Y.	500 Miles
WBAY	New York, N. Y.	475 Miles
WWJ	Detroit, Mich.	175 Miles

J. W. AUSTIN, Lexington, Ky., made a crystal set in accordance with the specifications for the "100-mile crystal receiving set" in the December issue of THE WIRELESS AGE. It took him about 10 bours and cost less than $5.00 to make the tuner. Experiments with it were made at station 9YC, tbe Radio Club at the University of Kentucky, with the following exceptional results:

WOC	Davenport, Iowa	400 Miles
WWJ	Detroit, Mich.	350 Miles
WGY	Schenectady, N. Y.	700 Miles

DONALD BLACKIE, Inglewood, Cal., recently blew out three tubes, and while earning the money to buy new ones had to return to a crystal receiver consisting of a variometer and a .0005 variable condenser. The results have surprised him:

KFAW	Santa Ana, Cal.	30 Miles
KPO	San Francisco, Cal.	375 Miles
KZN	Salt Lake City, Utah	600 Miles
KDYL	Salt Lake City, Utah	600 Miles
KGW	Portland, Ore.	850 Miles

Just before be blew out the tubes he heard:

WOR	Newark, N. J.	2,425 Miles
WHAZ	Troy, N. Y.	2,500 Miles

Broadcasting Seen Through RCA Eyes

The Annual Report of the Radio Corporation of America for 1922 Makes Plain the Vital Position that Broadcasting Occupies and Analyzes Future Development

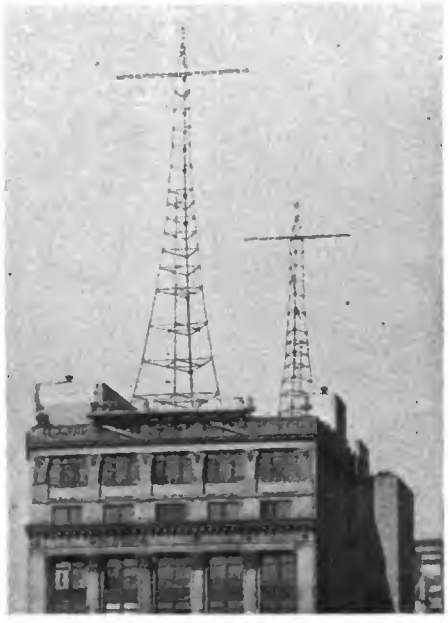
Editor's Note — The quotation from the 1922 report of the Radio Corporation of America is printed herewith in order to give as wide a circulation as possible to the facts given and opinions expressed. These are not only valuable in themselves, but when it is considered that they are the official utterance of the largest American radio corporation they assume an importance that is even greater than their general interest.

"At the time your Corporation was formed in 1919, for the purpose of building up a world-wide international wireless communication system, wireless telephony had not passed out of the experimental stage, and it was not at that time foreseen that the broadcasting art would ever reach the high point of popularity that it has in the last year. The engineers and scientists had anticipated the development of wireless telephony for communication purposes, but no one had visualized the phenomenal expansion of wireless telephony as used today for broadcasting.

"In the last year the number of broadcasting stations has grown from less than twenty to almost six hundred. The art itself is advancing very fast, and the ultimate effect of broadcasting upon the economic, social, religious, political, educational life of the country and the world, is comparable only with that of the discovery of printing 500 years ago.

"The value of broadcasting to any individual or community is in proportion to the difficulty of getting this same thing by any other means, and radio's greatest service next to the saving of life at sea will be through broadcasting to those people who are confined to their homes or live in remote communities.

"This, however, will not limit its entertainment value for those who live in the more densely populated sections of the country, as the service should be constantly expanded to meet the wishes and desires of our whole population. It is the opinion of the officers of your Corporation, that radio broadcasting is here to stay, and has become a permanent part of the everyday life of the people of the United States, the home of its development, and that it will ultimately extend throughout the whole civilized world.



Two separate antennas now swing between these towers on the roof of Aeolian Hall, enabling two distinct programs to be transmitted simultaneously

"Successful broadcast wireless telephony is only a little more than a year old, and it is one of the problems of your Corporation to participate in and carry on the technical improvement of the art for the purpose of helping to make broadcasting of the greatest service to all of the people of the country. Today, broadcasting is being done by electrical manufacturing companies, automobile schools, newspapers, Chambers of Commerce, state universities, department stores, Government Departments, etc. Depending upon the size of the station and the class of service rendered, the cost of operating these stations ranges from $25,000 to $100,000 a year.

"It is popularly believed that radio communications can be carried on through the air to an unlimited extent. That, unfortunately, is not true. The spaces in what scientists call 'the ether,' through which communications may be carried on, are very limited.

"In many places in the past year, because of the limited number of wave lengths available for broadcasting and the large number of stations trying to operate on these wave lengths, there has been a great deal of interference. Generally one of two things has happened: either good programs have suffered from this interference, or stations capable of serving many thousands of listeners have been asked to give up time on specific wave lengths to stations less well equipped, which can at best serve only small communities and a limited number of listeners with local programs.

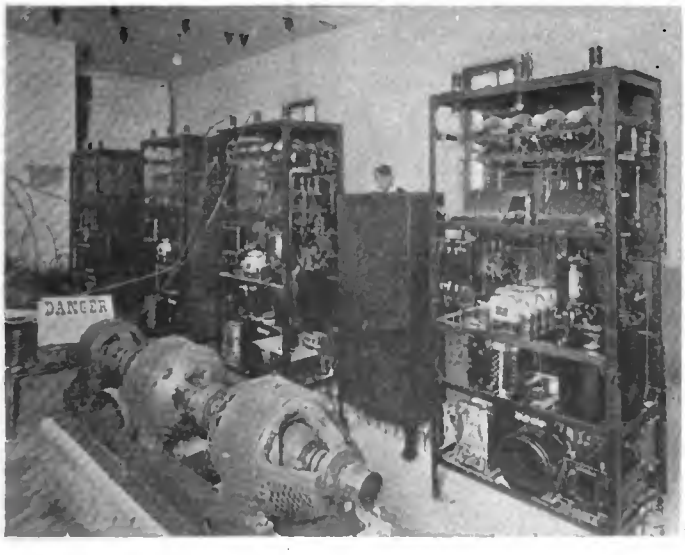
"Although radio broadcasting in spite of this interference has progressed to a point where it is of great value, if the country is to realize the greater possibilities of wireless telephony without going through years of inefficient service and financial loss, broadcasting must ultimately be organized along national lines. The questions of who eventually is to do broadcasting, or of how it is to be paid for and of how to utilize the available wave lengths so that the greatest good will come to the greatest number must be answered before broadcasting can be put upon an enduring and satisfactory basis.

"The officers of your Corporation are giving study to these questions with the hope that through the co-operation of those interested in the development of broadcasting a constructive program will be worked out insuring a universal permanent service.

"During the past year, your Corporation in co-operation with the Westinghouse Electric & Manufacturing Company, has been operating a broadcasting station, WJZ, at Newark, N. J. Your Directors also early in the year authorized the erection of broadcasting stations in New York and Washington. Your engineers designed plans and drew specifications for these stations and the construction work is now nearing completion.

"The stations will embrace all of the latest and most advanced types of transmitting apparatus and will be capable of transmitting on two wave lengths simultaneously. It is hoped that they will be in operation in the very near future.

"The station in New York will be erected on Aeolian Hall Building at 42nd Street near Fifth Avenue, in the heart of the city, and the station in Washington will be located on the Riggs National Bank Building, at 14th Street and Park Road, N. W."

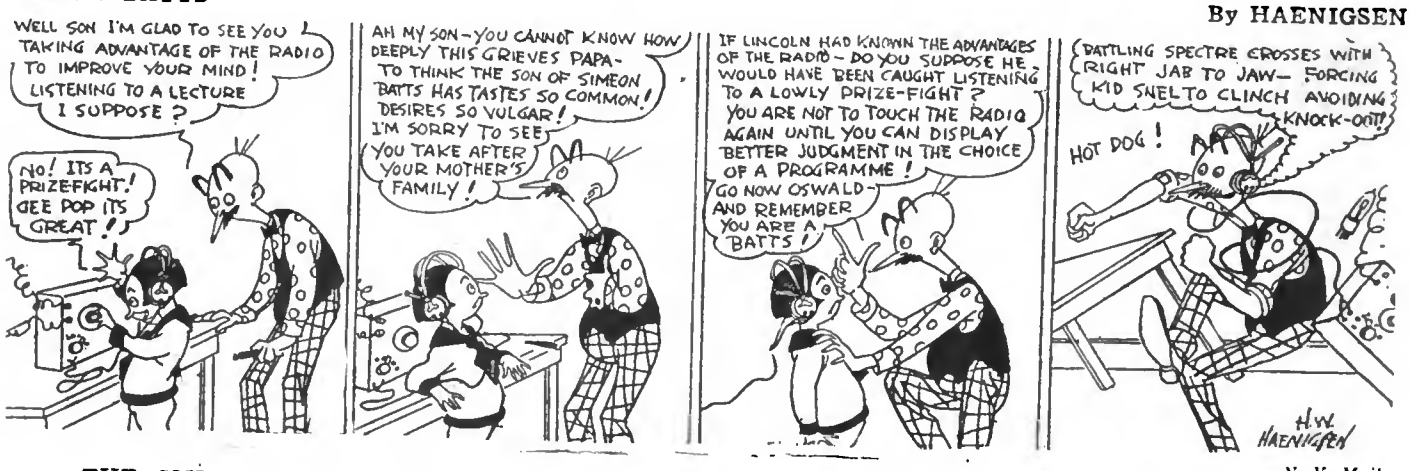


Soon to be heard on the air—the two transmitters in the little radio house on the roof of Aeolian Hall, New York City, with part of the motor-generator plant that provides power. The danger sign means what it says; current was turned on while non-electrical workmen were still on the job, and they had to be warned

Cartoonists' Pens Are Busy with Wireless Witticisms

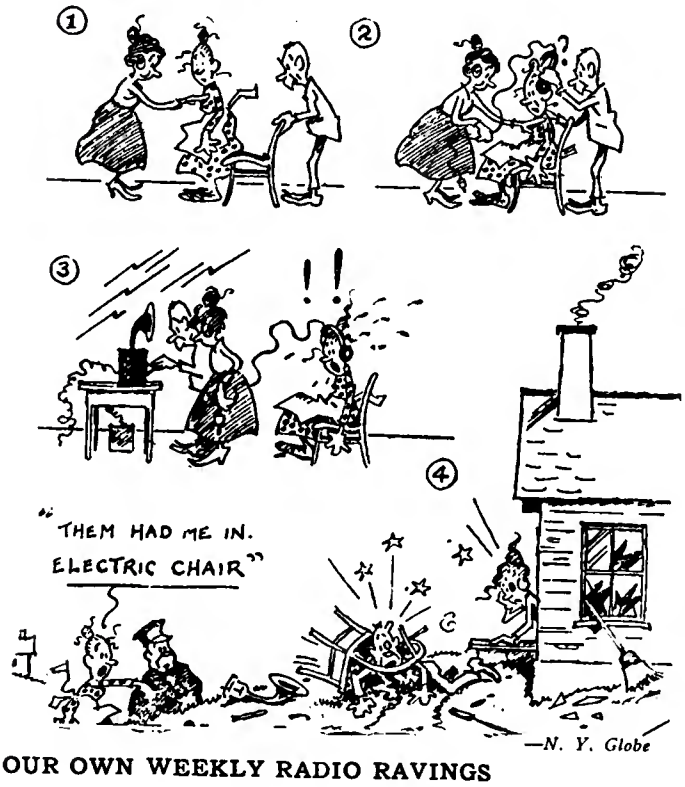
SIMEON BATTS

By HAENIGSEN



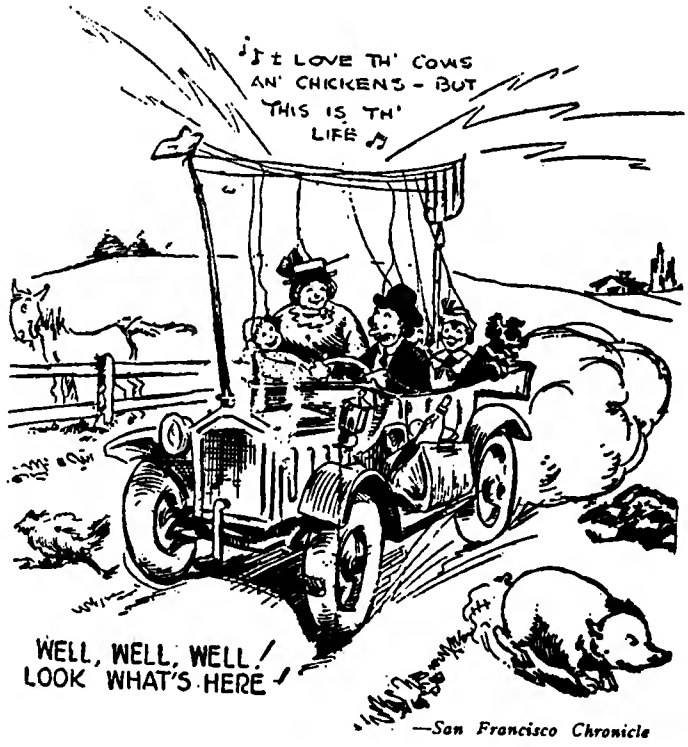
—N. Y. Mail

THE SMITH'S NEW SERVANT GIRL
By FONTAINE FOX



—N. Y. Globe

THE RADIO WAVE
By PINTO

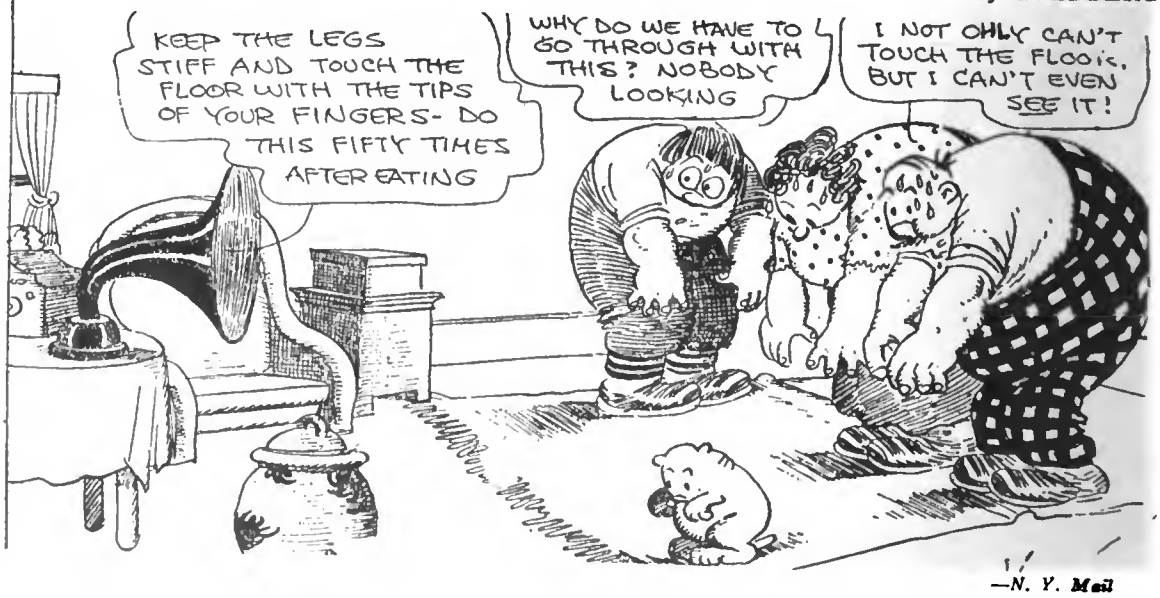


—San Francisco Chronicle

OUR OWN WEEKLY RADIO RAVINGS

By GOLDBERG

THIS FAMILY GOT A LOT OF PLEASURE OUT OF THE RADIO UP TO THE TIME THEY PICKED UP A LECTURE ON PHYSICAL CULTURE BY PROF JULIAN T. LIMBER— BUT IT'S NOT THE RADIO'S FAULT THAT THE FAMILY IS FAT.



—N. Y. Mail

Laughter on the Radio Wave

Radio Mentality Tests

A MENTALITY test for all applying for marriage licenses is proposed by a woman member of the Oregon legislature. Why not apply the idea to intending purchasers of radio stuff? Here goes:

For Mother

If you like to have your clothes line taken for erecting the antenna, mark a cross in this space (——) but if on the other hand you prefer to have the parlor all messed up with wires, draw a circle around the X showing where Willie is spanked.

Put appropriate words in the blanks in this sentence: "Johnnie, if you—— stop dirtying up your room with—— I'll——you."

When you're cooking in the kitchen what good is a radio set in the attic?

Or in the parlor?

Or in the barn if you're entertaining the Thursday Ladies' Club in the (ahem!) drawing room?

Can you turn a knob?

Whose?

Are you familiar with pliers?

What does your husband think about this?

For Father

Add the following and give the answer in dollars and sense (common or garden variety).

$411.44.
Shoes for the baby.
Three spring hats.
One baseball suit.
30c.
Three Pittsburgh stogies.
One case Wrigglums gum.
10 gallons gasoline.
1 ground clamp.
100 feet copper wire.
3 knobs.
Solder, spaghetti, and burnt fingers.
Seven assorted cuss words.
The world's best radio magazine.
Glorious radio concerts.

When you and a goat meet face to face, which salutes first?

Recite the alphabet and name the most popular combinations of three and four letters beginning with W and K.

Why are all groups of three or four letters beginning with N or a numeral regarded with suspicion, aversion and abhorrence?

Any previous signs of insanity in your family?

For Brother

Draw hook-up of the set you want.

How much would it cost?

How does it work?

Explain theory of regeneration in 200 words.

Write 100 words telling how a vacuum tube works.

If you had all the money in the world, what would you buy first?

Wouldn't you buy two of them, so papa could enjoy it too?

How about sister and Aunt Sally, and poor Mrs. Gumms on the other side of the railroad track?

Is there any question on radio that you can't answer?

If so, ask yourself.

"Excuse It, Please!"

Here is one that created hysterics in our house the other day:

Son at radio set—

"Mother, here is Pittsburgh."

Two minutes later:

"Here's Chicago."

Fond Mother, in disgust—

"Open the window and you'll get Chile."

Father (rather chilly himself):

"If you open that window you'll get 'Hell.'" E. M. Myers.

TUNING IN

"Gee, I got station KASH"
"All right, bo, look out for interference from KOPS"

Wise Crack-les

DIT: "Have you learned the code yet?"

DAH: "Morse, Continental, or Fire Underwriters'?"

J. W. P. and E. C. W. complain that when a Ford starts up near their receiving antenna they can hear the engine, even if the antenna is disconnected.

Have you tried shutting the doors and windows and putting cotton in your ears?

In this day of radio bugs nothing surprises us. For instance, we heard without a quiver of a Jerseyite who uses his wire-haired terrier for an aerial. —*N. Y. American.*

THANK YOU!

Gentlemen:

I am a subscriber to W. A. and see in the Wise Crack-les that you would like us to send in jokes; here is mine:

WIRELESS: "Say dumbbell don't you think radio is wonderful, doesn't it give you a thrill when I say you can talk with Chicago by radio?"

AGE: "That's nothing, why, I had a friend in the army in Germany and he blew a bugle there, and when he returned to his home in Long Island he saw the sound." (Long Island Sound).

Don't think I copied this from the *Evening Mail* because I didn't. I was the one who sent it in.

Yours truly,
John Leoutt.

PISH POSH.

Ama Tooer wants to know if the "push pull" amplifier he hears so much about is a portable set, or whether it is necessary to have two men, one pushing and the other pulling, to move it about?

No, dearie, it's the dealer that pushes out the amplifier and pulls in on your pocketbook. After that all you do is push and pull on the switch and the amplifier does the rest.

BROADCASTING STATION DIRECTORY

(Revised to April 20th, 1923)

Class B stations, broadcasting on 400 meters, are designated by ★

KAD	Young Men's Christian Association	Denver, Colo.
KDN	Lee U. Meyerberg Co.	San Francisco, Calif.
★KFI	E. C. Anthony	Los Angeles, Calif.
KFV	Foster Bradbury Radio Store	Yakima, Wash.
KFZ	Doerr Mitchell Elec. Co.	Spokane, Wash.
KGB	Wm. A. Mullins Electric Co.	Tacoma, Wash.
KGG	Hallock & Watson Radio Service	Portland, Ore.
KGN	Northwestern Radio Mfg. Co.	Portland, Ore.
KGD	Altadena Radio Laboratory	Altadena, Calif.
KGU	M. A. Mulrony	Honolulu, Hawaii
★KGW	Oregonian Publishing Co.	Portland, Ore.
KGY	St. Martin's College	Lacey, Wash.
★KHJ	Times Mirror Co.	Los Angeles, Calif.
KHQ	Louis Wasmer	Seattle, Wash.
KJJ	The Radio Shop	Sunnyvale, Calif.
KJQ	C. O. Gould	Stockton, Calif.
KJR	Vincent I. Kraft	Seattle, Wash.
KJS	Bible Institute of Los Angeles, Inc.,	Los Angeles, Calif.
KLB	J. J. Dunn & Co.	Pasadena, Calif.
KLN	Noggle Electric Works	Monterey, Calif.
KLS	Warner Brothers	Oakland, Calif.
KLX	Tribune Publishing Co.	Oakland, Calif.
KLZ	Reynolds Radio Co.	Denver, Colo.
KMC	Lindsay-Weatherill & Co.	Readley, Calif.
KMJ	San Joaquin Light & Power Co.	Fresno, Calif.
KMD	Love Electric Co.	Tacoma, Wash.
KNI	T. W. Smith	Eureka, Calif.
KNJ	Roswell Public Service Co.	Roswell, N. M.
KNN	Bullock's	Los Angeles, Calif.
KNT	North Coast Products Co.	Aberdeen, Wash.
KNV	Radio Supply Co.	Los Angeles, Calif.
KNX	Electric Lighting Supply Co.	Los Angeles, Calif.
KDA	Y. M. C. A.	Denver, Colo.
KDB	New Mexico College of Agriculture and Mechanical Arts,	State College, N. Mex.
KDP	Detroit Police Dept.	Detroit, Mich.
KDQ	Modesto Evening News	Modesto, Calif.
★KPD	Hale Brothers	San Francisco, Calif.
KQI	University of California	Berkeley, Calif.
KQP	Apple City Radio Club	Hood River, Ore.
KQV	Doubleday-Hill Electric Co.	Pittsburgh, Pa.
KQW	Charles D. Herreid	San Jose, Calif.
KQY	Stubbs Electric Co.	Portland, Ore.
KRE	Maxwell Electric Co.	Berkeley, Calif.
★KSD	Post Dispatch	St. Louis, Mo.
KSL	The Emporium	San Francisco, Calif.
KSS	Frost & Dean Radio Rsch. Lab.	Long Beach, Calif.
KTW	First Presbyterian Church	Seattle, Wash.
KUD	The Examiner Printing Co.	San Francisco, Cal.
KUS	City Dye Works & Laundry Co.	Los Angeles, Cal.
KUY	Coast Radio Co.	Del Monte, Calif.
KWG	Portable Wireless Telephone Co.	Stockton, Calif.
KWH	Los Angeles Examiner	Los Angeles, Calif.
KXD	Herald Publishing Co.	Modesto, Calif.
KYI	Alfred Harrell	Bakersfield, Calif.
KYJ	Leo J. Meyberg Co.	Los Angeles, Calif.
KYQ	Electric Shop	Honolulu, T. H.
★KYW	Westinghouse Electric & Mfg. Co.	Chicago, Ill.
KZM	Preston, D. Allen	Oakland, Calif.
KZN	The Desert News	Salt Lake City, Utah
KZV	Wenatchee Battery & Motor Co.,	Wenatchee, Wash.
★KDKA	Westinghouse Electric & Mfg. Co.,	Pittsburgh, Pa.
KDPT	Southern Electric Co.	San Diego, Calif.
KDYL	Telegrem Publishing Co.	Salt Lake City, Utah
KDYM	Savoy Theatre	San Diego, Calif.
KDYQ	Oregon Institute of Technology	Portland, Ore.
KDYS	The Tribune, Inc.	Orast Falls, Mont.
KDYW	Smith, Hughes & Co.	Phoenix, Ariz.
KDYX	Star Bulletin Publishing Co.	Honolulu, T. H.
KDZA	Arizona Daily Star	Tucson, Ariz.
KDZB	Frank E. Siefert	Bakersfield, Calif.
KDZE	The Rhodes Co.	Seattle, Wash.
KDZF	Automobile Club of So. Calif.,	Los Angeles, Calif.
KDZG	Cyrus Peirce & Co.	San Francisco, Calif.
KDZH	Fresno Evening Herald	Fresno, Calif.
KDZI	Electric Supply Co.	Wenatchee, Wash.
KDZK	Nevada Machinery & Electric Co.	Reno, Nev.
KDZQ	Pyle & Nichols	Denver, Colo.
KDZR	Bellingham Publishing Co.	Bellingham, Wash.
KDZT	Seattle Radio Association	Seattle, Wash.
KDZU	Western Radio Corporation	Denver, Colo.
KDZW	Cope & Cornwell Co.	Salt Lake City, Utah
KDZX	Glad Tidings Tabernacle	San Francisco, Calif.
KDZZ	Kinney Brothers & Slipprell	Everett, Wash.
KFAD	McArthur Brothers Mercantile Co.,	Phoenix, Ariz.
KFAE	State College of Washington	Pullman, Wash.
KFAF	Western Radio Corporation	Denver, Colo.
KFAJ	University of Colorado	Boulder, Colo.
KFAN	Electric Shop	Moscow, Idaho
KFAP	Standard Publishing Co.	Butte, Mont.
KFAQ	City of San Jose	San Jose, Calif.
KFAR	O. K. Olsen	Hollywood, Calif.
KFAT	Dr. S. T. Donohue	Eugene, Ore.
KFAU	Independent School District	Boise City, Idaho
KFAV	Abbott-Kinney Co.	Venice, Calif.
KFAW	The Radio Den, Ashford & White,	Santa Anna, Cal.
KFAY	W. J. Virgin Milling Co.	Central Point, Ore.
KFAZ	C. H. Weatherall	Raddlay, Calif.
KFBB	F. A. Buttrey & Co.	Havre, Mont.
KFBC	W. K. Asbill	San Diego, Calif.
KFBD	Clarence V. Welch	Hanford, Calif.
KFBE	Reuben H. Horn	San Luis Obispo, Calif.
KFBK	Kimball-Upson Co.	Sacramento, Calif.
KFBL	Leese Brothers	Everett, Wash.
KFBS	Chronicle News and Gas & Elec. Supply Co.,	Trinidad, Colo.
KFBU	Bishop N. S. Thomas	Laramie, Wyo.
KFCB	Nielsen Radio Supply Co.	Phoenix, Ariz.
KFCD	Salem Elec. Co.	Salem, Ore.
KFCF	Frank A. Monre	Walla Walla, Wash.
KFCH	Electric Service Station	Billings, Mont.
KFCK	Colorado Springs Radio Co.,	Colorado Springs, Colo.
KFCL	Los Angeles Union Stock Yds.,	Los Angeles, Calif.
KFCM	Richmond Radio Shop	Richmond, Calif.
KFCP	Ralph W. Flygare	Ogden, Utah
KFCQ	Motor Service Station	Casper, Wyo.
KFCV	Fred Mahaffey, Jr.	Houston, Tex.
KFCY	Western Union College	Le Mars, Iowa
KFCZ	Omaha Central High School	Omaha, Nebr.
KFDA	Adler's Music Store	Baker, Ore.
★KFDB	Mercantile Trust Co.	San Francisco, Calif.
KFDC	Radio Supply Co.	Spokane, Wash.
KFDD	St. Michaels Cathedral	Boise, Idaho
KFDF	Wyoming Radio Corp.	Casper, Wyo.
KFDH	University of Arizona	Tucson, Ariz.
KFDJ	Oregon Agri. College	Corvallis, Ore.
KFDL	Knight-Campbell Music Co.	Denver, Colo.
KFDD	H. Everett Cutting	Bozeman, Mont.
KFDP	Hawkeye Radio & Supply Co.	Des Moines, Iowa
KFDR	Bullock's Hardware & Sporting Goods,	York, Nebr.
KFDU	Nebraska Radio Elec. Co.	Lincoln, Nebr.
KFDV	Gilbreth & Stinson	Fayetteville, Ark.
KFDX	First Baptist Church	Shreveport, La.
KFDY	South Dakota State College of Agrl. & Mech. Arts,	Brookings, S. D.
KFDZ	Harry O. Iverson	Minneapolis, Minn.
KFEB	The City of Teft	Taft, Calif.
KFEC	Meier & Frank Co.	Portland, Ore.
KFEJ	Guy Oreason	Tacoma, Wash.
KFEL	Winner Radio Corporation	Denver, Colo.
KFEP	Radio Equipment Co.	Denver, Colo.
KFEQ	J. L. Scroggin	Oak, Nebr.
KFER	Auto Electric Service Co., Inc.,	Ft. Dodge, Iowa
KFEV	Radio Electric Shop	Douglas, Wyo.
KFEY	Bunker Hill & Sullivan Mining & Const. Co.,	Kellogg, Idaho
KFEZ	American Society of Mech. Engrs.	St. Louis, Mo.
KFFA	Dr. R. C. Shelton	San Diego, Calif.
KFFE	Eastern Oregon Radio Co.	Pendleton, Ore.
KFFJ	Jenkins Furniture Co.	Boise, Idaho
KFFD	Dr. E. H. Smith	Hillsboro, Ore.
KFFP	First Baptist Church	Moberly, Mo.
KFFQ	Marksehoffel Motor Co.	Coloredo Springs, Colo.
KFFR	Jim Kirk	Sparks, Nev.
KFFV	Graceland College	Lamoni, Iowa
KFGB	Loewenthal Brothers	Pueblo, Colo.
KFGF	Buehanan Stevens & Co.	Mt. Vernon, Wash.
KFGH	Leland Stanford, Jr., Univ.	Stanford Univ., Colo.
KFHA	Colorado State Normal School	Gunnison, Colo.
KFHB	P. L. Boardwell	Hood River, Ore.
KFHJ	Fallon Co.	Santa Barbara, Calif.
KFHR	Star Electric & Radio Co.	Seattle, Wash.
KFIF	Benson Tech. Student Body	Portland, Ore.
KFGL	Arlington Garage	Arlington, Ore.
KFHH	Ambrose McCue	Neah Bay, Wash.
WBL	T. & H. Radio Co.	Anthony, Kans.
WBS	D. W. May, Inc.	Newark, N. J.
WBT	Southern Radio Corporation	Charlotte, N. C.
WBU	City of Chicago	Chicago, Ill.
WBZ	Westinghouse Elec. & Mfg. Co.,	Springfield, Mass.
WCE	Findley Electric Co.	Minneapolis, Minn.
WCK	Stix-Beer-Fuller	St. Louis, Mo.
WCM	University of Texas	Austin, Tex.
WCN	Clark University	Worcester, Mass.
★WCX	Detroit Free Press	Detroit, Mich.
WDM	Church of the Covenant	Washington, D. C.
WDT	Ship Owners Radio Service	New York, N. Y.
WDZ	James L. Bush	Tuscola, Ill.
WEB	Benwood Co.	St. Louis, Mo.
WEH	Midland Refining Co.	Tulsa, Okla.
WEV	Hurlburt-Still Electrical Co.	Houston, Tex.
WEW	St. Louis University	St. Louis, Mo.
★WFI	Strawbridge & Clothier	Philadelphia, Pa.
WFY	Cosradio Co.	Wichita, Kans.
WGF	The Register & Tribuna	Des Moines, Iowa
WGI	American Radio and Research Corporation,	Medford Hillside, Mass.
WGL	Thomas F. J. Howlett	Philadelphia, Pa.
★WGM	Atlanta Constitution	Atlanta, Ga.
WGR	Federal Tel. & Tel. Co.	Buffalo, N. Y.
WGV	Interstate Electric Co.	New Orleans, La.
★WGY	General Electric Co.	Schenectady, N. Y.
WHA	University of Wisconsin	Madison, Wisc.
★WHB	Sweeney School Co.	Kansas City, Mo.
WHD	West Virginia University	Morgantown, W. Va.
WHK	The Radiovox Company	Cleveland, Ohio
WHN	Ridgewood Times Printing & Pub. Co.,	Ridgewood, N. Y.
WHX	Iowa Radio Corporation	Des Moines, Iowa
WIK	K. & L. Electric Co.	McKeesport, Pa.
WIL	Continental Electric Supply Co.,	Washington, D. C.
★WIP	Gimbel Brothers	Philadelphia, Pa.
WIZ	Cino Radio Mfg. Co.	Cincinnati, Ohio
WJD	Richard H. Howe	Oranville, Ohio
WJH	White & Bayer	Washington, D. C.
WJK	Service Radio Equipment Co.	Toledo, Ohio
WJX	DeForest Radio Tel. & Tel. Co.,	New York, N. Y.
WJZ	Radio Corporation of America—Westinghouse Elec. & Mfg. Co.,	Newark, N. J.
WKA	Landaus Music & Jewelry Co.,	Wilkes-Barre, Pa.
WKC	Joseph M. Zamoiski Co.	Baltimore, Md.
WKN	Riechman-Crosby Co.	Memphis, Tenn.
WKY	Oklahoma Radie Shop	Oklahoma City, Okla.
WLB	University of Minnesota	Minneapolis, Minn.
WLH	Hamilton Mfg. Co.	Indianapolis, Ind.
WLW	Crosley Mfg. Co.	Cincinnati, Ohio
WMA	Arrow Radio Laboratories	Andarson, Ind.
WMH	Precision Equipment Co.	Cincinnati, Ohio
WMU	Doubleday-Hill Electrical Co.	Pittsburgh, Pa.
WNJ	Shotton Radio Mfg. Co.	Albany, N. Y.
WNO	Wireless Telephone Co. of Hudson County, N. J.,	Jersey City, N. J.
★WDC	Palmer School of Chiropractic	Davenport, Iowa
WOI	Iowa State College	Ames, Iowa
WOK	Arkansas Light & Power Co.	Pine Bluff, Iowa
★WDD	John Wanamaker	Philadelphia, Pa.
WOQ	Western Radio Co.	Kansas City, Mo.
★WOR	L. Bamberger Co.	Newark, N. J.
WOS	Missouri State Mktg. Bureau,	Jefferson City, Mo.
WOU	Metropolitan Utilities District	Omaha, Nebr.
WOZ	Palladium Printing Co.	Richmond, Ind.
WPA	Fort Worth Record	Fort Worth, Tex.
WPG	Nushawg Poultry Farm	New Lebanon, Ohio
WPI	Electric Supply Co.	Clearfield, Pa.
WPM	Thomas J. Williams	Washington, D. C.
WPD	United Equipment Co.	Memphis, Tenn.
WQX	Walter A. Kuehl	Chicago, Ill.
WRK	Doron Brothers Electric Co.	Hamilton, Ohio
WRL	Union College	Schenectady, N. Y.
WRM	University of Illinois	Urbana, Ill.
WRP	Federal Institute of Radio Telegraphy,	Camden, N. J.
WRR	City of Dallas (Police and Fire Signal Department),	Dallas, Tex.
WRW	Tarrytown Radio Research Laboratory,	Tarrytown, N. Y.
★WSB	Atlanta Journal	Atlanta, Ga.
WSL	J. & M. Electric Co.	Utica, N. Y.
WSY	Alabama Power Co.	Birmingham, Ala.
WSZ	Marshall-Gerken Co.	Toledo, Ohio
WTG	Kansas State Agr. College	Manhattan, Kans.
WTP	George M. McBride	Bay City, Mich.
WWB	Daily News Printing Co.	Canton, Ohio
WWI	Ford Motor Co.	Dearborn, Mich.
★WWJ	The Detroit News	Detroit, Mich.
WWL	Loyola University	New Orleans, La.
WWZ	John Wanamaker	New York, N. Y.
WAAB	Valdmar Jensen	New Orleans, La.
WAAC	Tulane University	New Orleans, La.
WAAD	Ohio Mechanics Institute	Cincinnati, Ohio
WAAF	Chicago Daily Drovers' Journal	Chicago, Ill.
WAAH	Commonwealth Electric Co.	St. Paul, Minn.
WAAJ	Eastern Radio Institute	Boston, Mass.
WAAK	Gimbel Brothers	Milwaukee, Wis.
WAAL	Beamish Electric Co.	Minneapolis, Minn.
WAAM	L. R. Nelson Co.	Newark, N. J.
WAAN	University of Missouri	Columbia, Mo.
WAAP	Otto W. Taylor	Wichita, Kans.
WAAQ	New England Motor Sales Co.,	Greenwich, Conn.
WAAS	Osorgia Radio Co.	Decatur, Ga.
WAAW	Omaha Grain Exchange	Omaha, Nebr.
WAAY	Yahrling-Raynor Piano Co.	Youngstown, Ohio
WAAZ	Hollister-Miller Motor Co.	Emporia, Kans.
WAJV	Indian Pipe Line Corp.	Princeton, Ind.
WBAA	Purdue University	West Lafayette, Ind.
WBAD	Sterling Electric Co. and Journal Printing Co.,	Minneapolis, Minn.
WBAH	The Dayton Co.	Minneapolis, Minn.
WBAN	Wireless Phone Corp.	Paterson, N. J.
WBAD	James Millikin University	Decatur, Ill.
★WBAP	The Star Telegram	Fort Worth, Tex.
WBAU	Republican Publishing Co.	Hamilton, Ohio
WBAV	Erner & Hopkins Co.	Columbus, Ohio
WBAW	Marietta College	Marietta, Ohio
WBAX	John H. Stenger, Jr.	Wilkes-Barre, Pa.
★WBAY	American Tel. & Tel. Co.	New York, N. Y.
WCAB	Newburgh News Printing & Publishing Co.,	Newburgh, N. Y.
WCAD	St. Lawrence University	Canton, N. Y.
★WCAE	Kaufman & Baer Co.	Pittsburgh, Pa.
WCAF	Michigan Limestone & Chemical Co.,	Rodgers, Mich.
WCAG	Daily States Publishing Co.	New Orleans, La.
WCAH	Entrekin Electric Co.	Columbus, Ohio
WCAJ	Nebraska Wesleyan University,	University Pl., Nebr.
WCAK	Alfred P. Daniel	Houston, Tex.
WCAL	St. Olaf College	Northfield, Minn.
WCAM	Villanova College	Villanova, Pa.
WCAD	Sanders & Stayman Co.	Baltimore, Md.
WCAR	Alamo Radio Electric Co.	San Antonio, Tex.
WCAS	William Hood Dunwoody Industrial Institute,	Minneapolis, Minn.
WCAT	South Dakota State School of Mines,	Rapid City, S. Dak.
WCAU	Philadelphia Radiophone Co.	Philadelphia, Pa.
WCAV	J. C. Dice Electric Co.	Little Rock, Ark.
WCAX	University of Vermont	Burlington, Vt.
WCAY	Kesselmen O'Driscoll Co.	Milwaukee, Wisc.
WDAC	Illinois Watch Co.	Springfield, Ill.
WDAD	Central Kansas Radio Supply	Lindsborg, Kans.
WDAE	Tampa Daily Times	Tampa, Fla.
★WDAF	Kansas City Star	Kansas City, Mo.
WDAH	Trinity Methodist Church	El Paso, Tex.
WDAI	Hughes Electrical Corp.	Syracuse, N. Y.
WDAJ	Atlanta & West Point R. R. Co.,	College Park, Ga.
WDAK	The Courant	Hartford, Conn.
WDAL	Florida Times Union	Jacksonville, Fla.
WDAM	Weston Electric Co.	New York, N. Y.
WDAD	Automotive Electric Co.	Dallas, Tex.
WDAP	Midwest Radio Central, Inc.	Chicago, Ill.
★WDAR	Lit Brothers	Philadelphia, Pa.
WDAS	Samuel W. Weite	Worcester, Mass.
WDAU	Slocum & Kilburn	New Bedford, Mass.
WDAX	First National Bank	Centerville, Iowa
WDAY	Kenneth M. Hance	Fargo, N. D.
WEAA	Fallain & Lathrop	Flint, Mich.
WEAB	Standard Radio Equipment Co.	Fort Dodge, Ia.
WEAD	Northwest Kansas Radio Sup. Co.,	Atwood, Kans.
WEAE	Virginia Polytechnic Institute	Blacksburg, Va.
★WEAF	Western Electric Co.	New York, N. Y.
WEAG	Nichols-Hineline-Bassett	Edgewood, R. I.
WEAH	Wichita Board of Trade & Landers Radio Co.,	Wichita, Kans.
WEAI	Cornell University	Ithaca, N. Y.
WEAJ	University of South Dakota	Vermillion, S. D.
WEAK	Julius B. Abercrombie	St. Joseph, Mo.
WEAM	Borough of North Plainfield,	North Plainfield, N. J.
WEAN	Shepard Company	Providence, R. I.
WEAO	Ohio State University	Columbus, Ohio
WEAP	Mobile Radio Co., Inc.	Mobile, Ala.
WEAR	Baltimore Am. & News Pub. Co.,	Baltimore, Md.
WEAS	Hecht Company	Washington, D. C.
WEAT	John J. Fogarty	Tampa, Fla.
WEAU	Davidson Brothers Co.	Sioux City, Iowa
WEAV	Sberidan Electric Service Co.	Rushville, Nebr.
WEAX	T. J. M. Daly	Little Rock, Ark.
WEAY	Will Horwita, Jr.	Houston, Tex.
WEAZ	Donald Redmond	Waterloo, Iowa
★WFAA	A. H. Belo & Co.	Dallas, Tex.
WFAB	Carl F. Woese	Syracuse, N. Y.
WFAC	Superior Radio Co.	Superior, Mich.
WFAF	Henry C. Spratley	Poughkeepsia, N. Y.
WFAG	Radio Engineering Laboratory,	Waterford, N. Y.
WFAH	Electrical Supply Co.	Port Arthur, Tex.
WFAJ	Hi-Orade Wireless Instrument Co.,	Asheville, N. C.
WFAM	Times Publishing Co.	St. Cloud, Minn.

WFAN Hutchinson Elec. Service Co...Hutchinson, Minn.
WFAQ Missouri Wesleyan College & Cameron Radio Co., Cameron, Mo.
WFAT Daily Argus Leader .....Sioux Falls, S. D.
WFAU Edwin C. Lewis, Inc. .....Boston, Mass.
WFAV University of Nebraska .....Lincoln, Nebr.
WFAW Miami Daily Metropolis .....Miami, Fla.
WFAY Daniele Radio Supply Co....Independence, Kans.
WFAZ Sooth Carolina Radio Shop....Charleston, S. C.
WGAC Orpheum Radio Stores Co. .....Brooklyn, N. Y.
WGAO Spanish Am. Schl. of Telegraphy, Ensenada, P. R.
WGAH New Haven Elec. Co. .....New Haven, Conn.
WGAJ W. H. Glass .....Shenandoah, Iowa
WGAK Macon Electric Co. .....Macon, Ga.
WGAL Lancaster Elec. Supply & Const. Co., Lancaster, Pa.
WGAM Orangeburg Radio Equipment Co., Orangeburg, S. C.
WGAN Cecil E. Lloyd .....Pensacola, Fla.
WGAQ W. G. Patterson .....Shreveport, La.
WGAR Southern American .....Fort Smith, Ga.
WGAT American Legion, Dept. of Nebr., Lincoln, Nebr.
WGAU Marcus G. Lumb .....Woostar, Ohio
WGAW Ernest C. Albright .....Altoona, Pa.
WGAX Radio Electric Co., Washington Courthouse, Ohio
WGAY North Western Radio Co. .....Madison, Wisc.
WGAZ South Bend Tribune .....South Bend, Ind.
WHAA State University of Iowa.....Iowe City, Ia.
WHAB Clark W. Thompson .....Galveston, Tex.
WHAC Cole Brothers Elec. Co.....Waterloo, Iowa
WHAO Marquette University .....Milwaukee, Wisc.
WHAE Automotive Electric Service Co., Sioux City, Ia.
WHAG University of Cincinnati .....Cincinnati, Ohio
WHAH J. T. Griffin .....Joplin, Mo.
WHAK Roberts Hardware Co. .....Clarksburg, W. Va.
WHAL Lansing Capitol News .....Lansing, Mich.
WHAM School of Music, Rochester Univ., Rochester, N. Y.
WHAO F. A. Hill .....Savannah, Ga.
WHAP Dewey L Otta .....Decatur, Ill.
WHAQ Semmes Motor Co. .....Washington, D. C.
WHAR Paramount Redio & Elec. Co., Atlantic City, N. J.
WHAS Conrier Journal & Louisvills Times, Louisville, Ky.
WHAV Wilmington Elec. & Supply Co., Wilmington, Del.
WHAW Pieree Electric Co. .....Tampa, Fla.
WHAX Huntington Press .....Huntington, Ind.
*WHAZ Rensselaer Polytechnic Institute....Troy, N. Y.
WIAS Joslyn Automobils Co. .....Rockford, Ill.
WIAO Ocean City Yacht Club .....Ocean City, N. J.
WIAE Mrs. Robt. E. Zimmerman.....Venton, Ia.
WIAF Oustav A. DeCortin .....New Orleans, La.
WIAH Continental Radio Mfg. Co.....Newton, Ia.
WIAI Heers Stores Co. .....Springfield, Mo.
WIAJ Fox River Valley Radio Supply Co., Neenah, Wisc.
WIAK The Stockman Journal .....Omaha, Nebr.
WIAP J. A. Rudy & Sons .....Paducah, Ky.
WIAQ Chronicls Publishing Co. .....Marion, Ind.
WIAS Burlington Hawkeye-Home Elec. Co., Burlington, Ia.
WIAT Leon T. Noel .....Tarkio, Mo.
WIAU American Sec. & Sav. Bank.....Le Mars, Ia.
WIAV New York Radio Laboratories, Binghamton, N. Y.
WIAW Saginaw Radio & Elec. Co.....Saginaw, Mich.
WIAY Woodward & Lathrop .....Washington, D. C.
WIAZ Electric Supply Sales Co. .....Miami, Fla.
WJAO Jackson's Radio Eng. Lab. .....Waco, Tex.
WJAQ Huse Publishing Co. .....Norfolk, Nabr.
WJAJ Y. M. C A. .....Dayton, Ohio
WJAK White Radio Laboratory.....Stockdale, Ohio
WJAM D. M. Perham .....Cedar Rapids, Ia.
WJAN Peoria Star & Peoria Radio Sales Co., Peoria, Ill.
WJAP Kelly-Duluth Co. .....Duluth, Minn.
WJAR The Outlet Co. .....Providence, R. I.
WJAS Capper Publications .....Topeka, Kans.
WJAT Kallay-Yawter Jewelry Co.....Marshall, Mo.
WJAX The Union Trust Co.....Cleveland, Ohio
WJAZ Chicago Radio Laboratory.....Chicago, Ill.
WKAA H. F. Paar & Republican Times, Cedar Rapids, Ia.
WKAC Star Publishing Co. .....Lincoln, Nebr.
WKAF W. S. Radio Supply Co. and Wm. Schack, Wichita Falls, Tex.
WKAH Planet Radio Co. .....West Palm Beach, Fla.

WKAK Okfuskee County News .....Okemah, Okla.
WKAL Gray & Gray .....Orange, Tex.
WKAN Alabama Radio Mfg. Co.....Montgomery, Ala.
WKAP Dutee Wilcox Flint .....Cranston, R. I.
WKAQ Radio Corporation of Porto Rico, San Juan, P. R.
WKAR Michigan Agrl. College.....East Lansing, Mich.
WKAS L. E. Lines Music Co. .....Springfield, Mo.
WKAV Laconia Radio Club .....Laconia, N. H.
WKAW Turner Cycle Co .....Beloit, Wisc.
WKAX Wm. A. MacFarlane .....Bridgeport, Conn.
WKAY Brenau College .....Janesville, Ga.
WLAC North Caroline State College.....Raleigh, N. C.
*WLAG Cutting & Washington Radio Corp., Minneapolis, Minn.
WLAH Samuel Woodworth .....Syracuse, N. Y.
WLAJ Weco Electrical Supply Co. .....Waco, Tex.
WLAK Vermont Farm Mech. Co.....Bellows Falls, Vt.
WLAL Tulsa Radio Co. .....Tulsa, Okla.
WLAN Putnam Hardware Co. .....Houlton, Me.
WLAP W. V. Jordon .....Louisville, Ky.
WLAQ A. E. Schilling .....Kalamazoo, Mich.
WLAS Hutchinson Grain Radio Co.....Hutchinson, Kans.
WLAT Radio and Specialty Co. .....Burlington, Iowa
WLAV Electric Shop, Inc. .....Pensacola, Fla.
WLAW New York Police Dept....New York City, N. Y.
WLAX Greencastle Community Broadcasting Station, Greencastle, Ind.
WLAY Northern Commercial Co. of Alaska, Fairbanks, Alaska
WLAZ Hutton & Jones Elec. Co.....Werren, Ohio
WMAB Radio Supply Co. .....Oklahoma City, Okla.
WMAC F. Edward Page.....Fernwood, Cazenovia, N. Y.
WMAF Round Hills Radio Corp. .....Dertmouth, Mass.
WMAG Tucker Electric Co. .....Liberal, Kans.
WMAH General Supply Co. .....Lincoln, Nebr.
WMAJ Drovers Telegram Co. .....Kansas City, Mo.
WMAK Norton Laboratories .....Lockport, N. Y.
WMAL Trenton Hardware Co. .....Trenton, N. J.
WMAM Beaumont Radio Equipment Co., Beaumont, Tex.
WMAN Broad Street Baptist Church.....Columbus, Ohio
WMAP Utility Battery Service .....Easton, Pa.
WMAQ The Chicago Deily News .....Chicago, Ill.
WMAR Waterloo Electrical Supply Co....Waterloo, Iowa
WMAT Peramount Radio Corporetion.....Duluth, Minn.
WMAV Alabama Polytechnic Institute.....Auburn, Ala.
WMAW Wahpeton Elec. Co.....Wahpeton, N. D.
WMAX K. & K. Radio Supply Co. ....Ann Arbor, Mich.
WMAY Kingshighway Presby. Church.....St. Louis, Mo.
WMAZ Mercer Univerelty .....Macon, Ga.
WNAB Park City Daily News.....Bowling Green, Ky.
WNAC Shepard Stores .....Boston, Mass.
WNAO Oklahome Radio Eng. Co. .....Norman, Okla.
WNAL R. J. Rockwell .....Omaha, Nebr.
WNAM Idesi Apparatus Co. .....Evansville, Ind.
WNAN Syracuse Radio Tele. Co. .....Syracuse, N. Y.
WNAP Wittenberg College .....Springfield, Ohio
WNAQ Charleston Radio Elec. Co. .....Cberleston, S. C.
WNAR C. C Rhodes .....Butler, Mo.
WNAS Texas Redio Corporation and Austin Statesman, Austin, Tex.
WNAT Lenning Bros. Co. .....Philadelphia, Pa.
WNAW Henry Kunzmann .....Fortress Monroe, Va.
WNAX Dakota Radio Apparatus Co.....Yankton, S. D.
WNAY Ship Owners' Radio Service.....Baltimore, Md.
WOAA Dr. Walter Herdy .....Ardmore, Okla.
WOAB Valley Radio .....Grand Forks, N. D.
WOAC Maus Radio Co. .....Lima, Ohio
WOAO Friday Bettery & Elec. Co.....Sigourney, Iowa
WOAE Midland College .....Fremont, Nabr.
WOAF Tyler Commercial College .....Tyler, Tex.
WOAG Apollo Theatre .....Belvidere, Ill.
WOAH Palmetto Radio Corp. .....Charleston, S. C.
WOAI Southern Equipment Co. .....San Antonio, Tex.
WOAJ Errin's Electrical Co.....Parsons, Kans.
WOAK Collins Hardwere Co. .....Frankfort, Ky.
WOAL Wm. E. Woods .....Webster Groves, Mo.
WOAN James D. Vaughan .....Lawrenceburg, Tenn.
WOAP Kalsmazoo College .....Kalamazoo, Mich.
WOAR Henry P. Lundskow .....Kenosha, Wisc.
WOAS Bailey's Radio Shop .....Middletown, Conn.
WOAT Boyd Martell Hamp .....Wilmington, Del.
WOAU Snowder Bolling Piano Co.....Evansville, Ind.
WOAV Penna. National Guard .....Erie, Pa.
WOAX Frankiyn J. Wolff .....Trenton, N. J.
WOAZ Penick Hughes Co. .....Stanford, Texas
WPAB Pennsylvania Stats College....State College, Pa.

WPAC Donaldson Radio Co. .....Okmulgee, Okla.
WPAO Wieboldt & Co. .....Chicago, Ill.
WPAF Peterson's Radio Co. .....Council Bluffs, Iowa
WPAG Central Radio Co., Inc.....Independence, Mo.
WPAH Wisconsin Dept. of Markets.....Waupaca, Wisc.
WPAJ Doolittls Radio Corporation....New Haven, Conn.
WPAK No. Dakota Agricultural College....Fargo, N. D.
WPAL Superior Radio & Tsl. Equipt. Co., Columbus, Ohio
WPAM Awerbach & Guettel .....Topeka, Kans.
WPAP Theodore D. Phillips .....Councll Bluffs, Iowa
WPAQ General Sales & Eng. Co.....Frostburg, Md.
WPAR R. A. Ward .....Beloit, Kans.
WPAS J & M Electric Co. .....Amsterdam, N. Y.
WPAT St. Patrick's Cathedral .....El Paso, Tex.
WPAU Concordie College .....Moorhead, Minn.
WPAV Paul Tinetti & Sons.....Laurium, Mich.
WPAW Radio Installation Co., Ino....Wilmington, Del.
WPAX S-W Radio Co., J. R. Shumate, Jr., Thomasville, Ga.
WPAY Bangor Radio Laboratory .....Bangor, Me.
WPAZ Dr. John R. Koch.....Charleston, West Va.
WQAA Horace A. Beale, Jr.....Parkersburg, Pa.
WQAB Southwest Missouri State Teachers College, Springfield, Mo.
WQAC E. B. Gish .....Amarillo, Tex.
WQAO Whithall Electric Co. .....Waterbury, Conn.
WQAE Moore Radio News Station.....Springfield, Vt.
WQAF Sandusky Register .....Sandusky, Ohio
WQAH Brock-Anderson Elec. Eng. Co., Lexington, Ky.
WQAJ Ann Arbor Times-News .....Ann Arbor, Mich.
WQAK Appel-Higley Electric Co. .....Dubuque, Iowa
WQAL Cole County Tel. and Tel. Co.....Mattoon, Ill.
WQAM Electrical Equipment Co. .....Miami, Fla.
WQAN Scranton Times .....Scranton, Pa.
WQAO Calvary Baptist Church .....New York, N. Y.
WQAQ West Texas Radio Co. .....Ahilene, Tex.
WQAR Press Publishing Co. .....Muncie, Ind.
WQAS Walter Prince Co. .....Lowell, Mass.
WQAT Radio Equipment Corporation...Westhampton, Va.
WQAV Huntington & Guerry, Inc.....Greenville, S. C.
WQAW Catholic University .....Washington, D. C.
WQAX Radio Equipment Co. .....Peoria, Ill.
WQAY Gaston Music & Furnitura Co....Hastings, Nebr.
WQAZ Greenshoro Daily News.....Greensboro, N. C.
WRAA Rice Institute .....Houston, Tex.
WRAB Savannah Board of Public Education, Savannah, Ga.
WRAC State Normal School .....Mayville, N. D.
WRAO Taylor Radio Shop .....Merion, Kans.
WRAH Stanley N. Reed.....Providence, R. I.
WRAK Economy Light Co.....Escanebe, Mich.
WRAL Northern States Power Co..St. Croix Falls, Wisc.
WRAM Lombord College .....Galesburg, Ill.
WRAN Block Hswk Elec. Co.....Waterloo, Iowa
WRAO Radio Service Co. .....St. Louis, Mo.
WRAP Winter Park Elec. Construction Co., Winter Perk, Fla.
WRAR Jacob C. Thomas .....David City, Nebr.
WRAS Radio Supply Co. .....McLeansboro, Ill.
WRAU Amarillo Daily News .....Amarillo, Tex.
WRAV Antioch College .....Yellow Spring, Ohio
WRAY Radio Sales Corporation .....Scranton, Pa.
WSAA B. S. Sprague Elec. Co.....Marietta, Ohio
WSAB Southeast Mo. State College, Cape Girardeau, Mo.
WSAC Clemson Agricultural College.Clemson College, S.C.
WSAH A. G. Leonard, Jr. .....Chicago, Ill.
WSAJ Grove City College .....Grove City, Pe.
WSAL Franklin Elec. Co. .....Brookville, Ind.
WSAP Seventh Day Adventist Church...New York, N. Y.
WSAS State of Nebraska .....Lincoln, Nebr.
WSAT Plainview Electric Co. .....Plainview, Tex.
WSAV Clifford W. Vick, Radio Construction Co., Houston, Tex.
WTAC Penn Traffic Co. .....Johnstown, Pa.
WTAS George D. Carpenter .....Elgin, Ill.
WTAU Rusgy Battery & Elec. Co.....Tecumseh, Nebr.
WTAW Agricultural & Mechanical College of Texas, College Station, Tex.
WWAC Sanger Brothers .....Waco, Tex.
WWAD Wright & Wright, Inc.....Philadelphia, Pa.
WWAH General Supply Co. .....Lincoln, Nabr.
WWAJ Columbus Radio Club .....Columbus, Ohio
WWAX Worman Brothers .....Laredo, Tex.
WWAY Marigold Gardens .....Cbicago, Ill.

Canadian Broadcasting Stations

CFAC Radio Corporation of Calgary, Ltd., Calgary, Alberta
CFCA Star Publishing and Printing Co., Toronto, Ontario
CFCS Marconi Wireless Telegraph Co. of Canada, Ltd., Vancouver, B. C.
CFCD Canadian Westinghouse Co., Ltd., Winnipeg, Manitoba
CFCE Marconi Wireless Telegrapb 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 Tha Bell Tedephone Co. of Canada, Toronto, Ontario
CFUC University nf Montreal.....Montreal, Quebec
CFVC Roy Russell Brown....Courtenay, British Columbia
CFYC Victor Wantworth Odlum.....Vancouver, B. C.
CFZC Canadian Westinghouse Co., Ltd..Montreal, Quebec
CHAC Radio Engineers, Ltd.....Halifax, Nova Scotia
CHSC Tha 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 Westingbouse 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. Silvar .....Montreal, Quebec
CHCZ The Olobe Printing Co.....Toronto, Ontario
CHFC John Millen & Sons, Ltd.....Toronto, Ontario
CHIC Canadian Westinghouse Co., Ltd., Hamilton, Ontario
CHOC Canadian Westinghouse Co., Ltd., Vancouver, B. C.
CHVC Metropolitan Motors, Ltd.....Toronto, Ontario
CHXC J. R. Booth, Jr.....Ottawa, 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 Manitobe 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
CKCD Vancouver Daily Province.....Vancouver, B. C.
CKCE Canedian Independent Telephone Co., Ltd., Toronto, Ontario
CKCK Leader Publishing Co., Ltd., of Regina, Ragina, Sasketchewan
CKCR Jones Electric Radio Co., St. John, New Brunswick
CKCS The Bell Telephone Co. of Canada, Montreal, Quebec
CKCZ Canadian Westinghouse Co., Ltd., Toronto, Ontario
CKKC Radio Equipment and Supply Co., Toronto, Ontario
CKOC The Wentworth Radio Supply Co., Hamilton, Ontario
CKQC Radio Supply Co. of London.....London, Ontario
CKZC Salton Radio Engineering Co., Winnipeg, Manitoba

WORLD WIDE WIRELESS

Radio Compass Aids in Rescues at Sea

A THRILLING instance of assistance given by wireless to a disabled vessel in mid-ocean is reported from the Furness liner *Sachem*. After a strenuous battle with Atlantic storms during a tow of 750 miles, this vessel brought the Norwegian ore-carrying steamer *Capto* safely to harbor at St. John's, Newfoundland.

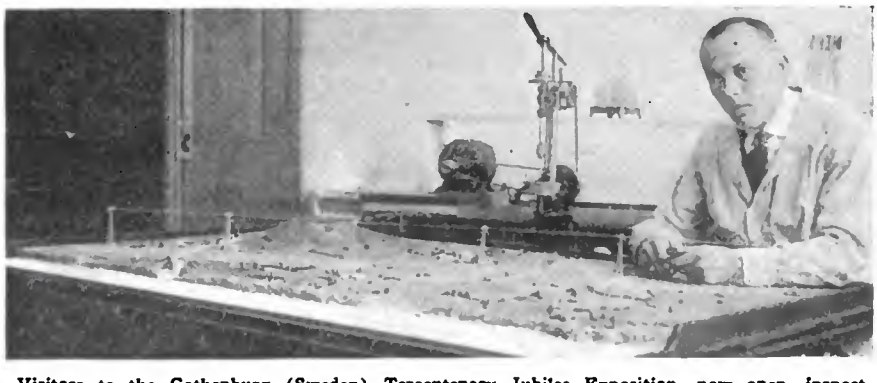
The *Capto's* wireless distress call, reporting the loss of a rudder and asking for assistance, was picked up by the *Sachem* when the vessels were about 100 miles apart; and the *Sachem* immediately steered in the direction given. A heavy gale was raging, and although the *Sachem* searched thoroughly she could not locate the disabled ship. The Canadian Pacific liner *Montclare,* equipped with Marconi direction finding apparatus, plotted the exact position of the two ships from the signals they were sending out, and communicated the information to the *Sachem,* which then soon came up with the *Capto*.

After many hours' strenuous work a hawser was connected, and the long tow began. That evening the hawser parted, and the ships drifted about until morning owing to heavy seas. With great difficulty the towline was restored. Again the hawser failed, this time in field ice with the gale increasing and developing into a blizzard with blinding snow.

The wireless operators were continuously on duty in order to maintain communication between the two ships. It took ten days to weather the conditions and reach harbor, and it was a welcome sight when the worn-out mariners made Cape Spear, and ended one of the longest tows of recent times.

There have been numerous instances during the last few years of vessels in distress miscalculating their positions by dead-reckoning and only being saved from complete disaster by the assistance given by other vessels which have been able to take bearings with Marconi direction finders. This adds another instance to the list, but on this occasion the value of wireless was demonstrated in more than one direction. By its means the call for assistance was sent out. The correct position of the disabled vessel was determined by wireless direction finding apparatus. It was a means of constant communication between the two ships from the time the distress call was sent until both vessels were safely anchored in St. John's harbor, some thousands of words being exchanged. By means of ice reports and warnings from ship and land stations dangerous ice-fields were avoided. It was of valuable assistance to both vessels while navigating the dangerous waters around the Virgin Rocks off the Newfoundland coast, in this case advantage being taken of the bearings given at regular intervals by the Canadian Shore direction finding station at Cape Race.

The great importance of the radio compass on shipboard again was brought forcibly to the public attention when newspapers all over the country carried a story of the rescue of the crew of the Italian freighter *Giulia* by the S. S. *Presidente Wilson* and the S. S. *Westlake*. The sinking Italian freighter sent out its SOS call, which drew a reply from the *Presidente Wilson*. They being in doubt as to the exact location of the vessel in distress, the radio compass equipment on the *Presidente Wilson* was called into play, the exact position of the *Giulia* ascertained in that manner and the rescue effected the following day without loss of life. Had it not been for the radio compass there would have been a delay that might have rendered the rescue impossible.



Visitors to the Gothenburg (Sweden) Tercentenary Jubilee Exposition, now open, inspect this model with great interest. It is built accurately to scale and shows the Rocky Point station of the Radio Corporation of America. Sweden will soon have a station almost exactly like this

Radio Saves Lightship Seaman

RADIO'S ability at setting even the most complicated affairs in motion toward a quick and successful end was never more spectacularly demonstrated than in the case of seaman J. H. Steel, of the crew of the Fenwick Island Lightship, which lies at anchor 30 miles southeast of Cape May, N. J. Steel was stricken with appendicitis, and a radio call for help was quickly sent out. The coast guard cutter *Kickapoo* rushed to the lightship, and in spite of heavy seas, Steel was lowered over the side to a small boat, hoisted aboard the *Kickapoo,* lowered again from that ship some time later, into a lifeboat off Lewes, Del., carried through the breakers to the shore, put into an automobile and taken to the hospital. Eight hours after the call for assistance was sent by radio, Steel had been operated upon and his life saved.

Another Life Saved

RADIO is to be credited with saving the life of Joseph Larue, of Texas, seaman on the S. S. *Narcissus,* who became dangerously ill at sea on March 23. Toxic neuritis blinded him and threatened his life, so a call for medical advice was sent by radio. The S. S. *President Harding* responded, and the ship's doctor, on learning of the symptoms, said that only expert attention would save the man's life. The two vessels converged their courses, Larue was transferred to the liner in a dangerously heavy sea, and cured there.

Sells Building by Radio

ONE of the biggest real estate transactions ever completed by the use of radio telegraph, so far as has been made public, took place on March 14, when E. C. Potter sold a New York office building for $1,200,000 by wireless. Mr. Potter at the time was on board the S. S. *Adriatic* in the Mediterranean Sea.

Leviathan to Have Biggest Radio

THE *Leviathan,* which will re-enter the trans-Atlantic service some time in June flying the U. S. Lines flag will have the most powerful and elaborate steamship radio equipment in the world. The contract to equip the *Leviathan* with a super-power marine radio installation was given by the U. S. Shipping Board to the Radio Corporation of America and work in connection therewith is now in progress. The completion of this work will give to America the distinction of radio supremacy upon the seas.

The famous vessel's radio equipment will enable her passengers to exchange messages with two continents regardless of her position on the high seas. With equipment six times as powerful as that carried by the average ocean greyhound, uninterrupted communication with points 3,000 miles distant is assured. Upon leaving her berth in New York Harbor, the *Leviathan* radio officers will be able to link the huge vessel with various marine centers in Europe, and to communicate with America when leaving European ports.

In addition to telegraph service, a radio telephone installation, which will provide voice contact with other vessels and shore stations, is also to be installed. While it is not expected that a commercial telephone service will be inaugurated immediately, it is quite probable that shore stations will, in the no distant future, be erected to handle wireless telephone traffic from ships in mid-ocean to points inland over the conventional land line system. When such arrangements have been made passengers and officers on vessels at sea may establish contact with those on shore at their homes or offices and speak with them with the same facility and ease that accompanies an ordinary telephone conversation on land.

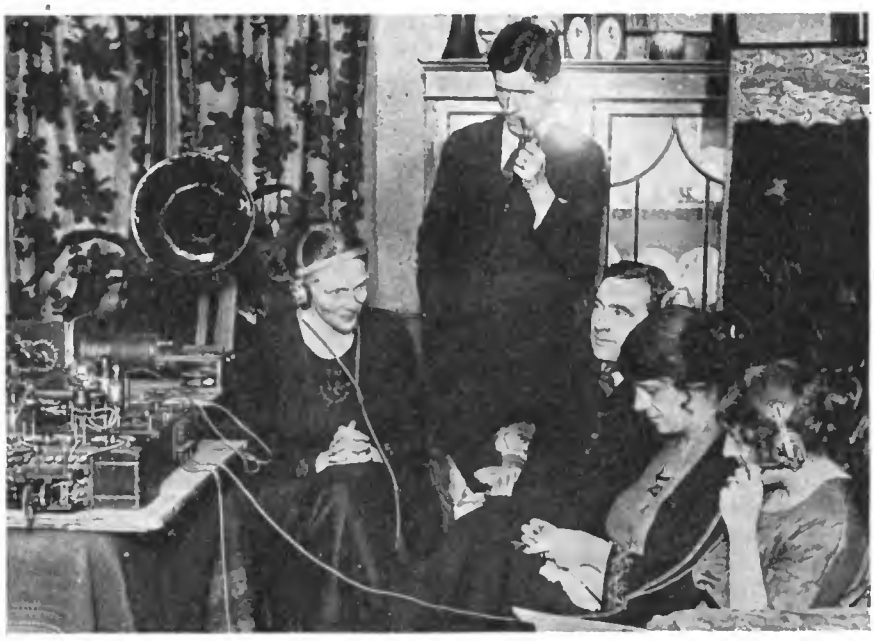
Inchkeith Wireless Lighthouse

THE first vessel to benefit by the "wireless lighthouse" established by Marconi's Wireless Telegraph Co., Ltd., on Inchkeith Island, in the Firth of Forth, is the S. S. *Royal Scot,* owned by the London & Edinburgh Shipping Co., Ltd. This boat, which is employed on the London and Leith service, has been fitted with a special type of wireless receiver which will detect the signals sent out by the "wireless lighthouse" and enable the navigating officer to pick his way through the dangerous channels of the Firth of Forth in the thickest fog.

The *Royal Scot* has just returned to Leith after her first round trip to London with this apparatus on board, and reports that the "lighthouse" signals were received perfectly during the whole time the vessel was within range, and that the ship's officers were easily able to use the apparatus.

The "wireless lighthouse" on Inchkeith Island is the first of its kind; but it is possible that similar stations will be established in other dangerous channels. The transmitter sends out a directional wireless beam which gives a distinctive signal as it passes through each point of the compass.

The receiving apparatus is extremely simple. Only one handle has to be operated. This switches the gear into use and is also calibrated so as to give a very fair indication of the distance from the shore in addition to the actual bearing. Thus the navigating officer can determine whether he is inside or outside his course.



The apparatus on the table doesn't look quite up-to-date—that's because broadcasting has just started in England, where this family listened to election returns

New Radio Rules in War

COLONEL GEORGE S. GIBBS and Major Wm. C. Sherman have returned to the United States from The Hague, Holland, where they have been attending the meeting of the commission on the rules of war. They are understood to have brought back with them copies of the recommendations of this committee as to the rules governing the use of radio in warfare. Though the recommendations have not as yet been made public, they are known to deal largely with the rights of neutrals during a time of war. When the first Hague convention was held, in 1907, radio communication had not developed to such a point that its importance led to it being considered as an essential part of either war or peace communications. Of course, it now has that distinction and in consequence steps must be taken to safeguard the radio rights of neutrals from infringement by belligerent powers.

Six New Radio Stations for Alaska

IN the early days of wireless the commercial interests in Alaska, particularly those engaged in the fishing business, were quick to see the advantages of this new method of communication. Since that time there have been close to one hundred private stations installed in Alaska. As a rule, these stations do not carry on any public business, but simply handle the business of the company by which they are owned.

The latest addition to this system has been furnished by the Alaska Consolidated Canneries, who have recently purchased from the Radio Corporation of America six sets for installation at the following Alaskan points: Chomly, Rose Inlet, Quadra, Tee Harbor, Pybus Bay, and Yes Bay.

On business routed south, these stations will clear with another station owned by the same company, located at Tenakee. Tenakee will in turn forward the business to the Naval Station at Ketchikan, Alaska, formerly a Marconi station, whence it will be relayed to Seattle.

At the present time, all equipment performing this class of work in Alaska is of the spark type, but it is certain that within a few years arrangements will be worked out whereby communication in this part of the country, will be carried on over the radio telephone to a large extent.

Radio on Lumber Ships

THREE vessels of the W. R. Chamberlin Co., operated out of San Francisco, Cal., in the coastwise lumber trade, are being equipped with radio apparatus by the Radio Corporation of America. They are the *Barbara C.,* formerly the *Pacific,* and the *Stanwood* and the *Phyllis.*

RCA Reveals Progress Made in 1922

THE annual report of the Radio Corporation of America, dated March 30, 1923, and covering the calendar year 1922, reveals a tremendous expansion of the company's interests in practically every field. It points out the work accomplished during the year in providing high power transmitting stations for Sweden and Poland; the assistance rendered Japan in improving her radio facilities; the arrangements made with radio corporations in England, France and Germany for development in South America; and the progress realized in erecting stations in China.

The Corporation now operates nine international radio circuits. Those across the Atlantic handle from 20 to 30 per cent. of all message business between America and Europe; those working in the Pacific, 50 per cent. of the trans-Pacific business. The RCA marine department, handling both instruments and messages for ship-to-ship and ship-to-shore work, increased its volume during the year. The summary of operations for the year shows that the gross income from operations amounted to $14,830,856, a striking increase from the total of $4,160,844 for the preceding year.

Gen. Harbord Fêted.

SAN FRANCISCO during March practically turned itself over to Major-General James G. Harbord, who became president of the Radio Corporation of America on January 1st of this year. General Harbord had gone to the Pacific Coast on a tour of inspection of the Radio Corporation's plants there. Inasmuch as during his army service he had spent much time at the Presidio and in other posts on the Pacific Coast and had thus accumulated many friends in that part of the country, the reception given to him on his return was highly enthusiastic. The fact that since he last had been in San Francisco, he had gone through the multiple triumphs of the A. E. F., in which he was Chief of Staff, commander of the Marines, and head of the Service of Supply, served to add to the enthusiasm at the Golden Gate. From the time he left the train in San Francisco until his departure he was a constant source of interest for Californians and for their newspaper men. On March 20th he was given a banquet at the Palace Hotel, under the auspices of the local sector of the Association of the Army of the United States. Over five hundred army and navy officers and civilians sat down to do him honor. Brigadier-Generals Thornwell and Mullaly presided and a radio message from General Pershing regretting his inability to be present, was read. The speakers included General Hunter Liggett, Mayor Rolph of San Francisco, and David Sarnoff, vice-president and general manager of the Radio Corporation of America. General Harbord in a stirring speech, referred to the strenuous days of 1918 during the time when the American army was making its big drive on the French front. In addition to various other receptions and functions, General Harbord participated in a review of the Post Troops at the Presidio, given in his honor.

RCA Buys Hammond Patents

THE radio devices invented by John Hays Hammond, Jr., some of them of the most important nature, have been purchased by the Radio Corporation of America and the American Telephone and Telegraph Company. Most of these were invented by Mr. Hammond primarily for war time use and include methods of controlling by radio, aerial and marine torpedoes, and also ships. The United States Government retains an option on all the devices for military use.

When an electric train or trolley is stalled somewhere along the line, communication may be made with headquarters by means of "carrier current telephony," using a transmitter something like a radio set. Tests in a New York trolley car have demonstrated the possibility

Approximately 200 separate patents are concerned in this transfer. Probably the best known of these are the ones relating to radio control of ships, Mr. Hammond's experiments in starting, stopping and steering boats by radio control having been made public some years ago. However, there are other developments, some of them devised during the course of the ship experiments, that are considered no less important. One of them is the Hammond selector invention by means of which two sets of radio impulses can be transmitted simultaneously on identical wave lengths and yet may be completely separated by suitable receiving apparatus. The most general application of this is thought to lie in broadcasting, as it makes possible the transmission of two separate programmes on the same wave.

Mr. Hammond also has developed a system of secret transmission for both speech and code, and this has been the subject of various tests by the U. S. Government. Still another invention attacks the problem of eliminating interference from static and from spark transmitters.

The Radio Corporation of America not only has secured these important patents, but also has retained Mr. Hammond and his assistants as consulting engineers and their talents, therefore, will be available in applying these patents in the commercial or broadcasting field.

Marconi Continues Experiments

THE scientific world is awaiting with great interest the results of the tests being conducted by Senatore Marconi with directional wireless on short wave lengths. Considerable space has been given in the daily press lately to reports of his experimentation on board his yacht, but to date nothing has been revealed that adds any data to that published in these columns in the issue for July, 1922. On June 20 last Marconi demonstrated his experimental model of a directional transmitter before the Institute of Radio Engineers and the American Institute of Electrical Engineers, rousing them to enthusiasm by a remarkable performance. It is this apparatus, or modifications of it, that is being used on shore and on his yacht. While in disclosing the nature of his experiments, Marconi made plain the tremendous difficulties in the way of commercial application of the principles involved, nevertheless their success on a laboratory scale is considered highly encouraging. The tests between sea and shore now being conducted no doubt will be made public in due time, when it will be possible to determine what strides directional radio on short waves has made since last summer.

KSE Begins Operation

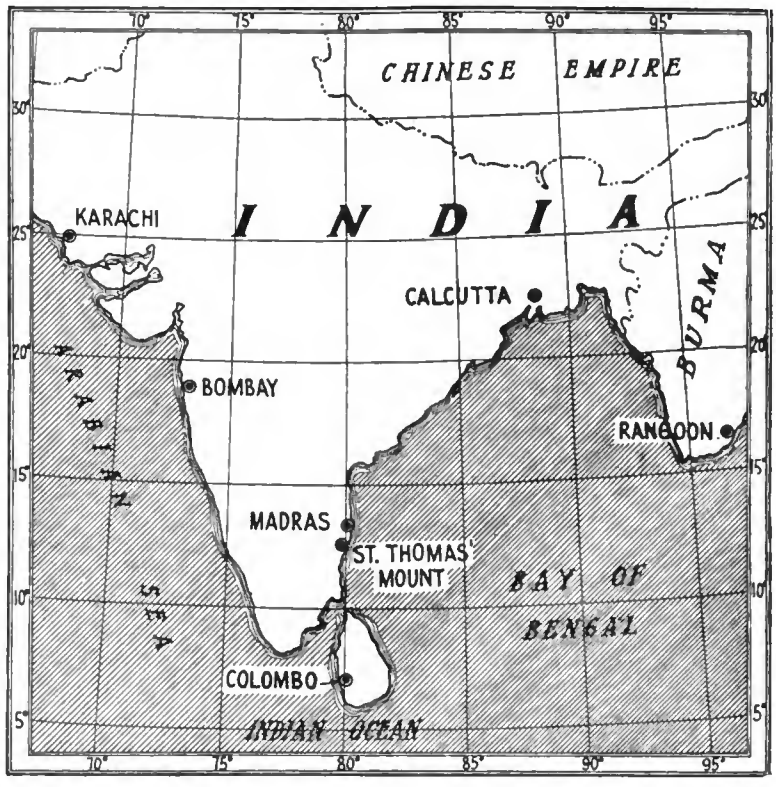
STATION KSE is the newest commercial radio station on the Pacific Coast, located at Wilmington, Cal. It was erected by the Radio Corporation of America in the terminal of the Wilmington Transportation Co., and forms another link in the RCA world-wide wireless system. It will work with ships in the Pacific Ocean.

Wireless Notes From India

By S. B. Banerjea

Former Editor, "The Calcutta University Magazine"

THE associated chambers of commerce of India held a meeting in Calcutta recently and passed several important resolutions. Amongst them there was one relating to wireless communication in India. This resolution, which was moved by Sir Montagu Webb of the Karachi Chamber of Commerce, urged the Government of India to secure a wireless installation of adequate power, capable of expansion and able to transmit messages at high speed, so as to place India in direct communication with any part of the world and give to this country the advantage of becoming a vital link in the intercontinental system of wireless communications now being organized. The Government was also urged to interest private enterprise in the installation so as to reap the advantage of every patent and improvement, as soon as possible; the Government to have the right to stipulate the maximum rates for transmission and have the option of taking over the installation after a period of years.



Map showing some of the commercial radio stations operating in India

In supporting this resolution, Sir Montagu pointed out the advantage from a commercial point of view of direct communication with the world.

It is feared, however, that owing to limited funds, the Government of India will not be able to go ahead with the project immediately.

There is an up-to-date wireless station at Diamond Island. For lack of funds, however, the Government wants to close it. The European mercantile community has protested against this. It is understood that the protests are being seriously considered by the Government, and that final decision will be made soon.

The charge is often laid at the door of the European merchants in India that they are not up-to-date. That this charge is without foundation has been proved in many instances. In the case of two Indo-British steamship companies, it may be stated that they have taken a number of Hindu and Anglo-Indian youths as apprentices on board their vessels, where they are being taught wireless telegraphy. Those who master the subject will be given permanent employment as wireless operators.

The Government of India also has started a school at Karachi for teaching wireless telegraphy. A number of young men have already been admitted.

The Ceylon Government is now engaged on important experiments to find out whether the electric trolleys in Colombo have any effect on the wireless station. Observations in England and elsewhere have indicated the possibility of interference from this source. G. E. Harper, who is conducting the experiments, has installed a small receiver in the central telegraph building at Colombo. The aerials are installed on poles, erected on the roofs of the central telegraph offices and the P. W. D. building. His report is awaited with interest. A suggestion has been made that experiments should also be carried on in Bombay, Calcutta, and Madras, where electric trams are operated. The cost will be small and I am sure the local council will not grudge the small sum needed for the purpose.

It will interest my readers to know that the Madras radio station has now been converted into a high speed automatic plant for working inland and to Rangoon. The Madras wireless has replaced the present land lines and cables from Calcutta to Rangoon for traffic between India and Burma. The present apparatus for communicating with ships will soon be replaced by a small station, to be erected near St. Thomas's Mount. This will afford much better communication with ships than is possible at present.

Certain Anglo-Indian dailies are now receiving wireless messages from their London correspondents regularly, thus enabling the Indian public to know the latest world happenings in the shortest possible time. No Hindu paper has so far set up any wireless apparatus, but this is due simply to want of necessary funds. Hindoo papers do not enjoy a large circulation and though their proprietors are not wanting in enterprise, they cannot imitate the example of their more fortunate Anglo-Indian brethren, because they need funds. There is no doubt, however, that time will cure this defect. It may be added *en passant*, that the results of the last Derby race in England were known in India almost at the same time they were published in the British papers. Formerly, when the information was transmitted by cable, 24 to 36 hours elapsed before such news reached India.

Success of Radio Medical Aid

AFTER a year's experience of prescribing medical treatment for seamen on ships at sea which had no surgeons, the Public Health Service announces that the experiment has been a marked success.

"The range of diseases and mishaps for which aid has been invoked during the first year has been amazing," according to a statement from the Public Health Service today. "The list includes appendicitis, asthma, cramps, diarrhoea, earache, eye injuries, heart disease, hernia, hiccoughs, influenza, infected teeth, malaria, opium poisoning, ptomaine poisoning, and swallowing broken glass. Many diagnoses were made on board ship as sailors are resourceful in meeting emergencies."

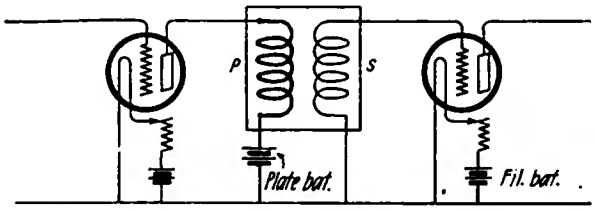
A Variometer-Coupled Radio-Frequency Amplifier for 175-275 Meters

By Samuel C. Miller
Member, I. R. E.

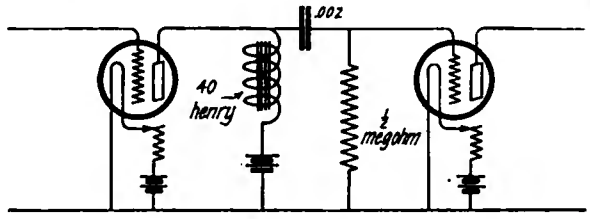
WITH the ever increasing use of radio frequency amplification for DX work, a great deal of attention has been paid to this phase of radio engineering by experimenters, but sad to state, in practically all cases it has been carried out for broadcast reception on wave lengths of the order of 300 and 400 meters, with little thought to the amateur, who is confined to wave lengths of 175 to 275 meters. To those who have attempted the problem of obtaining radio frequency amplification at these short wave lengths, it can be said that it has not been an easy problem, the difficulty being among various things, mostly in the securing of vacuum tubes, which would amplify properly at the lower wave lengths upon which the amateur operates. With the advent into the market of the "A" amplifier tubes, a tube is produced which is highly efficient for this sort of work. The "A" amplifier tubes require only ¼ ampere at 5 volts to light the filament and make it operative, so that many tubes of this type can be used in parallel with a small storage battery consumption. Not only does the "A" amplifier tube enjoy the advantage of requiring only one-fourth the power to operate of any of the other 6-volt tubes on the market, but it also has the advantages of giving a higher ratio of signal output to signal input, and also of having a very much higher exhaust. The grid conductance (the factor determining the quality of a tube) of the "A" tube is between .0004 to .00045 micromhos as compared to the other tubes available which usually do not run higher than .00035 micromhos. The higher the value of grid conductance, the more will be the ratio of signal output to signal input. The grid conductance is obtained by dividing the amplification constant (μ), by the internal impedance (z) between plate and filament; it actually represents the variation of the impressed voltage on the grid and the plate current variation it produces. Because the "A" tube gives a large plate current variation for a small impressed grid voltage variation, it is superior in operation to other tubes and was for this reason used in the design of the radio frequency amplifier to be described.

There are four methods in use with various modifications, for obtaining radio frequency amplification depending on the way the tubes are intercoupled. Tubes can be intercoupled by either transformer, choke coil, resistance or variometer arrangements.

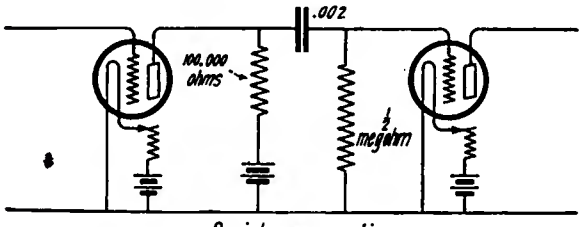
The most popular method used in broadcast reception, is by transformer coupling as shown in figure 1. The transformer is of special design and can be bought in units with or without an iron core. The transformer is connected between tubes in the same manner as an audio frequency amplifying transformer, but differs from the audio frequency transformer in that, both the primary and secondary windings have much smaller values of inductance; the secondary winding usually has an inductance of such value that when used with a tube, the tube capacity between grid and filament is enough to make this secondary circuit resonant to a definite wave length, generally around the wave length the amplifier is mostly used. A disadvantage in the use of transformers is that, as the secondary is tuned only to one particular wave length, it gives only moderate results at all other wave lengths. Although transformers have enjoyed a good degree of success on wave lengths higher than 300 meters, they have been very unsatisfactory when applied to wave lengths under 250 meters.



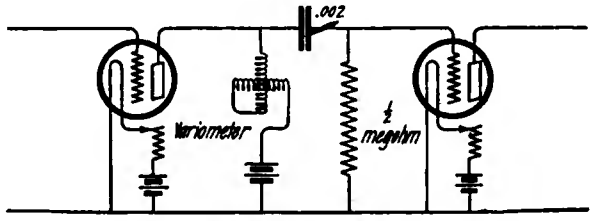
Transformer coupling
Figure 1



Choke coil coupling
Figure 2

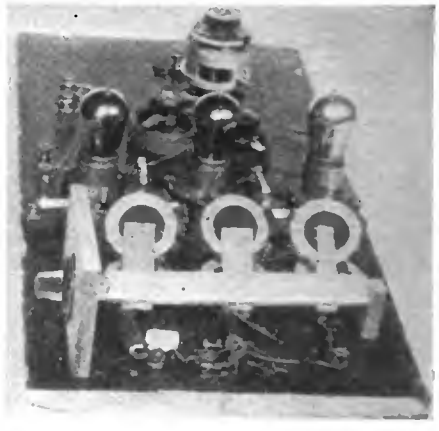


Resistance coupling
Figure 3



Variometer coupling
Figure 4.

There are four methods in use with variometer coupling as shown in figure 1. The transformer is of special design and can be bought in units with or without an iron core. The transformer is connected between tubes in the same manner as an audio frequency amplifying transformer, but differs from the audio frequency transformer in that, both the primary and secondary windings have much smaller values of inductance; the secondary winding usually has an inductance of such value that when used with a tube, the tube capacity between grid and filament is enough to make this secondary circuit resonant to a definite wave length, generally around the wave length the amplifier is mostly used. A disadvantage in the use of transformers is that, as the secondary is tuned only to one particular wave length, it gives only moderate results at all other wave lengths. Although transformers have enjoyed a good degree of success on wave lengths higher than 300 meters, they have been very unsatisfactory when applied to wave lengths under 250 meters.



Two views of the 175-275 meter variometer coupled radio frequency amplifier

The second method of obtaining radio frequency amplification, is to insert a choke coil (iron core) of 30 to 40 henries inductance, in the plate circuit of a tube. If

this choke is properly designed and has a low distributed capacity, about 90 per cent. of the voltage amplification of one tube can be transferred to the next tube to which it is coupled. As with transformer coupling, this choke coil method works well at wave lengths above 300 meters and not when used for wave lengths under 250 meters. The choke coil method of coupling is shown in figure 2.

Resistance coupled radio frequency amplifiers are extensively used in Europe especially by the British amateurs. Their big disadvantage is the very poor amplification obtained per stage, requiring the use of a large number of tubes for satisfactory operation. A resistance coupled amplifier is efficient as regards quality because there is practically no distortion. This distortion is mostly due in other types of amplifiers, to the use of coupling coils of some sort that by inductive and capacitive effects tends to by-pass the upper and lower frequencies in telephony. As five or six stages are required for good results, the resistance coupled amplifier is quite an expensive affair and is therefore not practical for the average amateur. The diagram of connections is shown in figure 3.

The fourth method for obtaining radio frequency amplification is by inserting a variometer in the plate circuit of a tube and tuning to the wave length to be received. The one disadvantage which has prevented the use of this method to any great extent, is the trouble required to tune each individual plate circuit in a multi-tube set. If a number of stations are listened to during an evening, the adjustments required are far too many for practical operation because, besides the tuning of the receiver proper, each plate circuit of a tube must also be tuned to the incoming signal. This arrangement necessitates great skill and fine adjustment; in fact if the set was already adjusted for a given wave length and was to be changed to another wave length, the time taken would be too long. The plate variometer method is then not very practical if each plate circuit must be tuned individually, but if this can be overcome in some way, and the tuning made more simple to adjust, then a very efficient radio frequency amplifier can be constructed—and at a low cost to the amateur. The efficiency of the amplifier will be high because with each plate circuit made resonant to the incoming wave, a maximum signal strength is obtained at the output. The three-stage amplifier to be described uses the variometer method of coupling and has been designed so that all three plate-circuits are tuned at the same time by mounting the three rotors of the variometers on a common shaft with one controlling knob and dial. Doubt may be raised in the minds of some, as to the practical use of this method, due to a slight variation of the internal capacity between plate to filament among different tubes. As this variation of internal capacity is an important factor in the variometer method of coupling, a test was made of many "A" tubes which showed the internal capacity to be constant—namely 6 micro-microfarads. Even if this value varied slightly in any of the tubes used in the amplifier, the resultant effect would be a slight broadening in the tuning.

CONSTRUCTION OF THE THREE-STAGE VARIOMETER COUPLED AMPLIFIER

As stated previously, the important point in the design of this amplifier is the construction of the variometers and the method used in mounting all rotors on a common shaft. The type of variometer to be used was carefully considered and after investigation of the various types available, a spider web form was found to be the best as regards simplicity of construction, low cost of operation and its adaptability for mounting three movable coils on a common shaft.

The forms for both the fixed and movable coils are made from 1-16 inch cardboard and are cut as shown in figure 6. The outside diameter of the forms is 3 inches and every one has 7 slots cut into it, each slot being 3-16 inch wide by ¾ inch long. Each form is wound with 30 turns of No. 32 double cotton wire and then dipped for an instant into a mixture of boiling paraffine. In making the connection between two pancakes for the variometer arrangement, the outside wire of one pancake is connected to the inside wire of the other pancake. Care must be taken when fastening the movable and fixed pancakes in place, to see that their windings are in the same direction or adding. If the windings are connected so that their fields buck when the pancakes are brought together the inductance of the variometer will be too low and will not cover the required wave length range.

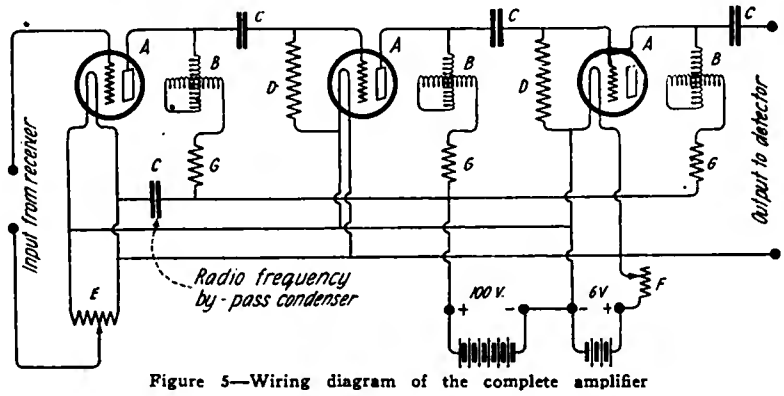


Figure 5—Wiring diagram of the complete amplifier

In figures 7a and 7b are shown the top and side views of the arrangement for mounting the movable coils on a common shaft. The actual arrangement used together with the placing of the various units in relation to the variometers, can be seen on the accompanying photographs of the experimental set-up. The distance between pancakes should not be less than 4 inches between centers as indicated in figure 7a,

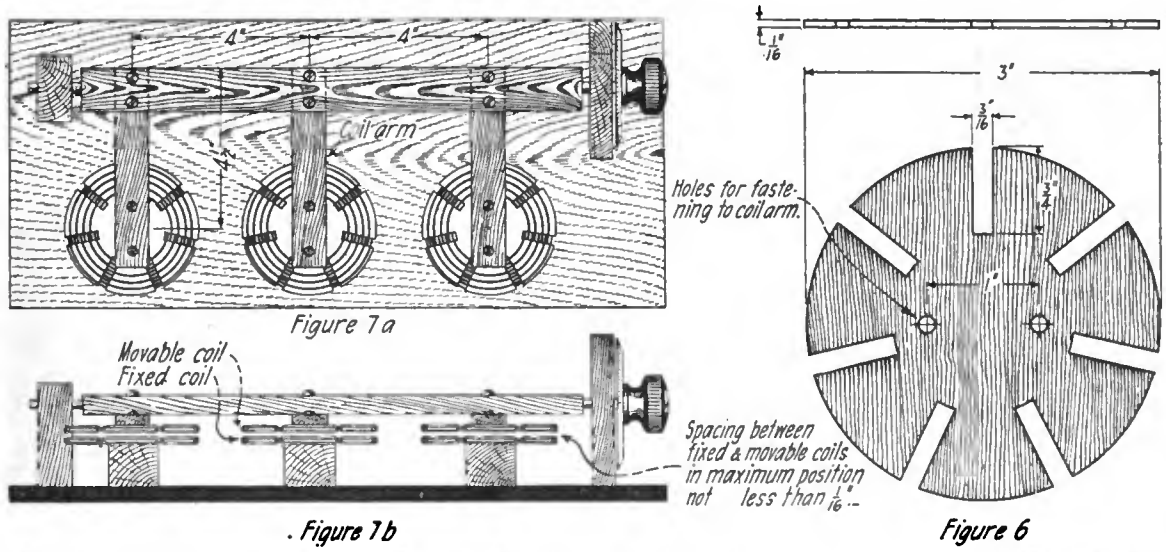


Figure 6—Constructional detail of form for winding fixed and movable coils. Figures 7a, 7b.—Top and side views of movable coils mounted on a common shaft

The wiring diagram of the complete amplifier is shown in figure 5, with the parts designated by means of letters which are

explained as follows: A—"A" amplifier tubes; B—spider web variometers; C—.002 microfarad condensers; D—½ megohm grid leak resistances; E—200-ohm R.C.A. potentiometer; F—7-ohm rheostat; G—500-ohm Ward Leonard resistance units.

When mounting the parts either on a flat board as in the photographs or in a more elaborate affair consisting of a panel and cabinet, it is essential to bear in mind the necessity of keeping the leads running to the plates and grids of each tube as short as possible. It is also just as important to take all possible precautions in placing the parts and in making other wiring connections so that the wires are kept as far apart from each other as is practical, because a short wave amplifier is very critical and unless these precautions are taken, the amplifier will tend to oscillate and cause howling. Short wave amplifiers usually depend more for their successful operation on the care taken in building the set than in the use of good parts improperly assembled.

In operating this amplifier, the receiver and amplifier can be tuned at the same time, the operator using both his hands. The potentiometer that is indicated in the wiring diagram for adjusting the positive bias on the grid of the first tube, may not be necessary as the 500-ohm unit placed in the plate circuit of each tube tends to stabilize conditions, but it is worth while to incorporate this unit in the set so that it can be used if required.

This amplifier was used with an outside antenna. Very good results were also obtained when connected to a 2-foot loop consisting of 8 turns of No. 18 annunciator wire, spaced ¼-inch apart with its terminals placed across a .0005 microfarad variable condenser for tuning.

English 5MS Heard Here

Transmitter Built Under Difficulties Due to Unusual Power Supply Has Input of Less Than One Kilowatt

BRITISH station 5MS, which is the special transmitting station built and operated by members of the Manchester Wireless Society, has been heard recently in this country with satisfactory audibility. The first report from the United States was received in Manchester recently, though it stated that 5MS had been heard in Pittsburgh, Pa., on December 10. Since then other American amateurs have picked up this British station, which has a characteristic guttural tone, sounding like A.C. that is only partly rectified.

Since then a Manchester amateur has reported that he has heard American amateurs discussing, by voice, the reception of the signals from 5MS, and apparently that station has well earned its reputation of being the most efficient in the British Isles, as far as trans-Atlantic transmission is concerned.

The Manchester people, according to the London correspondent of THE WIRELESS AGE, consider that credit should be given not so much for reception in America as for the fact that the station was ever put into operation at all.

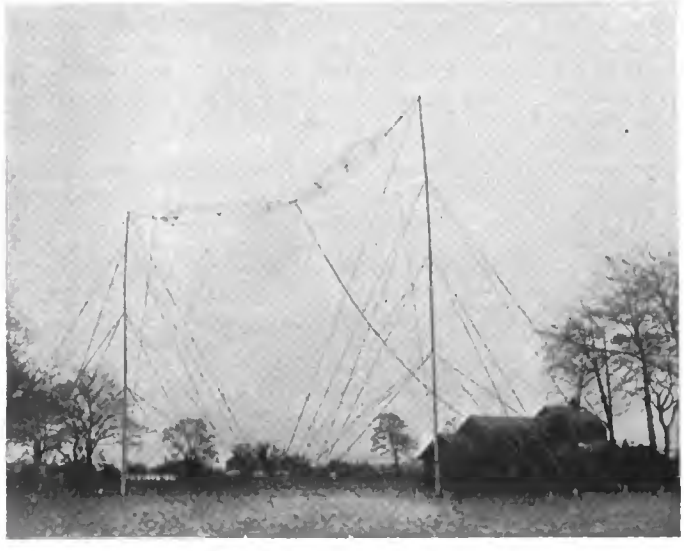
When the Society decided to put up a transmitter it found that the only current available was 100 volts, 80 cycles, single phase A.C. Lack of funds made it impossible to secure the special transformers that would be necessary for its current supply, and the next best thing in the way of apparatus was used. The result has been considerable inefficiency in the transformer system. The plate transformer is rated at 200 watts and steps up the voltage from 100 to 10,000 volts, and is supposed to work on 50 cycles. Since the power put into this transformer is something less than a kilowatt, it is very much overloaded. In order to eliminate power consumption in choke coils, the use of an efficient filter system was discarded, and it is this lack of any means of smoothing out the current that produces the characteristic tone of the station, producing a wave that sounds almost like a very low toned I.C.W., as has been commented upon by Americans who have heard the station.

The oscillating circuit of the transmitter consists of two T-450 tubes, with a tuned grid and directly coupled antenna. The grid circuit and the center taps of the filament transformers are grounded. The grid circuit consists of a coil coupled with the antenna tuning inductance and is provided with a small variable condenser for tuning. Both the grid condenser and grid leak are variable and the key is connected in series between the leak and condenser.

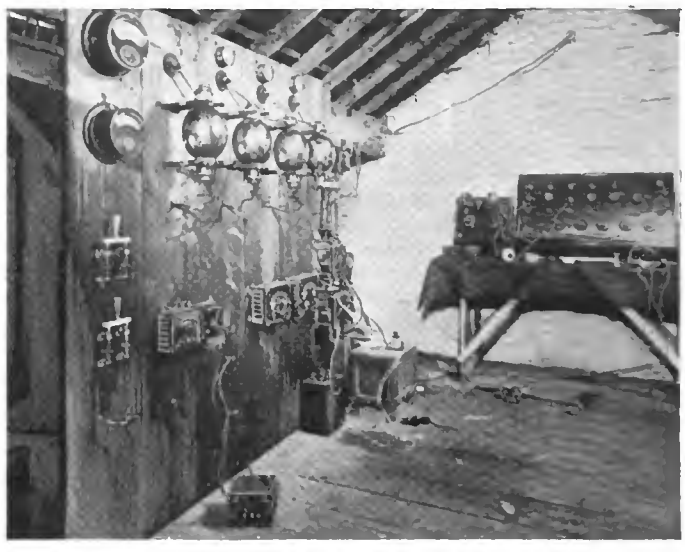
Throughout the apparatus provision has been made for varying the voltages of the filament, plate and grid circuits and this possibility of making critical adjustments throughout is credited with making possible the very sharp tuning that is secured. In most cases a direct coupled antenna militates against sharp tuning and the sharpness at 5MS is noteworthy, therefore. The wave length is in the neighborhood of 200 meters.

The aerial is of the sausage or cage type, with a constricted waist in the center, where the lead-in is connected, thus forming a T. The antenna consists of 6 wires arranged on hoops, 120 feet long, supported between two 80-foot masts. The lead-in also consists of 6 wires, held around small hoops. The ground system consists of a network of wires, buried at water level under the ground.

Although the actual power input to this set is less than 1 kilowatt, the antenna current is 9 amperes. During experimental work while the transmitter was being assembled, it became possible to use, temporarily, a direct current supply at 2,500 volts, which put 12 amperes in the antenna with a power input of 1 kilowatt. 5MS and 5MT are being operated on alternate Sundays.



Antenna system of English 5MS station, heard by American amateurs



Tube transmitter and receiving equipment of English 5MS

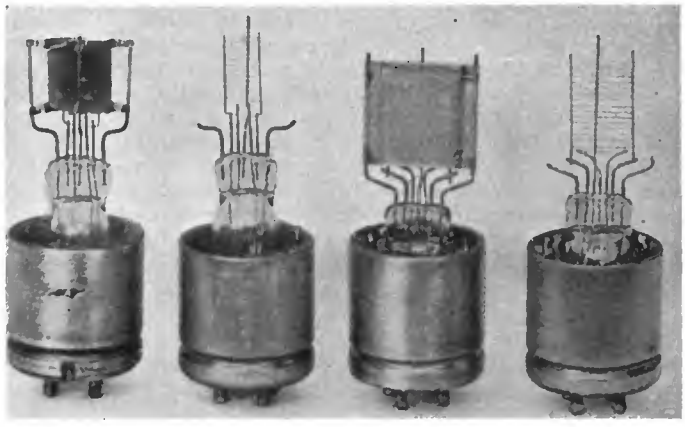
A New Receiving Radiotron—UV-201A

By J. C. Warner

Research Laboratory, General Electric Company

THERE has recently appeared on the market a new vacuum tube in which have been incorporated several interesting and valuable improvements. This tube, since it was designed to be interchangeable with the widely used UV-201, is known as the UV-201-A. It is easily distinguished from the UV-201 by the silvered or colored appearance of the bulb.

Perhaps, the most noticeable feature of this tube manufactured for the Radio Corporation of America is the new type of filament. This is made of tungsten, but is distinguished from the older tungsten filaments by its smaller current consumption, lower operating temperature and long life.



Radiotron UV-201 (left) and UV-201A (right)

The maximum filament current required by the UV-201-A is .25 ampere, or one-fourth as great as the consumption of the UV-201 filament. In other words, a storage battery will require charging only about one-fourth as often if the new tubes are used in place of the old. The normal filament voltage has been kept at 5.0 volts so that the UV-201-A may be used in sets designed for the UV-201. However, care should be taken that the filament rheostats have sufficient resistance to reduce the voltage to 5.0 volts, or less, at the terminals of the tube. Most sets are provided with rheostats having from 4.0 to 10 ohms maximum resistance on one tube and these are suitable for the UV-201-A without change.

In general, all vacuum tube filaments should be operated at the lowest temperature consistent with satisfactory results. It is usually not necessary to use the full rated 5.0 volts on the UV-201-A filament, and it is often possible to reduce the voltage to 4.0 volts or even less without reducing the detector action or amplification. This, of course, lengthens the life of the tube. The reason for this desirable property lies in the characteristics of the new type of filament which gives a very high electron emission at a relatively low temperature and small power consumption. This is illustrated in figure 1 where the filament of the UV-201-A is compared with that of the UV-201. This shows that at rated voltage the electron emission of the UV-201-A filament is over five times as great as that of the UV-201 and, since the power required is only one-fourth as great, the electron emission efficiency, that is, the number of milliamperes emission for each watt expended in the filament is over twenty times as great as in the UV-201.

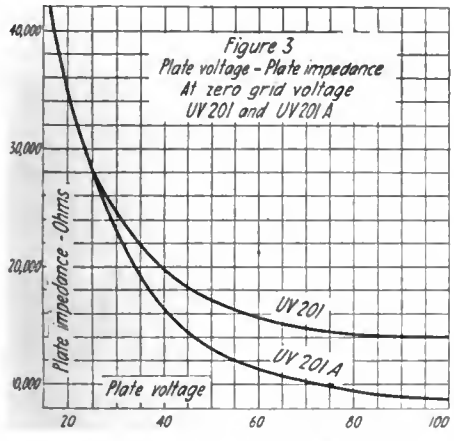
The useful life of the tube is determined not by the actual burnout of the filament, but by a decrease in the electron emission. This decrease does not take place gradually throughout the life of the tube, but occurs during a short period close to the end of life. Thus, the operation of the tube is uniform until almost the end of its useful life. This point is indicated by a decided increase in the filament voltage required for satisfactory operation.

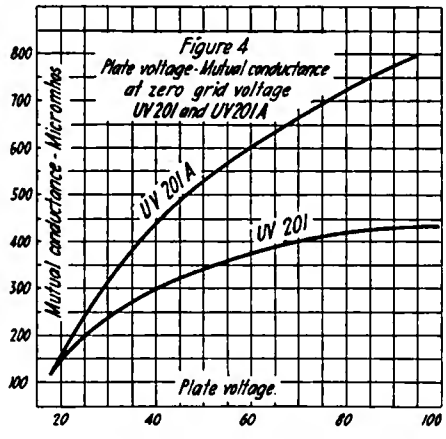
The filament of the UV-201-A is approximately 50 per cent. longer than that of the UV-201. This makes possible the effective use of a larger grid and plate. Figure 2 shows views of the internal construction of the two tubes. The larger surfaces of the UV-201-A elements cause a considerable improvement in the amplifying characteristics of the tube. This may easily be understood by a consideration of the various factors which determine the amplification. An erroneous idea exists among many users of vacuum tubes that the so-called amplification constant of a tube is a measure of the amplification given by the tube in any circuit. This is very seldom true since the output impedance is of equal importance. It is a simple matter to design a tube with an extremely high amplification constant, several hundred or even more, but the high output or plate impedance which almost invariably accompanies a high amplification constant would make such a tube useless in an ordinary receiving set.

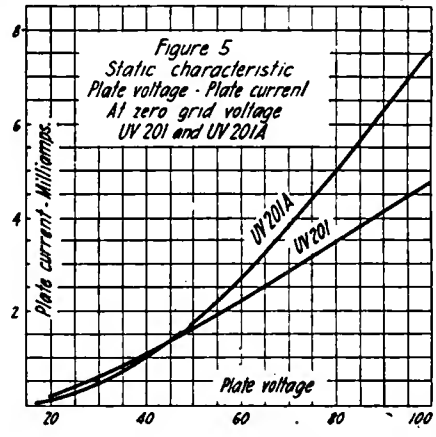
A much better method of comparing receiving tubes is on the basis of grid-plate conductance, or mutual conductance, as it is often called. This quantity is a measure of the effectiveness of the grid in producing or changing the current in the plate circuit. For example, if a one volt change in grid potential causes a change in plate current of 500 microamperes, the tube is said to have a mutual conductance of 500 microamperes per volt or 500 micromhos. The mutual conductance is easily found by experiment, or it may be calculated by dividing the amplification constant by the output impedance.

The output impedance of a tube is inversely proportional to the effective area of the plate, consequently if this area is increased the impedance of the tube can be lowered without changing the amplification constant. Or, if it is desired to keep the output impedance the same when the area of the plate is increased a slight change in the construction of the grid will raise the amplification constant, leaving the impedance unchanged. It is clear that in either case, the mutual conductance of the tube is increased by increasing the area of the plate. The UV-201-A represents a combination of the two possibilities mentioned. The amplification constant of the tube has been increased from 6.0 to over 7.0 while the impedance has been lowered from 20,000 ohms to about 16,500 ohms at 40 volts on the plate. Figure 3 shows curves of plate impedance against plate voltage for the UV-201-A and UV-201 and figure 4 shows the mutual conductance. Figures 5 and 6 give the usual static characteristics for the two tubes.

The lower output impedance of the UV-201-A gives improved amplifier action for two reasons. First, for the same input the actual current output in a given circuit is increased, simply because the total imped-







ance of tube and circuit is lowered. Second, there is less distortion on telephone signals. This is due to the fact that the greater the ratio of load impedance to tube impedance the less is the distortion of signals.

On account of its high electron emission and low output impedance the UV-201-A is particularly well adapted for use with loud speakers or where a considerable amount of power is required from the tube. On a 20,000-ohm resistance load the UV-201-A gives about 40 per cent. greater current and 100 per cent. greater power output than the UV-201.

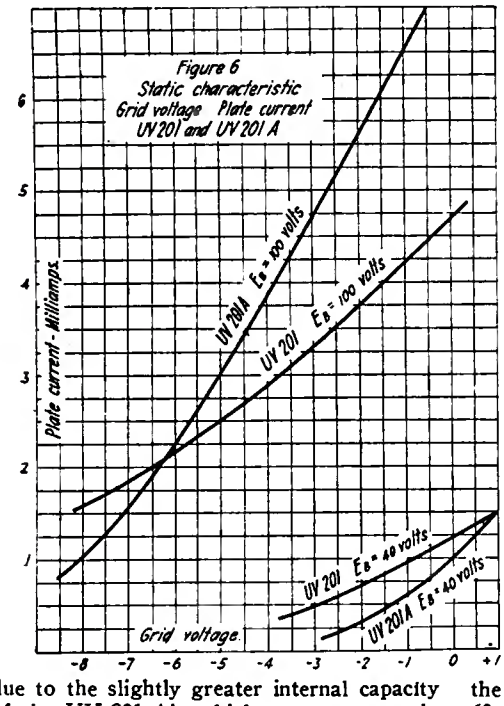
Occasionally, when UV-201-A tubes are placed in radio frequency amplifiers built for the UV-201 tube trouble is experienced from the tubes oscillating. This is seldom due to the slightly greater internal capacity of the UV-201-A's which amounts to only a few per cent., but to the greater amplification which increases the feed back action and the tendency to oscillate. Decreasing the plate voltage on the radio frequency tubes will usually stop oscillations, but a better method is to re-arrange the wiring of the set and leads so as to reduce the capacity coupling and inductive effect between the input and output circuits and so decrease the tendency of the set to oscillate.

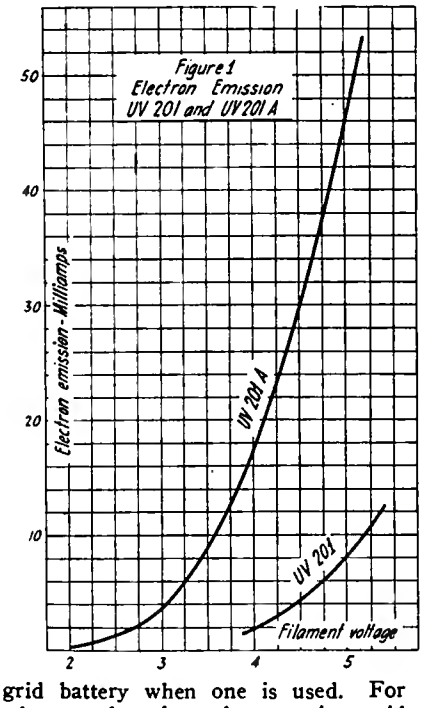
As an audio amplifier the UV-201-A requires from 40 to 100 volts on the plate. The higher voltage should be used when telephone signals of considerable intensity are desired, otherwise very satisfactory results may be obtained at 40 volts. A negative grid bias should always be provided in order to secure maximum distortionless amplification and also to prevent excessive plate current and possible plate overload at the higher plate voltages. The amount of grid bias required depends on the plate voltage. For 40 volts on the plate .5 to 1.0 volt negative bias is sufficient and this may be provided by utilizing the voltage drop in the filament rheostat. Figure 9 shows this connection and also the proper location of the grid battery when one is used. For 60 volts on the plate the negative grid voltage should be 1.5 to 3.0 volts; for 80 volts on the plate, 3.0 to 4.5 volts; and for 100 volts on the plate, 4.5 to 6.0 volts.

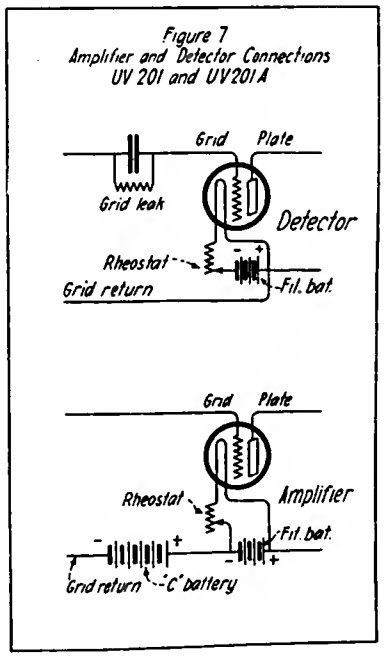
In detector action the UV-201-A is better than the UV-201. This is evident when it is remembered that a three-element tube used as a detector with a grid leak and condenser acts as a rectifier in the grid circuit and an amplifier in the plate circuit. Thus, other factors remaining the same, any improvement in action of the tube as an amplifier appears to the same extent when the tube is used as a detector. For this use, the plate voltage should be approximately 40 volts. Higher plate voltage gives but a very slight increase in detector action and causes excessive plate current since no grid bias can be used on the detector tube.

The grid return lead on the detector tube should be connected to the positive side of the filament as shown in Figure 7 and it should be noticed that this is not the same as for the amplifier tubes. The grid condenser should have about .00025 microfarad capacity while the grid leak resistance should be from two to ten megohms. On weak signals the higher values of grid leak resistance usually gives best results, but on strong signals or when static is strong the resistance must be lowered to prevent distortion.

The UV-201-A is exceptionally well exhausted and the high vacuum insures uniform characteristics and quiet operation throughout the entire life of the tube and adds to the quality of reception.







Reduction of Antenna Resistance

By Edward T. Jones, I. R. E

SEVERAL years ago the author described a receiving antenna in the various electrical and radio magazines which was a decided improvement over the ordinary antenna used at that time and an improvement over the antenna being used to-day by the average radio telephone enthusiast.

Since the received current is generally considered to be about three-trillionths of the radiated energy. there certainly is a need for a decided reduction of antenna resistance.

The conservation of the received energy is in fact more important than the radiated energy. as it is infinitesimally small and consequently very easily wasted.

Some speak of soldered connections—there should not be any need for soldered joints in the ordinary antenna. In all my aerial construction work I have eliminated the necessity of applying the hot iron by cutting the lengths of wire so that each piece includes enough for the lead-in. In the case of a four-wire antenna it is only necessary to solder the ends of the lead-in into a lug which is generally done with a torch insuring absolute connection.

Litzendraht Antenna

Radio engineers and practically everyone in the profession admit that Litzendraht wire has certain advantages over single-strand copper (insulated) wire in the design of induction coils no matter in what part of the circuit they are used. That much of the story being set aside as "unquestionably true" we will now collect our thoughts for a moment and reason why it is that the "horse is placed before the cart."

If it is true that the high-frequency resistance is reduced by the use of Litzendraht wire in the receiving circuit and in the induction coils which cause it to function properly why not apply the same reasoning to the wire used in the receiving antenna?

This is exactly what I have done, and am safe in saying that there is a material advantage in using the Litzendraht cable for an antenna in receiving.

(*Continued on page 66*)

An Easily Assembled Radiophone

By John F. Bront

THE novice who has had the pleasure of listening to the phone broadcasts from the many stations of the country often feels that he should like to realize his own voice being carried across the sky in the same manner as that of the announcer and the artists at the broadcasting station. Considerable pleasure may be gained from the operation of a radiophone set of low power and, contrary to general belief, the apparatus and the operation of such a set does not necessitate indulging in very complicated apparatus or intricate wiring schemes. Some very simple apparatus may be assembled with a minimum of component parts which will serve the purpose in a most satisfactory manner.

Herewith is given the wiring scheme and general description of a small transmitter which may show some surprising results if properly assembled and operated. As it is most advisable for the novice to indulge in only the simplest apparatus at first the simple transmitter here mentioned should prove popular. A brief analysis will show that the apparatus is no more nor less than a one-coil regenerative receiver in disguise. with the exception that a transmitting tube is employed. A 5-watt Radiotron will serve very well.

Primarily, the inductance has been reduced to a single unit. This latter may be either a helix of No. 14 copper wire wound upon a coil form with turns separated sufficiently to avoid short circuiting, or instead of the helix a variometer composed of two spider web or pancake coils may be so arranged that they can be continuously tightly or loosely coupled. This will serve to select the proper amount of inductance in the antenna. A helix of 50 turns should cover requirements with any amateur antenna.

The variable condenser not only aids in tuning the antenna but serves as a capacity coupling. By reference to the various leads of the circuit it is seen that the grid circuit through the variable condenser is coupled to the antenna, a part of which serves as the output circuit of the plate, whereby the high frequency current traverses the inductance and the condenser. The condenser K1 is not absolutely necessary in the transmitter at all, but is advisable so that in case the coupling condenser becomes short circuited through any reason, there will be no heavy drain upon the B battery through the leads running to the antenna, the helix and through the variable condenser to the other terminal of the battery.

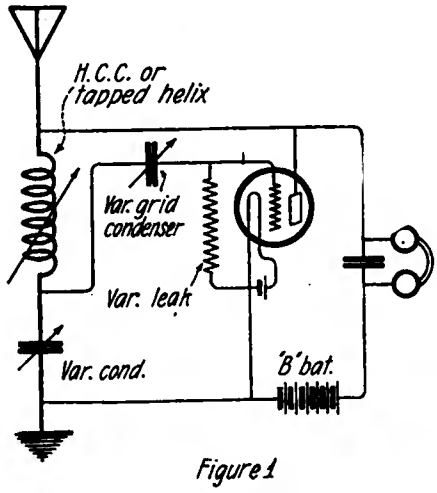


Figure 1

The one-coil regenerative receiver

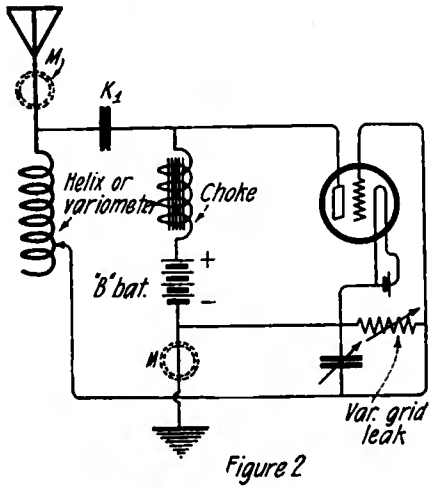


Figure 2

Radiophone transmitter

The choke coil composed of a number of turns of No. 22 or No. 24 copper wire with good insulation serves to shunt the high frequency output of the plate circuit to the antenna. It is advised that an iron core of soft wires be utilized in its makeup.

The grid leak is important and should be variable over a considerable range. The maximum necessary will be in the neighborhood of a megohm. That will generally be more than is at all necessary for any make of transmitter tube although the 5-watt Radiotron is recommended, on account of practical results obtained with it by so many experimenters.

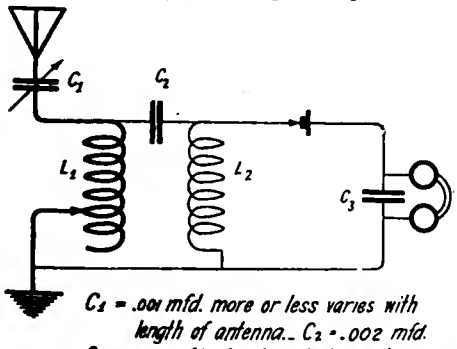
All conductors should be of the largest cross-section that it is most convenient to use so that there will be a minimum of high-frequency losses because of surface resistance.

In the case of the novice I would suggest that the microphone, for the modulation of antenna current at speech frequencies, be inserted in the antenna or ground at first. This is really not the best practice but grid modulation or other schemes will be better understood by the beginner after he has become familiar with the simple arrangement described here.

Some genuine results and enjoyment can be readily found in the operation of such a low powered and simple apparatus. The range of such an outfit will be one to five miles, according to the plate voltage and the antenna and ground system used.

Distance Reception on a Crystal Receiver

EDWARD C. GILL of Washington, D. C., has been having exceptionally successful results with a crystal set of his own design. He has two hook-ups. With a single phone on a horn these hook-ups give sufficient volume to be heard over two rooms, and using head phones on his ears Mr. Gill reports reception of WOC at Davenport, Iowa, 700 miles distant.

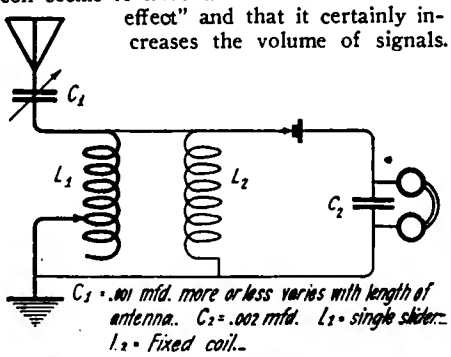


C_1 = .001 mfd. more or less varies with length of antenna.. C_2 = .002 mfd. C_3 = .0025 mfd. L_1, L_2 = Vario coupler or loose coupler.. L_1 = varies. L_2 = 50 turns No. 30

Figure 1—Modified loose-coupler, crystal receiving circuit

In hook-up figure 1 Mr. Gill has found that either a variocoupler or loose-coupler may be used. In the diagram L-1 is the primary of the tuner and is varied either by taps or by means of a slider, while L-2 consists of 75 turns of No. 30 wire. C-2, the condenser between the antenna inductance and one side of the secondary inductance, is a condenser of .002 mfd. C-3 is an ordinary phone condenser, .0025, across the telephones. C-1 in this hook-up is a variable condenser of .001 mfd. capacity and is used for tuning the antenna.

In hook-up figure 2 the antenna condenser and the phone condenser are the same as in the first diagram. L-1 is a single slide tuning coil while L-2 is a fixed coil of a number of turns dependent upon the capacity and inductance of the antenna and of the first coil. In constructing this set L-1 is first wound and then used for reception in the conventional single slide hook-up. The slider is manipulated until the point is found that is best for both 360 and 400 meters, using the antenna condenser for differentiating between the two. Then the number of turns are counted for this purpose and the fixed coil is wound with that number. The fixed coil is then paralleled with the single slide tuner. The antenna condenser then will have to be nearly doubled in its setting. Mr. Gill reports that the addition of this fixed coil seems to have what he calls "a tickler effect" and that it certainly increases the volume of signals.



C_1 = .001 mfd. more or less varies with length of antenna.. C_2 = .002 mfd. L_1 = single slider. L_2 = Fixed coil..

Figure 2—Crystal receiver with a fixed coil

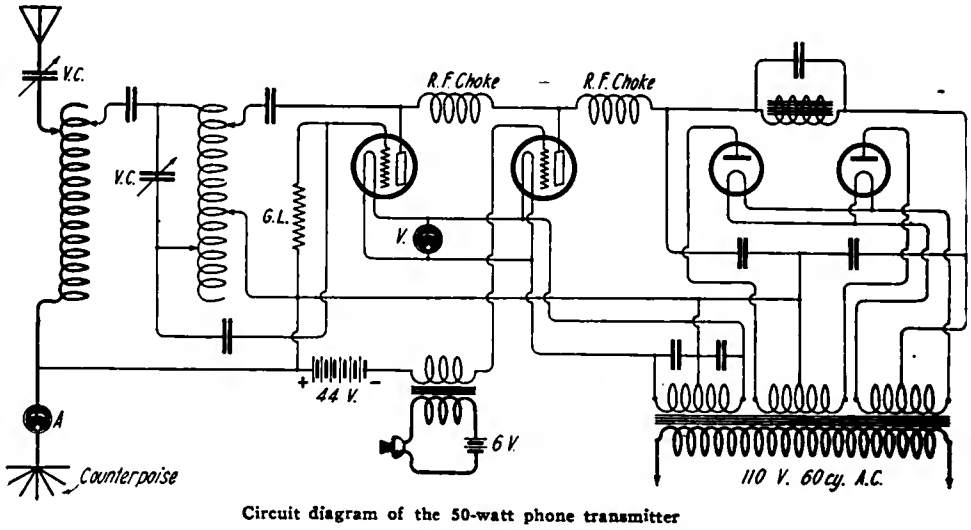
Excellent Work in Cuba on 50 Watts

REGULAR reception at a distance of 300 to 500 miles, and occasional reception at over 1,000 miles, is the record of the 50-watt phone transmitter operated by Frank H. Jones at Tuinucu, Cuba. Mr. Jones uses grid modulation using one 50-watt tube as a modulator and another one as an oscillator with 3.2 amperes in the antenna.

The antenna is a cage of 6 wires, 5 feet in diameter and 200 feet long, hung between two iron poles aboot 320 feet apart and 90 feet high. A counterpoise system is used, consisting of 6 wires stretched 25 feet above the ground, so that they clear the Jones bungalow and also some trees. Mr. Jones confesses that this is not good practice theoretically, "but I can't move the house or the trees, so my lead-in comes down through the counterpoise to the set." The counterpoise is 285 feet long and 15 feet wide, in over-all dimensions.

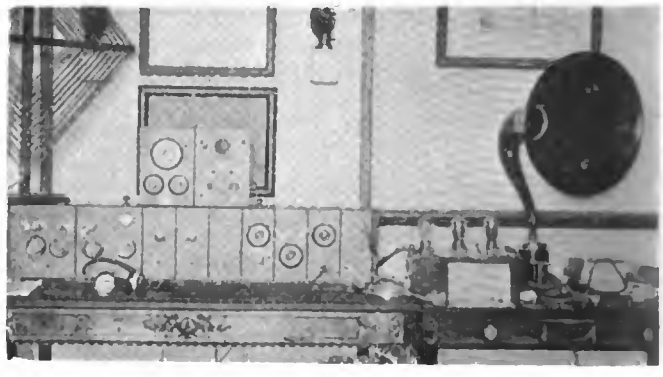
The record of this set to date on phone, is 1,375 miles. So far transmission has been exclusively by voice, but experiments with C. W. telegraphy will be undertaken in the near future. Using both 50-watt tubes as oscillators, gives 4 to 4.5 amperes in the antenna on 342 meters and about 4 amperes on 275 meters.

In reception, Mr. Jones says, "Since the middle of 1921 I have been receiving all the radiophones there were to receive. On detector tube, alone with a Westinghouse-R. C. set, I picked up every 500-watt set in the United States." These stations he is able to make audible through a wide area by means of a loud speaker, some of them having been heard over a mile from the house. There also are 3 stages of radio-frequency available. The receiving apparatus, outside of the R. C., is arranged in units so that it may be switched around in any desired combination of tuners and radio and audio amplifiers.



Circuit diagram of the 50-watt phone transmitter

Assembled view of the phone transmitter



Receiving units used in various combinations

A Study of the Loop Antenna

By William A. Dickson

ALTHOUGH the coil antenna, or "loop," is by no means a recent invention, yet it is only lately that its use has become prominent among radio enthusiasts. Its use for radio receiving purposes has increased with the popularity of radio frequency amplification, without which it would be almost useless. Loop antennas have been in use for several years by government and commercial stations, but probably more often as direction finders than for actual receiving purposes.

Generally speaking, the loop aerial has a decided advantage over the ordinary, elevated type, due to the fact that a large amount of atmospheric disturbance and interference can be eliminated, also because it has distinct directional characteristics and is portable.

The action of the loop antenna differs considerably from that of the ordinary type, which primarily is a large electrical condenser. The loop can be considered to act as an electrical inductance, and the induced E. M. F. from the incoming wave causes a current to flow in the circuit connected to the receiving apparatus.

Assume that two vertical wires of the same length are placed 300 meters apart, and are insulated from both one another and their supports at each end. Then, when any incoming wave approaches, an E. M. F. will be induced in each wire. If it comes from a direction which is perpendicular to the plane of these two vertical wires (see figure 1) the crest of the wave will reach each wire at the same time, consequently these two induced E. M. F.'s can be said to be exactly in phase.

Now suppose that this wave approaches from any other direction, it will be seen that the E. M. F.'s induced in the two wires would be generally out of phase, and for a given wave length, the difference of phase would be greatest for a wave approaching in the direction of the plane of the two wires.

If a wave 600 meters in length came from a point in the direction of the plane of the vertical wires (see figure 2) then the induced E. M. F.'s would be 180 degrees out of phase. This is due to the fact that the time required for the wave to travel from one wire to the other would be one-millionth of a second, which is half the time it would take for the wave to pass a given point. Hence, the E. M. F. at the lower end of one wire will have a positive maximum, while the E. M. F. at the lower end of the other wire has a negative maximum.

Now, if the upper ends of the two vertical wires are connected and receiving equipment placed across the lower ends, a current will flow in the rectangular circuit so formed. It can be proved here by experimentation that these horizontal wires contribute nothing whatever to the effective E. M. F. which is induced in the circuit.

Take the case in which a wave approaches from a direction perpendicular to the plane of the two coils. In this case the E. M. F.'s induced in the two vertical wires

would be exactly in phase, and the E. M. F. at the lower end of one wire will attain a maximum at the same instant as the E. M. F. at the lower end of the other wire, and no current will flow in the circuit.

This explains why it is necessary to turn a loop "edge on" to the incoming wave in order to secure maximum results.

Imagine a case where there is a wave length other than twice the distance between the two vertical wires. For a given wave length the maximum potential difference will exist at the lower ends of the two wires for a wave approaching in a direction of the plane of the two wires, and no potential difference will exist for a wave that approaches perpendicular to this direction.

This rectangular circuit constitutes a loop antenna and may consist of two or more turns which will be equivalent to vertical antennas of two or more times the height of the size of the coil.

From the above explanation of the action of the loop, it is obvious that if the coil is mounted on a frame which can be rotated, it can be adjusted for maximum signal strength by turning the coil on its axis to the plane of the incoming wave.

A common form of loop antenna consists of four or five turns of copper wire wound on a wooden frame about four feet square; a variable condenser is always used in connection for tuning purposes. It must be emphasized that satisfactory results cannot be expected using loop antennas unless sufficient amplification is used, as the amount of energy received is far less than that received on any of the outdoor aerials.

Design of Loop Antennas

As the loop is primarily an inductance, and as it possesses a distributed capacity in itself, it has a natural oscillating period or wave length of its own. This fundamental wave length may be defined as the wave length which is radiated by the loop when oscillating freely without the addition of any other values of inductance or capacity.

For ordinary receiving purposes a loop antenna should not be used to receive waves which are shorter than about two or three times its fundamental wave length.

In the use of loop antennas it is desirable to have the received current as large as possible. It will be understood from the theoretical action that if the coil is turned in the direction of the approaching waves the received current is greater; the larger the number of turns of wire on the loop, the greater the area and consequently the greater the inductance. Hence the following law may be stated: "The received current varies directly as the area, directly as the number of turns, inversely as the resistance and inversely as the wave length of the incoming wave."

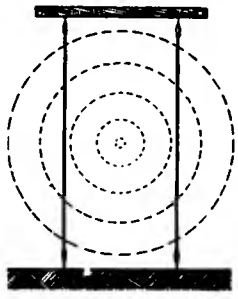


Figure 1 Figure 2

The phase characteristics of the induced E.M.F. is determined by the position of the loop

One would deem it odd at first that the increase in resistance which is due to the number of turns is not compensated for by the increase of inductance with the number of turns. This is due to the fact that the resistance of radio frequency currents is dependent upon the wave length, and increases rapidly as the latter approaches the natural wave length of the loop. Litzendraht wire has been found to be far superior to solid wire in the construction of loop antennas as the value of high frequency resistance is considerably lower.

The spacing between the turns on a loop antenna depends on the amount of capacity that is to be allowed for it; the common spacings range from one-quarter to one inch. The capacity of a loop increases rapidly at first, then more slowly with the number of turns. With close spacing, the capacity is at a maximum and decreases rapidly until a certain point is reached, after which it changes very slowly. The table given herewith will explain the relationship of the constants.

Characteristics of Loop Antennas

Length of one side	Number of turns	Spacing between turns	Inductance in micro-henries	Capacity in micro-farads	Natural wave length
6 ft.	4	¼ in.	124	66	170
4 ft.	6	¼ in.	164	55	174
3 ft.	8	¼ in.	193	49	183

From the following constants and dimensions of different loop antennas the reader will get a practical idea of the design:

Case I: A loop five feet square with the turns placed one-half inch apart is used in conjunction with a variable condenser whose capacity ranges from .00004 mfd. to .00065 mfd. With four turns the wave length would be from 200 to 400 meters; with eight turns, from 350 to 700 meters; with sixteen turns, from 500 to 1,000 meters.

Case II: A loop five feet square with the turns placed one-half inch apart is used in conjunction with a condenser of a maximum capacity of .0014 mfd. and minimum capacity of .000045 mfd. With four turns the wave length would be from 380 to 650 meters; with eight turns, from 400 to 950 meters; and with sixteen turns, from 675 to 2,300 meters.

Case III: A loop four feet square with the turns spaced one inch apart is used with a condenser whose capacity ranges from .000045 mfd. to .0014 mfd. The fundamental wave length in this case would be from 180 to 500 meters. If this same loop is used in conjunction with a condenser with a capacity ranging from .00004 mfd. to .0006 mfd., the wave length would be only 150 to 350 meters.

Further interesting information in connection with loop antennas is given in Bureau of Standards Scientific Paper No. 354.

A New Reflex Circuit

By Stanley Russell

THERE seems to be a wrong impression formed regarding the reflex circuit. This circuit is not as difficult to build or hard to operate as some circuits which have appeared recently. The reflex circuits functioning properly are not difficult to tune, nd the one tube set is very easy to build.

Using a one-tube reflex circuit with a Western Electric phone attached to a Victrola, sufficient volume is obtained to fill a large room. In this circuit the currents are passed through the bulb at radio frequency, rectified in a crystal detector and then passed back through the tube and amplified at audio frequency. While the results are not exactly

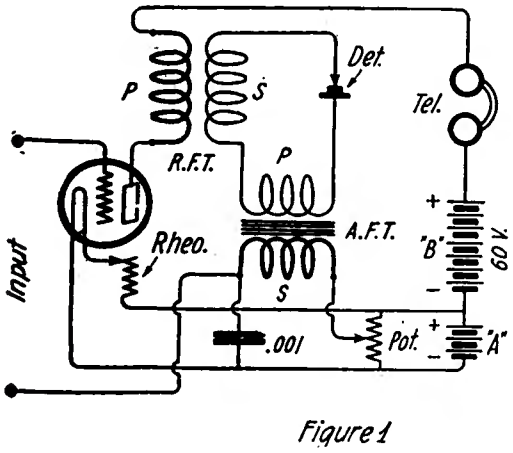


Figure 1

The reflex circuit

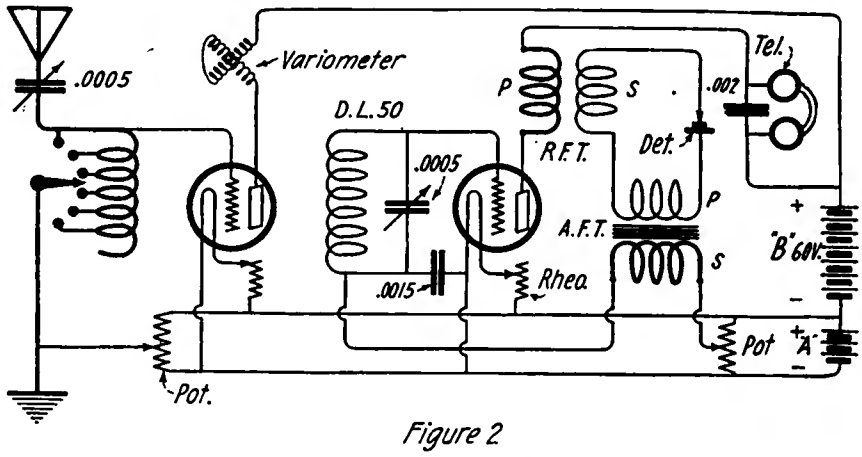


Figure 2

The radio amplifier coupled to the reflex through D.L.-50

equal to a three-bulb transformer-coupled one-step radio and audio set, still there is considerable radio frequency and some audio frequency amplification present.

To be conservative the circuit is at least several hundred times stronger on an aerial and ground than any existing single bulb circuit. This applies whether a dry cell or six-volt tube is used, though the volume is much greater on the six-volt tube. The circuit and constants are given below.

The circuit has been tried at the Hackensack Radio Laboratory and the results proved it to be the greatest improvement recently made in radio. It allows strong reception of local stations on a loop using only one bulb. For a Summer-time set in bad static conditions it should prove ideal for the experimenter. Such a set made by an experimenter has received WGM, Atlanta, Ga., on a four-foot loop.

Correct polarity between the secondary of the radio frequency transformer and the primary of the audio frequency is essential for good operation. The values given in the diagram are correct for circuits using Federal, Jefferson or Marle audio transformers. The Mu-Rad and Cotocoil radio transformers gave good results, though apparently any good transformer can be used. When used on a loop only a variable condenser is used for tuning. A big loop gives better results owing to the small amount of radio frequency present. A later development was the addition of a step of regenerative radio frequency. The results were very unusual and are summed up as follows.

There was little increase in volume of local stations. The marked improvement in distant station audibility was remarkable. Atlanta, Chicago, Kansas City, Memphis, Tenn., were all audible throughout the room with the phones hanging on the wall.

In figure 2 the radio amplifier is coupled to the reflex through the DL-50 coil, tightly coupled to the variometer in the plate circuit of the radio frequency amplifier. The aerial tuning inductance can be a DL coil, size probably 50. Use a very small aerial with this circuit. I have not shown any audio amplification as the addition of this is conventional and can be left to the experimenter. One stage is about all the circuit can stand.

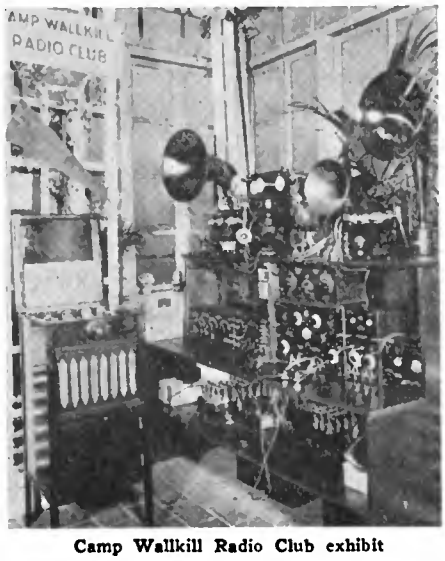
Second District Convention and Exhibition

AMATEURS in the second district thronged the Hotel Pennsylvania, New York City, on March 1, 2 and 3, during the 1923 Convention. Despite the fact that the Executive Radio Council, which conducted the Convention, made every effort to restrict the attendance to transmitting amateurs, approximately 6,000 secured admission, and 850 sat down at the banquet on the last day. Amateur operators were there from almost every district. One of the outstanding features of the exhibition was the exhibit of A. H. Grebe & Company, which operated a model amateur station, including both receiver and transmitter. The transmitter had 200 watts power and through it amateurs in many states were successfully worked.

Some of the most famous names among the manufacturers of radio apparatus were represented in the trade section. The exhibitors were:

Westingbouse Union Battery Company, Electric Storage Battery Company, Radio Corporation of America, Mortimer Radio Co. and Advance Metal Stamping Co., General Radio Company, Acme Apparatus Company, W. J. Murdock Company, Jefferson Electric Mfg. Company, American Radio Relay League, F. A. D. Andrea, Experimenters Information Service, Federal Tel. and Tel. Company, Diamond State Fibre Company, A. H. Grebe & Co., Inc., Executive Radio Council, Second District, De Forest Radio Tel. and Tel. Co., Marko Storage Battery Co., The Bristol Company, Jewell Electrical Instrument Co., Adams-Morgan Company, Novo Manufacturing Company, The Allen D. Cardwell Mfg. Corp., Colin B. Kennedy Co., Jones Radio Co., Kellogg Switchboard & Supply Co., P. M. Dreyfuss Co., Alden Napier Co.

No less than sixteen radio clubs in the second district had exhibits, as follows:



Camp Wallkill Radio Club exhibit

Radio Club of Brooklyn, Hackensack and Ridgefield Park, N. J., Radio Clubs; Chelsea Radio Association, Radio Association of Greater New York, Ridgewood Radio Club, Hudson Radio Club, Department of Commerce, Bronxville Radio Club, Bronx Radio Club, New York; Hill City Radio Club, Staten Island Radio Club, Radio Club of Jamaica, L. I.; Radio Division Hudson River Yacht Club, Busbwick Eve. Trade School Radio Club, Roselle Park Radio Club, Camp Wallkill Radio Club.

The Bronx Radio Club won first prize for the best booth, and now is the proud possessor of a General Radio wavemeter. The Hudson Radio Club was second and was decorated with a General Radio Phantom antenna.

The feature of the Convention, of course, was the banquet, which opened with an address by the Chairman, G. T. Droste.

Introduction of Convention Committee, Introduction of Amateurs by Districts, H. P. Maxim, President A. R. R. L. Arthur Batcheller, Chief Radio Insp., Second District; Introduction of Radio Clubs, Introduction of Amateurs Successful in Transatlantic Tests, K. B. Warner, Secretary A. R. R. L., Editor QST.; P. F. Godley, Radio Engineer, W. F. Crosby, Editor Modulator, Testimonial to J. O. Smith, Award of Prizes.

The prize stunt of the banquet was staged by Paul F. Godley, of the Adams-Morgan Company, who had installed a mammoth Paragon RD-5 in the balcony of the banquet hall. The lights were dimmed, a spotlight played upon Mr. Godley and his receiver, and the two of them going through the process of tuning-in.

Presently, a marvelous voice was heard through a loud speaker. After several numbers Mr. Godley in an apparent search for something, lifted the lid of the receiver, whereupon up popped Miss Margaret Merle, known as "The Nightingale of Vaudeville," who had been responsible for the vocal part of the performance.

The Convention was conducted by a committee consisting of the following: G. T. Droste, Chairman; W. J. Howell, Assistant to Chairman; W. F. Crosby, H. I. Danziger, R. W. E. Decker, G. F. O'Brien, F. Frimereman, C. E. Huffman, F. B. Ostman, G. K. Kilbourne, L. Jacquet, R. T. Morris, J. Stantley, M. Thury.

Hudson Radio Club exhibit

Jamaica Radio Club and Hudson River Yacht Club exhibits

Coil Data for Accurate Design of Wavemeter and Receiver Inductances

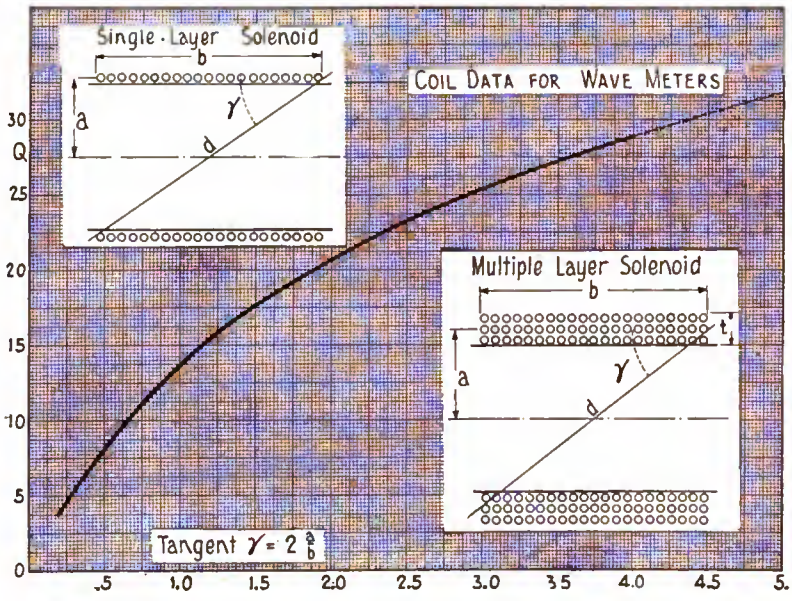
By M. Wolf

WHEN calculating inductances for wavemeter work, it is necessary to work to a considerable degree of accuracy, as those who have done standardizing work know. During a period in which the writer did some extensive work on the subject some coil data for wavemeters was gathered and boiled down in very compact form. The writer is making this data available to the amateur fraternity through the pages of THE WIRELESS AGE, and there will be many, no doubt, who will be able to make good use of it.

The data here given will also be found very useful in designing receiver coils and any other type of single and multiple layer solenoids.

In our investigations it was found that the best and simplest formula to employ for calculating inductances was Nagaoka's formula

$$L = a\, n^2\, Q$$



in which, a is the radius of the solenoid, n the number of turns, and Q a factor depending upon the ratio of $\frac{2a}{b}$, where b is the length of the coil winding. Now this formula is a theoretical formula for inductance based upon the conducting wires being thin sheets. Obviously for accurate wavemeter design work where round wire is used an error is introduced. This error is corrected by a factor ΔL shown in the equations of the tabulated text.

In using this data the following procedure is followed. In the first place the inductance is calculated without the corrections. For this purpose the graph is employed. The curve is plotted for values of Q against values of $\frac{2a}{b}$, so that knowing the radius and length of our coil we can immediately read off Q from the chart, and at once calculate very simply the coil inductance from the formula $L = a\, n^2\, Q$. The calculations involved here are the simplest and most elementary, thanks to the graph. This graph can thus be used to calculate in a jiffy the inductance of any single or multiple layer solenoid.

Now if it is desired to get these inductances to a high degree of accuracy, as we

Single Layer Solenoid

$L = L_s - \Delta L$

$L_s = a n^2 Q$

$\Delta L = 4\pi a n (A+B)$

- L = inductance of solenoid in cms.
- L_s = inductance for current sheet distribution.
- ΔL = correction for solenoid wound with circular conductor.
- a = radius of solenoid.
- b = overall length of solenoid including insulation of conductor (n times pitch.)
- n = total number of complete turns.
- d = diameter of conductor.
- A = correction term depending on $\frac{d}{D}$ TABLE I
- B = correction term depending on number of turns n
- D = pitch of winding.
- Q = function of $2\frac{a}{b}$, tangent γ
- Dimensions in centimeters.

Multiple Layer Solenoid

$L = L_u' + \Delta_2 L$

$L_u = L_s - \Delta_1 L$

$L_s = a n^2 Q$

$\Delta_1 L = 4\pi a n (A+B)$

$\Delta_2 L = 4\pi a n (C+F+E)$

- Q = function $2\frac{a}{b}$. Table 3
- A = function $\frac{t}{d}$. Table 4
- B = function turns. Table 2
- C = correction for round wire = 0.1383
- F = correction pitch = $\log_e \frac{D}{d}$
- E = correction G.M.D. Table 5
- t = thickness of current sheet
- a = mean radius
- b = length (n times pitch)
- m = number of layers
- n = number of turns
- L_u = inductance for m turns
- L_u' = inductance for n turns < to square m turns value

$L = L_s - \Delta_1 L + \Delta_2 L$

TABLE 1

Values of correction term A, depending on the ratio $\frac{d}{D}$ of the diameters of bare and covered wire on the single layer coil.. $A = \log_e (1.7452\frac{d}{D})$

d/D	A	d/D	A	d/D	A
1.00	0.3388	0.75	0.2691	0.50	-0.1383
.99	.5488	.74	.2557	.45	-.1585
.58	.5367	.73	.2421	.48	-.1771
.97	.5264	.72	.2283	.47	-.1982
.96	.3160	.71	.2143	.46	-.2157
0.95	0.5056	0.70	0.2001	0.45	-0.2418
.94	.4949	.69	.1857	.44	-.2641
.93	.4842	.68	.1711	.43	-.2871
.92	.4734	.67	.1563	.42	-.3108
.91	.4626	.66	.1413	.41	-.3347
0.90	0.4515	0.65	0.1281	0.40	-0.3594
.89	.4403	.64	.1106	.35	-.3847
.88	.4290	.63	.0948	.38	-.4107
.87	.4176	.62	.0789	.37	-.4374
.86	.4060	.61	.0626	.36	-.4648
0.86	0.3943	0.60	0.0460	0.35	-0.4929
.84	.3825	.59	.0282	.34	-.5219
.83	.3705	.58	+.0121	.33	-.5518
.82	.3684	.57	-.0063	.32	-.5826
.81	.3461	.56	-.0230	.31	-.6143
0.80	0.3337	0.55	-0.0410	0.30	-0.6471
.79	.3211	.54	-.0594	.28	-.6810
.78	.3084	.53	-.0781	.28	-.7161
.77	.2955	.62	-.0971	.27	-.7525
.76	.2824	.61	-.1165	.26	-.7902
0.76	0.2691	0.50	-0.1363	0.25	-.8294

TABLE 2

Values of correction term B, depending on the number of turns of wire on the single layer coil.

Number of turns = n	B	Number of turns = n	B
1	0.0000	50	0.3186
2	.1137	60	.3218
3	.1883	70	.3239
4	.1973	80	.3257
5	.2180	90	.3270
6	.2329	100	.3280
7	.2443	125	.3298
8	.2332	150	.3311
9	.2604	175	.3321
10	.2664	200	.3328
15	.2837	300	.3343
20	.2974	400	.3351
25	.3042	500	.3356
30	.3083	600	.3359
35	.3119	700	.3361
40	.3148	800	.3363
45	.3169	900	.3364
50	.3188	1000	.3365

TABLE 3

Values of the constant Q in formula, $L_s = n^2 a Q$

$2\frac{a}{b} = \tan\gamma$	Q	$2\frac{a}{b} = \tan\gamma$	Q
0.20	3.83240	1.80	19.87888
0.30	5.23388	2.00	20.74831
0.40	8.71017	2.20	21.82049
0.50	8.07470	2.40	22.81498
0.80	9.33892	2.60	23.74013
0.70	10.51349	2.80	24.60482
0.80	11.80790	3.00	25.41813
0.50	12.63059	3.20	28.18009
1.00	13.38892	3.40	26.80177
1.20	19.33798	3.60	27.58548
1.40	16.88640	3.80	28.23484
1.80	18.30354	4.00	28.85335

TABLE 4

Value of the constant A as a function of $\frac{t}{a}$, t being the depth of the winding and a the mean radius.

t/a	A
0.	0.6949
0.10	0.6942
0.15	0.6933
0.20	0.8922
0.25	0.6909

TABLE 5

Summary of the values of E found for the various cases considered.

Turns	Layer	E
2		.006528
3	1	.009045
4	2	.01891
4	1	.01035
8	2	.01335
10	1	.01276
20	1	.01357
16	4	.01512
100	10	.01713
400	20x20	.01784
1000	50x50	.01778
Infinite		.01806

have to in accurate wavemeter work, then we must make corrections, which procedure is very much simplified by the aid of Tables I to V, which are the result of considerable calculations carefully and thoroughly worked out.

In the case of a single layer solenoid, it will be seen from the formula on the graph sheet, that the correction Δ L depends upon two factors A and B. Factor A is a function of the ratio of the diameter of bare wire to the diameter of actual insulated wire used on the coil. Knowing these diameters from the size of wire used on the coil, this ratio d/D is easily calculated, and from Table I we can immediately read the correction *A* corresponding to this ratio. Factor B is a function of the number of turns on the coil and we can read off from Table II the value of this correction corresponding to any number of turns. If the exact number of turns falls between two values of turns in Table II, then the correction B is obtained simply by interpolation. Knowing the factors A and B, the correction Δ L can be easily calculated from the formula on the data sheet.

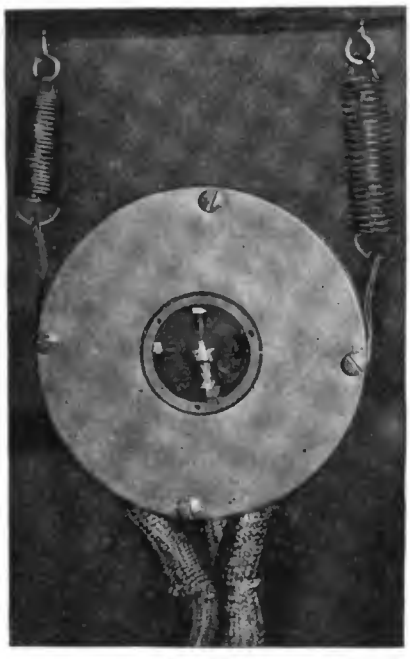
In a similar way the correction for multiple layer solenoids is obtained. Here, however, there are five factors, A, B, C, F, E, as seen from the data sheet. Factor *A* is a function of the ratio of coil thickness *t* to coil radius r, (t/r), and this factor A can be obtained from Table IV. Factor B is the same as for single layer coils and is obtained from Table II. Factor *C* is a constant, namely 0.1381, which is a partial correction for the use of round wire. Factor E is read off from Table V, while F is the only factor which is not tabulated, and must be calculated, as stated on the graph sheet, from the formula, $\log \frac{D}{d}$. With these various correction factors known, the actual corrections ΔL_1 and ΔL_2 can be calculated from the formulas on the data sheet, and the correct inductances thereby obtained. For precision work these corrections are absolutely essential. Where approximate results only are desired the results obtained from the curve alone will be sufficient.

The use of this curve for receiver coil calculations will be found to be a boon, for it saves time and energy lost in calculations. Its accuracy is as good as any other formula, and it has the advantage that it is simpler to handle. No doubt many amateurs and coil designers will find this data useful.

Glow-Discharge Transmitter

RADIO broadcasting fans will be benefited by a new radio transmitter invented by Dr. Phillips Thomas, research engineer of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. The new transmitter makes possible the broadcasting of music and other sounds exactly as produced. It has been used at the Westinghouse broadcasting station KDKA during the past few months, which explains the clarity and strength of this station's signals.

The basis of Dr. Thomas's invention is the elimination of the diaphragm now used in all transmitters in practical service. This diaphragm consists of a thin disk of metal or other substance and operates by being vibrated by the sound waves which strike it. But because of its inherent inertia, no material diaphragm is capable of vibrating in perfect sympathy with the entire range of audible sounds. If it can transmit low notes successfully, it will fail on high notes; and vice versa. The ordinary diaphragm is designed with reference to the middle register, and it therefore does not transmit extremely high and extremely low notes satisfactorily. The piano is a case in point. The radio audience hears the highest notes as a series of clicks and the very low bass notes as a roar.



The New Thomas Glow-Discharge Transmitter showing position of electrodes

In the Thomas transmitter, a minute electrical discharge takes the place of the mechanical disk. This discharge flows between two points, separated by a very small fraction of an inch. It is affected by sound waves, just like the diaphragm, but being non-material and having no perceptible inertia, it responds equally well to all vibrations. Hence music broadcasted by means of it is transmitted in all its original purity.

The development was completed by the working out of a low current, high voltage rectifier, with resistance-capacity filters, which permits the discharge to be struck or started by flashover, and maintains its current practically independent of discharge impedance.

Dr. Thomas has recently been experimenting with his transmitter at the Westinghouse Pittsburgh Station, KDKA. Listeners all over the country have noticed from time to time the great improvement in the quality of the voice of this station, but have naturally been unaware of the cause. Within the near future, all Westinghouse stations will be regularly equipped with this device, and the art of broadcasting will take another step forward.

In appearance, the Thomas transmitter resembles a large watch, with the front and back covered by wire gauze. On looking into it, a point of light can be seen, caused by the flow of the electrical energy against one of the terminals. From this fact, it is called the Glow Discharge transmitter.

KDKA's studio as it now appears, with the Thomas Glow-Discharge Transmitter in use

How I Made My Receiver

By Mrs. H. J. Richards

WE hear and read a great deal about what men are doing in making and operating radio sets, and what wonderful things they are accomplishing, but nobody says very much about the ladies, so I rather concluded that the fact that I made a tube set myself must be unusual. I cannot claim that I was absolutely inexperienced when I started, for I had wound tuning coils for my husband's set, but I had never used a drill or soldering iron.

In experimenting, my husband had discarded coils, condenser, rheostat, cabinet and a great deal of wire. It was a pity to let all this material go to waste, and having read so much about making a set I went to work. By evening I had it ready to try, in the meantime having done my housework and taken care of the two children. It worked fairly well, considering the fact that it was made of cast-off material, and I grew more enthusiastic, tore it down, bought new parts, and with these and the variable condenser went to work to make a real good set.

I bought parts and wire for a variocoupler. The rotor was held on a shaft made of a piece of 3/8-inch fibre tubing, which rotates in bearings made of two flat pieces of fibre screwed inside the primary coil at the top. A lot of drilling had to be done, in the fibre supports, in the center of the fibre tube, and I had to use a round file to enlarge the hole in the rotor to 3/8-inch size. The ball was wound with about thirty turns of No. 26 D. C. C. on each side and shellacked.

In winding the primary I started about an inch below the top of the tube, punched two holes with a crochet hook to start the wire, winding 25 turns, twisted the wire with a crochet hook in order to make a loop for a tap and after that made a loop every sixth turn. I had to use stranded wire to make connections with the rotor, in order

Mrs. Richards "makin' her own"

to allow movement without breaking the wire. I had some difficulty in getting the stranded wire through the fibre tubing, but this was finally accomplished by hooking the wire to a bent hairpin.

I knew that I would have to solder every connection, and as I had never used a soldering iron, but had only seen soldering done, I was a bit skeptical about this part of the work. I heated the iron on the gas stove and used just a tiny drop of acid on each connection. I succeeded beyond my expectations, only burning myself once. In fact, the soldering was easier than the wiring, as the diagrams and explanations made me study hard.

I had no trouble in mounting the set as the panel is 3-ply veneer. I drilled a hole nearly large enough for each screw and then used a larger drill to make a hole deep enough to let the screw heads fit in. I was quite proud of all this drilling.

My variable condenser gave me some trouble because it had been used so much that the plates rubbed pretty badly, but I made it work again by running a dinner knife between the plates until they stopped rubbing. This was only a 23-plate condenser, but having read so much about verniers I added a separate 3-plate condenser, which improved tuning very much. Because this small one was added afterwards I could not find any place to put it where it would not touch some of the wiring and so I had to wrap adhesive tape over some of the wires in order to prevent short circuits.

Then I had only the dials to put on and it turned out that the bushings were not big enough. Drilling them out was the hardest job of all, as the bushings were made of brass and I had to use three different sizes of drill and take out a little more metal each time. As I had no help and had to use a drill brace, I had to place the dial against a wall, the handle of the brace against my chest, steady the dial with one hand and turn the brace with the other. With some hard work and a great deal of patience this work was done and no dials broken.

With this set, using a single UV-201, I have certainly heard a lot of stations, including WWJ at Detroit, WLAG, Minneapolis; WGY, Schenectady; WDAP, Chicago; WSB, Atlanta; WBAP, Ft. Worth; KDKA, Pittsburgh, etc. I surely enjoy it all, especially the music, as I am a musician myself.

Improving the Feed-Back Circuit

By Ross Wood

WE have all been annoyed by the inconvenience of having to re-tune after making a slight change in tickler adjustment, especially in some of the single circuit tuners. It is doubtful if very many have given serious thought to overcoming this difficulty. The principle about to be explained is being used in the better class of single-circuit tuners now on the market, not only to overcome this difficulty, but for other reasons just as important.

Suppose we consider first the underlying reasons for this de-tuning effect. If the tickler coil is entirely disconnected, and the tuner used as a non-regenerative one, it will be found that changing the position of the tickler coil still produces the same detuning effect, though to a much smaller extent. This can be attributed to two reasons, namely: capacity effect between the tickler coil and the tuning coil; and variation in the amount of energy absorbed by the tickler coil. Of course when the tickler is in circuit, the change in mutual inductance when the tickler is rotated produces the same effect, but there is no way of eliminating this condition. There are several ways of overcoming the condition due to the capacity to a certain extent, but on account of the extreme sensitiveness of the regenerative receiver it is obvious that it is very difficult to completely do away with it.

A consideration of figure 1, will show that the capacity between the tickler and tuning coil can be decreased simply by arranging the connections so that the end of the tuning coil farthest away from the tick-

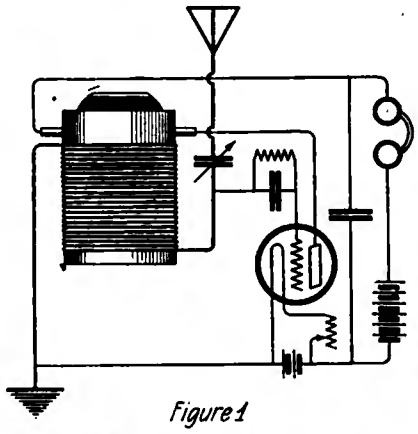


Figure 1

Circuit possessing instability and capacity effects

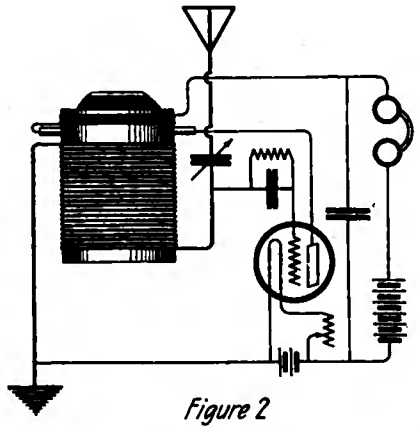


Figure 2

The improved feed-back circuit

ler is connected to the antenna and the end nearest the tickler is connected to ground. It is apparent, since the tickler is practically connected to ground—through the bridging condenser, and the B battery and phones—that by the arrangement shown of having the ground end of the tuning coil nearest the tickler, the effective capacity across the tuning coil is materially decreased.

The second method is accomplished by reducing the capacity between the two coils by changes in the tickler construction. Instead of having all the tickler winding on the rotor, we wind approximately half of the winding on the rotor and the other half on the same tube with the tuning coil, but separated therefrom by at least one-half inch. By connecting these two sections in series, as shown in figure 2, we can still obtain the same degree of maximum coupling as was possible before splitting the tickler coil. We also see that by doing this we have cut in half the number of turns on the rotor and consequently reduced the capacity between the tickler rotor and the tuning coil. This can further be reduced by winding the rotor of the tickler with comparatively small wire, say No. 28 or No. 30. Contrary to popular belief, the use of small wire in the tickler circuit will not prove detrimental.

In splitting the tickler as mentioned above we have accomplished a dual result. Not only have we reduced the capacity effect, but in doing so we have changed the tickler into the form of a variometer. Starting with zero coupling—when the two tickler sections are opposing—and increasing the coupling 180 degrees to maximum—when the direction of winding on the two sections is the same—the inductance of the tickler is simultaneously varied from practically zero to its maximum value. Thus we see that instead of simply varying the tickler coupling we also tune the plate circuit which is a decided advantage. It will be found that tubes will oscillate very much more readily as a result of this tickler arrangement and also that the set will oscillate on all wave-lengths within the range of the tuning elements.

The Kenotron Rectifier

By B. R. Cummings

Radio Engineer, General Electric Company

THE development of three-element vacuum tubes for use as generators of radio frequency power has been accompanied by the requirement for a power supply of high voltage direct current, which is applied between the plate and filament of the three-element tube. At lower powers the high voltage direct current is obtained from a direct current generator with a rotating armature. At higher voltages than are obtainable from such machines, however, it has been necessary to develop other means for obtaining this supply. The kenotron rectifier has been developed primarily for this purpose in connection with radio telephone and telegraph transmitters, although it is applicable to other uses where a high voltage direct current power supply is required.

In common with the more familiar three-element tube, a filament, in a highly evacuated container, is heated to incandescence by the passage of direct or alternating current through it. Under these conditions the filament emits a great number of electrons, which are unit charges of negative electricity. If a potential difference is created between the filament and the second electrode, known as the "plate," and the plate is made positive with respect to the filament, the negative electrons will be attracted to the plate, and will enter it, causing a flow of current between the filament and plate inside the tube and from the plate back to the filament in the circuit external to the tube.

The output of such a rectifier will be a pulsating direct current, each successive alternation of the power supply, of the same polarity, producing a pulse of direct current. It is customary, therefore, where direct current of constant amplitude is required to add a so-called "filtering system" in the output circuit of the rectifier, which will smooth out the ripple.

For the production of high voltage direct current by means of a kenotron rectifier, it is customary to step-up the alternating current supply voltage by means of a transformer, to a voltage somewhat higher than that actually required for the operation of the three-element pliotron in the radio transmitter proper, so as to allow sufficient additional voltage to compensate for the voltage drop through the kenotron tubes and the filter system. It is possible, by means of a number of kenotrons, and by utilizing a multiplicity of phases, to obtain a direct current output from the kenotron rectifier which will have remaining in it only a small percentage of intermittent direct current.

Particularly in the radio telephone transmitter, it is essential that the plate supply to the pliotron tubes be constant, and it is customary in such equipment to associate with the kenotron rectifier a filter system. Such filter systems usually consist of a combination of condensers and reactors of comparatively high capacity and inductance, connected across, and in series with, the load.

The kenotron rectifiers built on this principle are applicable not only to radio equipment, but to any circuit in which a high voltage direct current is required. Such rectifiers have been built with capacities up to 30 kilowatts at 15,000 volts direct current, although much larger equipments can, of course, be developed.

Such equipment is preferable in many respects to revolving machinery, even at voltages at which the latter can be built. The kenotron rectifier is noiseless in operation, has no moving parts and requires no maintenance other than the infrequent replacement of the rectifier tubes.

Reduction of Antenna Resistance

(*Continued from page* 58)

My Litzendraht antenna is made up of six strands of No. 24 DCC wire. One stretch of this cable 140 feet long gives excellent results even though it is but twenty feet above the ground at any point. The ends of the wire are bared at each end of the cable and they are all soldered together. This is the only metallic connection at both ends only between the wires.

To protect the cable I wound a small piece of wire around it every five feet. No. 24 DCC can be used for this purpose. One turn is sufficient. The cable when completed can be pulled tight without any trouble whatsoever and it makes a very light antenna. I have stretched 10 wire cables, No. 28 wire, 210 feet long without more than a two-foot sag at the mid-point when the cables were suspended between poles but ten feet in height. My idea is to start at the very beginning if there is any improvements to be brought about.

More resistance is encountered in the ground connection than in the antenna itself. Very few take the trouble to sweat a joint when soldering to a water pipe and this is very important.

The water pipe is a good radiator of heat and dissipates it almost as fast as the torch can apply it. By wrapping copper wire around the faucet or pipe itself, generally the solder adheres very readily to the wire and forms a band around the pipe or faucet only to work loose after a very short while. The "tinkerer" goes away satisfied that it is a well soldered connection.

The only way to insure such a joint is to first tin the pipe thoroughly. This can only be done if the pipe is cleaned extremely well with a file followed by the application of sand-paper. Next the wire or ground clamp is tinned and applied to the pipe. Then the torch is applied to the pipe and clamp and when the solder begins to run well, and portions of the pipe immediately around the connection cause the solder to run when applied to it, you can rest assured that the joint is perfect. This is absolutely necessary.

Where there are no water pipes to connect to, five-foot lengths of pipe driven into the earth are far superior to buried plates. Buried plates after one year are generally "not plates" any more. Sweat a heavy copper wire to the end of the pipe which goes down into the earth so that proper ground connection will be assured at all times. When moist earth cannot be reached at that depth, it is best to bury wires directly under the antenna at a depth of one foot and then construct a counterpoise antenna—an absolute duplicate of the erected antenna, if possible.

Getting back to the Litzendraht antenna, I have a latent idea in my mind that the passing waves generate current in each individual wire and that they add together, all being in the same position at the time the waves pass by. This may be the correct answer to the question as to why the Litzendraht antenna gives a greater signal than the bare wire.

Unfortunately it is necessary to repeat the time-worn precautions regarding the construction of an antenna:

Keep the antenna away from trees.

Keep the antenna away from tin roofs.

Keep the antenna away from telegraph, telephone and power lines.

Keep the lead-in at least three feet from the side of the building.

Properly insulate the antenna.

Properly insulate the lead-in.

If there are connections in the antenna wires—sweat them.

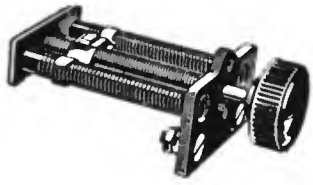
Use pure copper wire or phosphor bronze.

NEW APPLIANCES AND DEVICES

The Autostat

THE Autostat, developed in the engineering laboratory of the Automatic Electrical Devices Company, Cincinnati, Ohio, also manufacturers of the Homcharger, has made its appearance this month and is available for general sale.

The Autostat known as a super radio rheostat, gives precise control of filament current, inasmuch as it is not necessary to



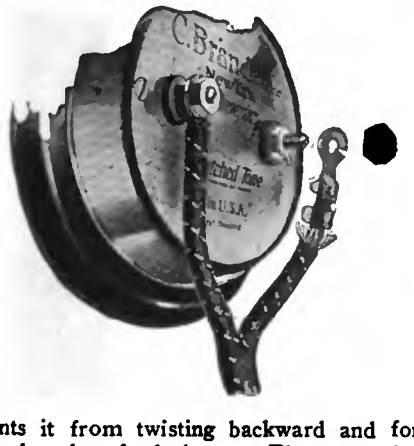
turn the knob a hair's breadth to get a fine adjustment, since there are forty complete turns of the knob between maximum and minimum resistance, compared to three-quarters to three turns on all others.

It is composed of two parallel mounted, wire wound, fire-proof resistance tubes, connected in series by a micrometer operated slider, the length of wire in circuit depending upon the location of this slider which gives a uniform change in resistance with each turn of the knob, possessing practically "zero" resistance at full-on position.

The Autostat is compact in size, neatly mounted, requiring less space than any other. Furthermore, it is a most economical rheostat inasmuch as only one Autostat is necessary to control two amplifying bulbs. It can also be used with six-volt or WD-11 detector tubes, or one 5-watt power tube.

Brandes Develops New Phone Cord Terminal

THE new cord for Brandes Matched Tone Superior Headsets is a decided improvement over the old ordinary way of terminating the cord at the receiver end and attaching it to the binding post. It is provided with a lock terminal that pre-



vents it from twisting backward and forward under the lock nut. The same piece of metal that holds the tinsel braid and forms the contact for the lead wires, goes around the binding post much the same as an ordinary lock washer, and thus prevents all possibility of the terminal slipping out of the binding post while the headset is being adjusted to the head and while it is in use.

The terminal is pressed from sheet phosphor bronze of greater thickness and strength than the material usually used on radio headset terminals. With the new terminal the tinsel cord is clamped under the first lug on the terminal and soldered. Then the second lug is sprung tightly against the woven insulator covering. This removes all strain from the tinsel conducting cord and keeps the braid from slipping back and thus exposing the tinsel.

Over all contact points and the inside weaving, clamped under the lug, is woven the outside braid that carries the interwoven tracer, thus providing a very neat finish for the cord at the terminal. All Brandes matched tone radio headset cords have a red interwoven tracer, showing the positive terminal.

New Storage Battery for WD-11 Tubes

THIS is a 2-volt 80-ampere-hour storage battery (11 plates) constructed throughout with Gould storage battery parts, and comprises the famous "dreadnaught" plates. It is just the thing for the operation of WD-11 tubes. With its 80-ampere-hour capacity it will give approximately 320 hours service on one WD-11 tube drawing ¼ ampere (or less).

Its size and weight makes it comply with the requirements of a portable radio set. It weighs but a few pounds and its overall dimensions are: 8 inches high, 4 inches wide and 7½ inches long. This battery is manufactured by the WD-11 Storage Battery Company.

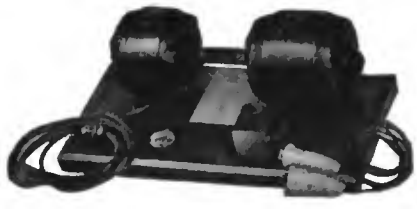
New Carter Rheostat

ACHIEVING the vernier adjustment on a rheostat by decreasing the diameter of the coil of resistance wire has been adopted for the new Carter Vernier Rheostat. This does away with separate vernier attachments and two-part knobs. The resistance element in the new Carter Rheostat consists of a spiral of nichrome wire 3/32 of an inch in diameter, held in a groove in the outer edge of a disk. The disk is attached to the knob and rotates past a stationary contact spring, which bears on one turn of the wire at a time. In passing from one turn to the next one, 5/16-inch resistance wire is added to or taken from the circuit, which is much less than in wire rheostats having a large diameter of resistance coil.

Another unique feature in the Carter rheostat is the use of a pig-tail connection on the rotating disk, thus doing away with loose sliding joints. The rotating member revolves in a large brass bearing and the springs used are of phosphor bronze. Widely spaced terminals are provided for soldering. When fully turned on there is a resistance of .2 ohms, which is provided in order to protect the filaments from possible overload by applying the full voltage of the battery. The rheostat has a capacity of 1½ amperes and is made in two resistances, one of 6 ohms for the ordinary 6-volt tube, and the other of 20 ohms for the new UV-201 A and C-301 A tubes.

Small Motor-Generator for Charging Batteries

BATTERY charging, that vexing problem for all who operate sets using storage batteries, may be done by means of various forms of rheostats and rectifiers, or

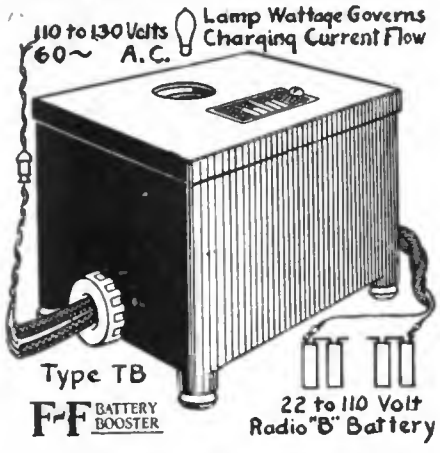


by means of a motor generator. For those who prefer the flexibility and other advantages of the latter there now is offered the Ohio motor generator set, for 6-volt and 12-volt batteries. This consists of an A. C. motor flexibly connected to a D. C. generator, the two mounted on a wooden base, with ammeter and rheostat to control the charging rate and flexible leads for connecting to a lamp socket and to the battery. The set will charge at any desired rate between 1 and 20 amperes. It needs no attention while in use, and is comparatively quiet in operation.

Rectifier for Charging "B" Storage Batteries

"B" STORAGE batteries of 22 to 100 volts can be charged from alternating current with the Type TB Mechanical Rectifier recently added to the line of F-F Battery Boosters made and marketed by The France Manufacturing Company.

Any group of lead or Edison cells of 22 to 100 volts can be charged in series at the same time. The current rate is regulated by an ordinary tungsten lamp screwed into a socket shown on rectifier. Usually a 60-watt lamp meets the requirement.



A "B" storage battery is charged by first disconnecting it from the receiving set. Clips supplied on the ends of the battery cords coming from the rectifier are snapped on to the battery terminals—positive to positive, negative to negative. There is no chance for reversal of currents. The extension cord is then plugged into any convenient A. C. lamp socket.

Size is 5 x 5 x 3 inches. Shipping weight, four pounds. The price of this new TB charging outfit complete is $5.00.

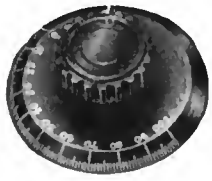
New Mesco Products

THE Manhattan Electrical Supply Company has recently brought out some new variocouplers and variometers which are made of genuine bakelite of reddish brown color. In designing the Manhattan variocoupler and variometer two important features have been introduced which are distinctive to these products. The electrical losses have been reduced to a very low point —first by the use of bakelite, with its high insulating qualities, and second by reducing to a minimum the amount of metal used. Variocouplers and variometers are frequently mounted on "shielded" panels. To eliminate all insulation difficulties a bakelite mounting block is provided, thus

permitting the use of both devices on a metal panel if desired.

The primary winding of the Manhattan variocoupler is provided with 12 taps, giving complete control up to a wave length of 700 meters.

The Manhattan variometer as commonly connected in a receiving set has a wave length of 170 to 490 meters. This insures efficient reception of amateur and broadcasting stations. The wave length range may be increased to approximately 1000



meters by the use of a fixed or variable condenser of .00025 mfd. across the variometer, or the familiar "long wave" coupler may be readily constructed to give a range up to 3000 meters.

The Manhattan line of genuine non-warping bakelite dials will appeal to those who desire precision and quality. The brass bushings for the shaft are accurately centered and insure perfect alignment. The engraving on the dials is extremely fine and clear. Numerals read from right to left.

New Willard "B" Battery

DEMANDS of radio operators for a smaller and less expensive "B" storage battery have recently been met by the Willard Storage Battery Company.

This company has just introduced to the market through its service stations a new 24-volt "B" battery. It has a little over half the capacity of the larger Willard "B" battery. It is rechargeable and it is claimed to have greater capacity on a single charge than the larger type dry "B" batteries.

Radio fans who have overhauled their sets in a quest for the cause of the "noises" only to find it finally in the slowly polarizing dry cells in the plate circuit, will welcome this quiet, inexpensive little "B" battery.

Tu-Way Plug Takes Many Headsets

THERE are very few radio sets that do not have more than one pair of headphones attached to them. The Carter Tu-Way plug will take two or even more sets of cord terminals. The plug terminals are broad, with a large-headed screw in each, and two grooves in the metal under the screw, so that two tips or wires may be fastened to each terminal. This means that cord terminals of any kind, including plain wire, may be used. When there is no more space available at the terminals for attachment of additional wires, still more headsets may be connected by tying the tips together outside—placing some of the sets in series. The combinations possible in this manner are numerous. This plug has been on the market for some time, and is steadily increasing in use because of its great convenience.

Volta Radio-Frequency Receiver

THE Volta Engineering Company has brought out a long distance receiving set which in tests has given exceptional results. In the laboratory this set successfully tuned in stations in California, Seattle, Canada, Havana, and at several other points more than a thousand miles distant.

This set is composed of three steps of radio frequency and detector. A type of radio frequency transformer developed by the engineers of the Volta Company is used.

Connected with a two-step audio-frequency amplifier, distant stations were received loudly and clearly on a loud speaker.

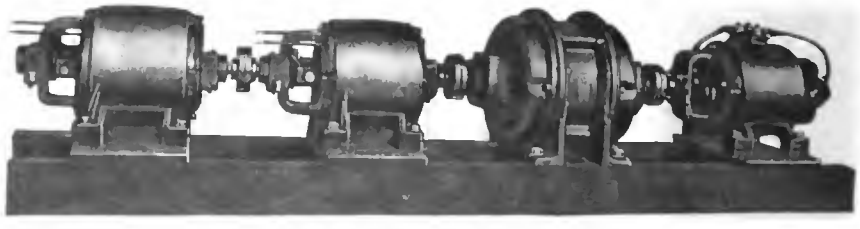
Powerful Motor Generator Outfit

PROBLEMS that the average electrician would be unable to solve have to be met in supplying electrical energy for radio transmitters, which require voltages and wattages up in the thousands, in alternating or direct current. For that reason hand in hand with the purely radio engineers have gone a comparatively small group of purely electrical engineers, who have developed for radio service a reliable and efficient means —and highly specialized ones, too—of providing the needed potentials.

An excellent example of their work has recently come to notice in a new complete Electric Specialty power plant for radio broadcasting purposes, which has just been shipped to one of the western broadcasters who is remodeling his station with the aim of making it the most powerful one in the country devoted to broadcasting.

This outfit is of the motor-generator type, and consists of a 10-horsepower electric motor, direct coupled to three generators. The motor operates on 220-volt 60-cycle 3-phase current, which is available for power purposes in the broadcaster's city. Of the generators, two produce 1,000 volts, 2,000 watts, and are connected in series, making their combined output 2,000 volts, 4,000 watts, for the plate-circuit of the vacuum tubes. The other generator turns out 2,000 watts of current at 12 volts, for the purpose of lighting the filaments of the tubes.

The entire unit is mounted on a single base by means of base plates and bolts, and individual couplings are provided between each unit, so that if it is necessary to remove any one for any reason it may be done without disturbing the others.



The Monthly Service Bulletin of the

NATIONAL AMATEUR WIRELESS ASSOCIATION

Guglielmo Marconi, *President* | J. Andrew White, *Acting President* | H. L. Welker, *Secretary*

Founded to promote the best interest of radio communication among wireless amateurs in America

THE Hoover cup, awarded annually to the owner of America's best amateur radio station, under the auspices of the American Radio Relay League, this year went to Frederick B. Ostman, owner and operator of station 2OM, located at 180 Broad Street, Ridgewood, N. J.

This trophy is awarded by the Department of Commerce through Secretary Herbert Hoover to the best all-around amateur station, the major part of which is home made. The entries are judged not alone on station arrangement or equipment, but on nine factors which are considered necessary in an ideal station.

The essentials considered in making the award include: Extent to which apparatus is home made; ingenuity in design, construction and arrangement; efficiency of transmitter; consistent transmitting range; efficiency of receiver; obedience to United States laws and local cooperative regulations; quality of operator's sending; amount of traffic handled; accuracy, completeness and neatness of station log.

In making the award two other stations among the list of entries were considered particularly, 2FZ, operated by F. Frimerman of 740 Prospect Avenue, New York, and 5ZA, operated by Louis Falconi of Roswell, N. M. The latter was the winner of the Hoover cup last year. Any licensed amateur radio station in the United States or its possessions is eligible to take part in the contest.

The transmitting spark set at 2OM station consists of a 30,000-volt United Wireless transformer, with two Dubilier and one homemade condenser across the secondary. The primary of the oscillation transformer is 3-inch brass ribbon. A Grebe synchronous gap is used. The antenna current of this set is 6½ to 7 amperes.

The continuous wave transmitter of the station, which was reported by English amateurs during the recent tests, includes four Radiotrons UV-202 in a Hartley circuit. Plate voltage is supplied by a homemade transformer. The filaments of the tubes are heated with A. C. by means of a rewound Acme transformer. The voltage is controlled by means of a homemade rheostat in the primary circuit.

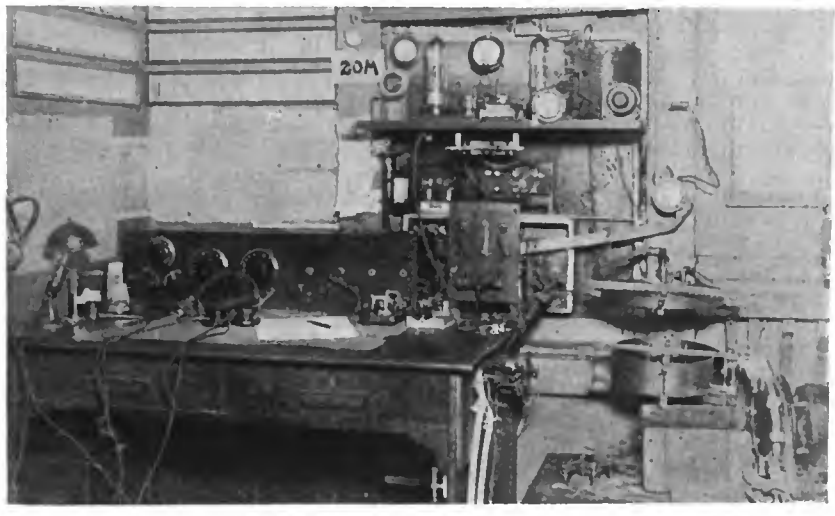
The receiver, which has done exceptional long distance work on all waves which it covers, was designed and built by F. B. and W. H. Ostman.

It is a three-circuit tuner with a detector and three stages of audio frequency amplification. A novel scheme is used for improving the results obtained from a short wave regenerator of the type using variometers for both grid and plate tuning. A four-circuit three-position anti-capacity switch is mounted on the rear of each variometer. These switches perform the following functions: when thrown to one side (left) they connect the rotor and stator coils of each variometer in parallel, giving a wave length range of 130 to 295 meters with better control and better signal strength than normal because losses are less, resistance less and the full 180-degree rotation available over amateur waves only. Thrown upright these switches connect the windings of each variometer in series as usual with a range of 180 to 550 meters

Detailed view of the home-made three circuit receiver

and when switches are thrown to the other side (right) they connect the variometer windings in series and in addition switch small condensers into parallel across them giving a wave length range of 435 to 1,400 meters.

The aerial is a vertical slanting flat top inverted "L" type, six wires spaced three feet, 75 feet long, 35 and 80 feet high. The ground system consists of the water mains all connected with heavy jumpers soldered; a well in which was sunk a long length of tin besides well pipe; a cistern in which over 50 pounds of salt was put. Strips of roofing tin one foot wide and four feet apart run directly underneath the aerial. Each ground lead is of one inch copper ribbon, run directly up to and tuned separately on the secondary of the oscillation transformer.



General view of transmitting and receiving equipment of the prize-winning 2OM station

A tuned counterpoise is also used which consists of two wires starting from the station running 150 feet back; these wires run 60 feet past the end of the aerial and are 60 feet apart at the far end and are connected. When used separately this counterpoise gives a much higher antenna current than the ground system. Tuned with the ground system a still higher value of antenna current is obtained.

The natural wave length period of the antenna is approximately 169 meters.

△ △

GREAT interest is being displayed by radio experimenters in Australia in the forthcoming trans-Pacific tests, beginning on May 1 and continuing throughout the month.

At a well-represented meeting, held in Sydney recently, it was unanimously decided to form a committee to carry out the necessary organization of the experimental wireless stations in N. S. W. for receiving the wireless signals to be transmitted by American amateurs.

Signals will be transmitted by American amateur stations on wave lengths between 250 and 350 meters, and the power used

will be up to 1 kilowatt C.W., and C.W. telephone will be used.

Special amateur stations are actually being built on the Californian coast in an endeavor to reach Australia. The tests will probably last one hour each evening for two or three weeks.

Kingsley Love, of the Victorian Division of the Wireless Institute of Australia, is the general organizer for Australia, whilst Malcolm Perry is chairman of the N. S. W. Organizing Section.

Any amateurs who desire to participate are invited to do so, and should transmit the word "test" and their call letters several times for periods of fifteen minutes, or more if desirable.

The best time for transmission by American amateurs who desire to participate in these tests is 4 to 5 a. m., Eastern Standard time.

Reports on these tests will be published in later issues of THE WIRELESS AGE.

△ △

DURING low power transmission tests recently conducted by Mr. C. D. Maclurcan, Strathfield, N. S. W., Australia, signals were received and the test letter correctly noted by Mr. Channon, Inverell (350 miles), and also by Mr. L. V. G. Todd, Tamworth (200 miles). The input plate voltage was 60 and the current 6 milliamps; total power, .36 watts.

△ △

WILLIAM HAMBLY, a Reading Railway employee of Philadelphia, recently made an April 1st receiving set, for an uninitiated friend of his, using in its construction two 40-watt incandescent bulbs, two condensed milk cans, and a baking powder box. The friend tried for three hours to hear something before they let him in on the joke. He was game, however, and went to the nearest radio store and bought a real set.

△ △

DANNY CHEN, a 12-year-old Chinese boy of Boston, upset the tranquillity of the Chinese section of Boston recently by building a receiving set which brought voices out of the air. However, as Danny is being schooled and groomed for the practice of law, and likely to become the future arbiter of the destinies of the Boston colony, his innovation was finally accepted as part of the regular order of things.

△ △

THE Connecticut State Convention of radio amateurs was held at the Commercial High School Auditorium, New Haven, Conn., under the auspices of the New Haven Radio Association.

The following spoke at the convention: F. H. Schnell, traffic manager of the American Radio Relay League; Frank M. Doolittle, F. L. Ham, of Bridgeport, and J. L. Reinartz, inventor of the Reinartz tuner.

About 400 radio fans from all parts of the state were present. The convention lasted from about 10 a. m. until 10 p. m.

△ △

A RADIO association has been organized at Stewartstown, Pa., with the following officers: President, James Fulton; vice-president, Allen G. Trout; secretary, Halbert Redding; treasurer, Lowell R. Fulton. The association is planning to open a broadcasting station. Many residents of the borough and its neighborhood have installed outfits.

△ △

THE Plainfield, N. J., Radio Club conducted a contest the week of April 2, in connection with the Own-a-Home and Mercantile Exposition which was held at the High School under the auspices of the Chamber of Commerce. The contest was open to the general public to exhibit any number of pieces of apparatus. Prizes were awarded.

△ △

THE annual Ohio State Convention of amateurs was held at the Hotel Columbus, Columbus, O., March 16 to 18, under the auspices of the Columbus Radio Club. Members of radio clubs from all over the state were present.

The meetings were held in the assembly room of the hotel. There were also exhibits by radio appliance companies and a small broadcasting station was in operation at the hotel.

△ △

THE annual general election for members of the Twin City Radio Council of Minneapolis and St. Paul closed with the following chosen for 1923:

D. C. Wallace, C. M. Jansky, M. E. Todd, C. J. Otterholm, S. D. Dimond, H. C. Forbes, A. C. Anderson, R. A. Braden, W. Hilgedeck, M. G. Goldberg, W. F. Kannenberg, L. C. Smeby, R. Tyrrell, Fay Gardener, Paul Trump, J. C. Linehan, A. P. Upham and D. C. Wills.

Special members elected are: Judge Baldwin, S. J. Gerlich, L. D. Smith, T. W. Findley, L. S. Stevenson and H. S. Marshall.

The Twin City Radio Council governs the radio interests of the Twin Cities. The council deserves credit for putting through the "Listening Hour," which all fans desired.

△ △

RADIO transmission in Cuba must be confined to continuous waves, according to the new rules there, which effect regulation by means of a Presidential decree. Until the present time there had been no restriction of any kind upon the construction or operation of radio stations in the island. The decree sets up five classes of non-governmental stations. Class A contains the amateurs, and all receiving apparatus. Transmitters in this class are limited to a wave length of 200 meters, and a power of half a kilowatt. Class B consists of educational institutions and experimenters, on waves between 225 and 275 meters, and .5 k.w. power. Class C, colleges and state institutions in general, is given 300 to 360 meters, and .5 k.w. Class D, state institutions only, has 400 meters, and Class E, meteorological stations only, 485 meters, and both may use up to a kilowatt power.

Licenses are required in each class, and are to be issued only after examination in radio elementals. Classes A, B and C must renew their licenses annually, while Class D and C licenses are good for five years.

The decree provides that all transmitting stations are subject to the regulations of the International Radio Convention of London, 1912.

△ △

THE Milwaukee Amateurs' Radio Club has been incorporated under the laws of the State of Wisconsin as a non-stock body, and its name changed to The Milwaukee Radio Amateurs' Club, Inc. The incorporators were L. S. Baird, C. N. Crapo, and Attorney L. J. Topolinski, the society's general counsel through whose efforts state incorporation was brought about.

Meetings are held weekly at 7:45 P. M., Thursdays, in the Trustees' Room of the Milwaukee Public Museum. The committee on meetings and papers is now arranging for a series of lectures on timely radio topics. R. E. Lathrop, 9ATX, of the club's technical committee represented Wisconsin at the Michigan State Convention held at Flint, Mich., and upon his return gave the Milwaukee club members a lengthy report.

Radio frequency amplification has been the subject of several general discussions at meetings, and a short paper entitled "Radio Frequency Intervalve Transformers" was presented by L. H. Strassman, 9AHO. Mr. Strassman, who is city manager, has reported from time to time the progress being made in ridding the air of unlicensed stations. These offenders have operated much to the discomfort of both the local radiophone listeners and the amateurs.

△ △

THE voice of 2EL is still being heard throughout the land, recent reports coming from 9KZ, Ashland, Ky.; 5ZAV, Oklahoma City; 4OI, San Juan, P. R.; Santiago de Cuba, Cuba; Garrochales, P. R.; Colon and Ancon, Canal Zone.

△ △

NOW that Major Lawrence Mott, of Avalon, where the flowers bloom all the year round, has made the call 6XAD internationally famous, he is going to try his luck with another one—a special amateur designation this time. So when the call 6ZW comes booming through in the early morning hours don't be surprised. That's the new call just assigned Major Mott's station and he will welcome reports on its reception.

△ △

EXTENSIVE tests were carried on during April between 6XAD-6ZW and amateurs in New Zealand and New South Wales. Major Mott's station was reported from New Zealand previous to the tests, and during April attempts at two-way communication between the station of Major Mott and that of C. D. Maclurcan, at Sydney were made. The result of this attempt at two-way international communication will be given in later issues of THE WIRELESS AGE.

△ △

F. C. MEYER, of 25 Oxford Street, Montclair, N. J. (2CBL), is a player on the harmonica. He gave a complete program of hamonica selections over his Paragon phone recently for the entertainment of a fellow listener, who came back on the land phone after each offering and expressed his opinion as to the good and bad points in his playing.

△ △

RADIO enthusiasts of Adams County, Pennsylvania, met recently at Gettysburg College and organized the Adams County Radio Club.

Can You Beat It?

SAM SOLOT, of Central High School, Philadelphia, has mounted a receiving set, that works, on a lead pencil.

△ △

Frank McHale, a West Philadelphia High School freshman, has a receiving set mounted on a corn cob pipe that brings in local broadcasting.

△ △

William B. Boyd, 3409 Arbor Street, Kensington, Pa., has a workable receiver mounted on a prehistoric object known as a "beer" bottle.

△ △

Radio has gone completely to the head of Alfred Pogany, 909 North St. Bernard Street, Philadelphia. He goes about wearing a derby hat with a receiving set mounted inside it.

△ △

Charles Plewinski, 412 Delmar Street, Roxborough, Pa., has built a receiver entirely within the shell of a peanut.

△ △

Charles F. Waag, Jr., 531 Callowhill Street, Philadelphia, has built a workable receiver on a cigarette holder, two inches long.

International Notes

By CHARLES BAILLY, Paris.

THE first of a series of weekly trans-Atlantic transmissions was attempted on the night of March 28th to 29th. Station WHAZ, the Rensselaer Polytechnic Institute of Troy, New York, was received in France distinctly during one hour, with code, there being no radio telephone transmission, contrary to expectations. It is not yet possible to give the list of amateurs who received this station. At present it is known that one French amateur, Mr. Sautau, was able to copy the entire transmission. He has a three-wire, 30-meter (99 ft.) antenna, and uses three tubes, one radio frequency with regeneration and two audio frequency. However, he was able to receive only during the time when the arc transmitter of the Eiffel Tower was silent, as the effect of that arc is so broad as to blot out all distant stations for listeners in the region of Paris.

△ △

MR. LABOWSKY has just notified Mr. Givelet, president of the Radio Club De France, that he has a prize of 10,000 francs, to be distributed annually in amounts of 1,000 to 1,500 francs to inventors of radio parts. The inventions must be patented and a month has been given for inventors to present them before a committee that has been named to consider their worth.

△ △

A FRENCH amateur, Louis Schroeder, who has made a special study of acoustic questions, has just devised a special coating for metal horns. This is claimed to result in a perfectly pure tone suppressing the difference in phase between the diaphragm and the horn. Mr. Schroeder's process has been patented. In a general manner it makes use of a thick varnish made of pulverized resin and cork dust of varying fineness. In applying this mixture on the metal horn, Mr. Schroeder claims that he suppresses the resonance of the metal composing it, and as a result that the vibrations of the transmitter are heard with their original intensity and tone. This composition has also been tested on a telephone diaphragm with a great improvement in the clearness of the sound.

△ △

THE Belgian section of radio amateurs has just passed a resolution that the International Congress of Amateurs, which, in accordance with precedent, was to be held at Brussels, shall meet instead at Paris. This apparently is in order to hold the Congress concurrently with the Radio Exposition which is to be opened during the celebration of the centenary of the Physical Society.

Examination for Junior Physicist

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 United States 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.

Junior Physicist: Examination on June 6th to fill vacancy in the Bureau of Standards, Washington, D. C., and elsewhere, at from $1,200 to $1,500 a year, plus the increase of $20 a month granted by Congress.

A New Radio Booklet

THE Jewell Electrical Instrument Company has just received from the printer its new radio booklet No. 14-A. Though small in size the booklet is very complete, covering thoroughly the subject of miniature indicating instruments in radio circuits, both transmitting and receiving. Copies will be supplied to anyone upon request.

Correction—Neutrodyne Receiver

The value of the neutralizing condensers in figures 8, 9, 10, 11, pages 56, 57, 58, April issue of THE WIRELESS AGE, should have been 1.5 micro-microfarads instead of 1.5 mfd. The values as given in the text of the article were correct.

STATIONS WORKED AND HEARD

Stations worked should be enclosed in brackets. All monthly lists of distant station 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 November 10th will be published in the December issue. Spark and C. W. stations should be arranged in separate groups.

3BVP, H. V. SWEENEY, West Manayunk, Pa.

4ag, 4bt, 4bx, 4cy, 4dn, 4fa, 4ft, CW and Fone, 4hw, 4ir, 4jk, 4km, 4le, 4mb, 4oi, 4ur, 4xj, 4yd, 4zc, 5abh, 5aby, 5agj, 5air, 5bm, 5dq, 5ek, 5ga, 5gj, 5jt, 5kc, 5mb, 5nv, 5nz, 5rh, 5uk, 5va, 5wb, 5xad, 5xm, 5xv, 5zaba (qra?), 5zak, 5zas, 5zav, 6zz, 7zo, 9aap, 9aau, 9aeq, 9aix, 9ajh, 9alg, 9amt, 9aps, 9apw, 9atw, 9avz, 9ayd, 9aza, 9bcf, 9bds, 9bhm, 9bhw, 9bik, 9bil, 9bri, 9brk, 9bsg, 9btl, 9bxm, 9bzo, 9cby, 9ccs, 9cdb, 9cdv, 9cfb, 9cfk, 9cfz, 9cii, 9cjc, 9cmk, 9ctv, 9cui, 9cwf, 9cyw, 9cte, 9dfb, 9dgw, 9dhr, 9dlw, 9dqu, 9dri, 9duq, 9dvl, 9dwk, 9dxm, 9dsg, 9ecr, 9ekf, 9ekx, 9ep, 9fc, 9hj, 9ii, 9lh, 9il, 9of, 9ox, 9qr, 9rc, 9ur, 9uu, 9zt.

CANADIAN—2be, 2cg, 2hg, 3bq, 3nb, 3oj, 3si, 3uz, 3xn, 3ni. QRK mi 10-watt CW? WI QSL all crds.

9ZT, D. C. WALLACE, 54 Penn Ave., N., Minneapolis, Minn. (February and March).

(1aw), 1fd, 1gv, (1hx), 1ii, 1qp, 1rd, 1ts, 1xu, 1ban, 1bes, (1bkq), 1boq, 1cdi, 1cja, 1cmk, 1cmp, 2cq, 2fp, 2kf, 2nz, (2om), 2rz, 2xl, 2xz, 2afp, 2agv, 2bmr, (2brb), 2bzv, 2cbw, 2ccd, 2ckl, 2cpa, 3ab, 3ax, 3cx, (3fp), 3fq, 3fs, 3gc, 3hg, 3hk, 3su, 3sw, 3tr, 3yo, 3zo, 3zp, 3adx, 3aln, 3apr, 3aro, 3bjc, 3bng, 3can, 4dn, 4fs, 4hw, (4km), 4aac, (5be), (5bw), (5ek), (5el), (5ho), (5jj), (5kc), (5kn), (5kw), (5mo), (5nz), (5pb), (5px), (5sk), (5uz), (5wh), (5za), (5zh), (5adb), (5aec), (5ahd), (5aib), (5xab), (5zas), (5zaba), 6cu, (6ea), 6eb, 6gf, (6if), 6ir, (6jn), 6jx, 6ka, 6mh, 6zh, 6zw, (6zz), (6aak), 6abk, 6abx, 6agj, 6anh, 6apw, 6awt, (6awx), 6beg, 6bjq, (6boe), (6bun), 6bvf, 6bvg, (6caj), 6cgw, (6xad), 7ec, (7eq), (7jw), 7lf, (7lr), 7lu, (7pf), 7wx, (7zn), 7zo, (7zu), 7zv, (7abb), 7afw, (7aiy), (8aa), (8ab), (8cf), (8cp), (8fu), (8jj), (8nv), (8pb), (8qk), (8uc), (8vy), (8wa), (8wv), (8zd), (8zn), (8adk), (8aiz), (8aio), (8atx), (8aio), (8akc), (8apt), (8apw), (8akc), (8apt), (8apw), (8asz), (8atx), (8avd), (8bbe), (8bcy), (8ben), (8bgl), (8bgq), (8bib), (8boc), (8bcb), (8bog), (8brd), (8buc), (8cap), (8cbi), (8cgj), (8cmi), (8cpd), (8cur), (8cvu), (8daa).

CANADIAN—3bq, 3co, (3de), 3gk, 3oj, (3si), (3ni), 3uc, 3xn, 3zl, (4bv), (4cn), (4co), 4dq, (4hh), 4kl, 3nb, (9a1), (9bx).

△ △

9CTV, M. N. ERVIN, 509 Central St., Peoria, Ill. (March).

1acb, 1akl, 1aok, 1atc, 1awe, 1ayz, (1ban), 1bas, (1boq), 1byn, 1bsp, 1chp, 1cmk, 1cmp, 1cni, (1cpi), 1ctl, 1gv, (1gs), (1ii), (1il), 1iv, 1kc, 1mc, 1rd, (1ts), 1vc, 1yk, 2add, (2agd), 2aja, 2anm, 2apd, 2bqb, 2bum, 2cgt, 2cpk, 2cpo, (2cvu), 2cxl, 2da, 2fp, 2nz, 2om, (2ry), 3aay, 3abw, 2adx, 3ais, 3ajd, 3ajj, (3aln), 3anq, 3aqr, (3apr), (3arp), 3ats, 3ba, 3bav, 3bgt, 3bhm, 3bji, 3bnu, 3brf, 3bs, (3btl),

3buy, 3cbm, (3cbu), 3ccu, 3em, 3fq, 3fs, 3hh, 3lf, 3iz, 3km, 3lk, 3lp, 3mo, (3od), (3oe), (3sk), (3su), (3tr), (3wf), 3yo, 3zo, 3zp, 4ao, 4ar, (4cy), 4dc, 4do, 4fa, (4hw), (4iv), 4ku, (4mb), 4mg, 4oi, 4pd, 4ya, 4xam, 4xj, 5aat, 5abh, 5abt, 5adb, 5ado, 5aec, 5aer, (5ahc), 5aib, (5ajc), 5aki, 5bm, 5di, (5ek), (5fv), (5ho), 5kc, (5ke), (5km), 5kp, 5ks, 5mb, 5ml, 5mo, 5mt, 5nk, 5ou, (5ov), 5pf, 5pv, 5px, 5rj, (5uk), (5vo), 5xad, 5xak, 5xb, 5zav, 5zh, 5zp, 6alu, 6anh, (6arb), 6avn, 6awt, 6awx, 6beg, 6bip, 6bjq, 6boe, 6bvf, 6bvg, 6cbg, 6cbn, 6cgw, 6ceb, 6cu, 6ea, 6ec, 6gf, 6iv, 6jd, 6ka, 6lu, 6mh, 6qa, 6qw, (6xad), 6yc, 6zh, 6zz, 7abb, 7aea, 7gp, 7hs, 7ln, 7sc, 7lw, 7zf, (7zn), 7zo, 7zv, 8abf, (8aje), 8alo, 8amo, (8aon), 8ayu, (8azc), (8bcy), 8beo, 8bgo, (8bog), (8bom), (8boz), (8bqa), (8brl), 8buc, (8bxt), (8bxx), (8byn), (8cei), 8cf, (8cfb), (8cgu), 8cih, (8cjc), (8ckv), 8clv, (8cpb), (8cpd), (8cpx), 8crc, 8cur, (8cwp), (8cxf), (8czn), 8dag, (8dat), (8er), (8qc), (8qe), 8qk).

CANADIAN—(2af), (3adn), 3bp, 3jj, (3ni), 3oh, 3pg, (3sx), 3xn, 4co, (4hh), 5go.

9DQI, GALE A. WADE, Manitowoc, Wis.

C. W.—1ap, 1dl, 1gp, 1ir, 1qp, 1sg, 1ts, 1uj, 1xa, 1xm, 1zr, 1aew, 1aun, 1awb, 1ban, 1beh, 1ber, 1btr, 1bum, 1cge, 1cmp, 1cnp, 1cpf, 2el, 2afe, 2afp, 2agb, 2alc, 2aqi, 2arl, 2awl, 2bod, 2bqh, 2brg, 2brs, 2bvh, 2bxp, 2cbc, 2cxl, 3ar, 3bz, 3fv, 3gb, 3hg, 3hs, 3ik, 3iw, 3jj, 3jl, 3jx, 3lp, 3me, 3mo, 3mx, 3oe, 3om, 3os, 3sk, 3xa, 3xm, 3zo, 3zz, 3ajd, 3ajj, 3alk, 3anj, 3apr, 3asp, 3auu, 3ava, 3bfu, 3bgt, 3blp, 3brl, 3bss, 3bvh, 3cbz, 3ckg, 4bc, 4bg, 4bi, 4bk, 4dc, 4eb, 4el, 4fa, 4fi, 4ir, 4oi, 4xa, 5aa, 5bm, 5bw, 5cy, 5ek, 5er, 5gb, 5gj, 5hl, 5js, 5kc, 5mq, 5ne, 5nk, 5pb, 5pf, 5pn, 5pv, 5sm, 5sp, 5sr, 5xw, 5xv, 5ye, 5zb, 5zl, 5agj, 5ahr, 5xaj, 5zaz.

Queries Answered

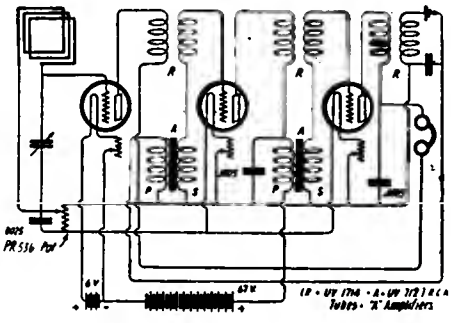
Answers will be given in this department to questions of subscribers, covering the full range of wireless subjects, but only those which relate to the technical phases of the art and which are of general interest to readers will be published here. The subscriber's name and address must be given in all 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.

Benjamin N. Swetzoff, Boston, Mass.

Q. 1. Kindly give me a hook-up of the De Forest D-7 Reflex circuit, employing three tubes.

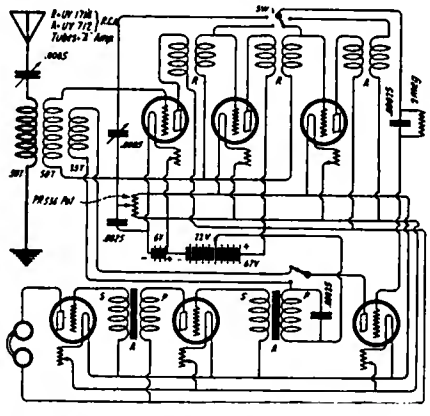
A. 1. See diagram below:



R=r. f. transformers UV-1714.
A=a. f. transformers UV-712.
All tubes=hard "A" amplifier tubes.

Q. 2. A hook-up using six tubes, three radio, detector and two audio frequency amplification with triple honeycomb mounting. This set to be wired so that any combination may be obtained such as detector or one stage radio and detector, etc. When the detector tube is used along in the above set, it is to be wired regeneratively. The combinations are to be obtained by switches. What can I use instead of jacks to plug in for the different combinations?

A. 2. See six-tube radio and audio amplifier diagram below:



R=radio frequency transformer UV-1714.
A=audio frequency transformer UV-712.
All tubes="A" amplifier tubes.

Q. 3. A hook-up using four tubes to give four stages of radio, detector, and two stages of audio-frequency amplification. Are all the tubes employed in the above circuits hard? Kindly indicate the kind of tubes employed.

A. 3. We advise against trying four stages of radio frequency amplification, since it is unstable and difficult to control.

Vernon S. Foote, Grand Rapids, Mich.

Q. 1. Is the enclosed diagram correct in every detail?

A. 1. The enclosed diagram is correct. You will, however, find it impossible to use the plate variometer at points 1, 2 and 3, although it may be of some advantage at 4.

Q. 2. Is anything shown which is not needed?

A. 2. It is unnecessary to use separate A, B and C batteries. The same batteries may be used for both radio and audio stages.

Q. 3. Is anything left out that would be advisable to include?

A. 3. Apparently you have omitted nothing.

Q. 4. Can you suggest any way to improve the hook-up?

A. 4. It may be advantageous to use a separate potentiometer to stabilize each radio frequency stage. A filament voltmeter arranged with switches so as to connect to different tubes is more serviceable than the ammeter indicated in your hook-up.

Q. 5. In which leg of the filament battery should each rheostat be?

A. 5. It is better to place the rheostats in the negative filament legs since then we have an additional negative bias applied to the grid and to the voltage drop in the rheostat.

Q. 6. Is the grid circuit of each tube completed through each transformer to the filament circuit in the proper manner?

A. 6. The grid circuits are completed to the filament in the proper manner.

Q. 7. Would you advise one or two variometers and where would you place them?

A. 7. One variometer, connected at point 4 may be of some advantage.

Q. 8. I would greatly appreciate your advice, as to the best radio and audio-frequency transformers and tubes for this particular hook-up. Also kindly state the recommended plate voltage for each tube.

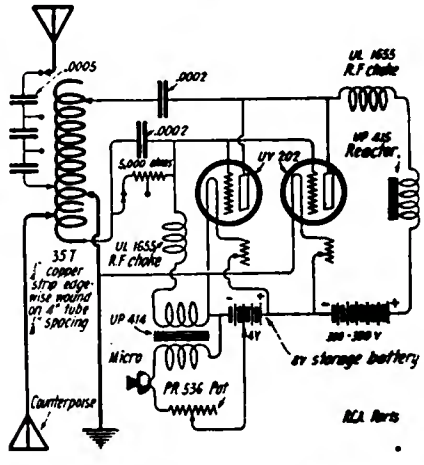
A. 8. Radio Corporation's UV-712 audio-frequency transformers and UV-1714 radio frequency transformers are designed to work with the new radiotron UV-201-A. The "A" amplifier tubes are probably the best on the market, not only as regards amplification, but also because of small filament consumption; only one-quarter of an ampere is drawn by each tube from a 6-volt storage battery. Thus a five-tube amplifier such as you describe will take only 1¼ amperes. For the radio frequency portion the plate voltage should be 66 volts. For the audio-frequency you can go up to 130 volts with a 7½ to 9 volt C battery. The detector works well at 22 volts.

* * *

Wilfred M. Pearson, Mt. Vernon, Ind.

Q. We are subscribers to THE WIRELESS AGE and we need a little help on radio transmitters. We have tried to put up an amateur radiophone station and have tried several of your hook-ups but have always failed. Please give us a diagram, using 6-volt and B batteries and 5-watt tubes.

A. Below is a hook-up for a radiophone



transmitter, using 8-volt storage battery and B batteries. UV-202 tubes will not be satisfactory unless 8-volt storage battery is used.

* * *

S. F. Smith, Danbury, Conn.

Q. Kindly advise me where I can obtain instructions for the winding of bank-wound vario-coupler sets, using four banks of winding. Also for the winding of the rotors for same, as I have a single tube loose coupler of 1500 meters. I desire to be able to get the stations that are out of my reach at present and also get the ever increasing number of broadcasters when they are allotted a higher wave.

A. The maximum wavelength of broadcasting stations as decided upon at the recent Washington conference will be 545 meters, which you should have no difficulty in receiving with present day equipment.

Book Reviews

For Amateurs and Novices Too

MOST authors when they have finished their labors lay aside their pens with pride. It may be good, it may be bad, but it is theirs, more or less. Hence the preface is short and usually says nothing. An exceptional writer is Stuart A. Ballantine, whose new book, "Radio Telephony for Amateurs," is neither a compilation nor a conglomeration, but a regulation book all written by one hand, with a magnificent preface. Ballantine did a fine job when he yielded to the universal temptation to write a volume on radio, and when it was finished he sat back and analyzed his work quite keenly. This is from the preface:

"With elementary treatments of the theory of radio communication on one hand, and with systematic engineering texts on the other, my book obviously enters into no competition. It is addressed mainly and first of all to the amateur; to the *amateur* in both the commonly accepted meaning of the word and in the true French sense of a lover, or admirer. This latter may be regarded as the legitimate amateur; a serious-minded individual with perhaps some technical propensities. My primary aim has been to include a maximum amount of practical information between its covers; secondarily to furnish an elementary theoretical web for this information, and to indicate in detail consistent with its restricted scope, the reasons for the suggestions and recommendations that have been made."

Mr. Ballantine has addressed the book to the amateur, and so popular has the volume become since it first appeared in 1922, that a second revised edition, has been required, and it is that that now is available.

Here is a book that can be thoroughly praised; in fact, it is safer to say much less than is deserved, lest the reader wax incredulous of superlatives. One way of getting around this is to say what the book is not: it is not for the beginning listener to broadcasting, who wants to learn how to make a set for $1.98. That same person, however, may turn to it gratefully after some months of wonder, experiment, and accumulation of elementary information from other volumes designed for his use.

Particularly will the novice appreciate it when he begins to ponder on setting up a transmitter of his own, for Mr. Ballantine gives the fundamental transmitting circuits, analyzes their virtues, vices and theory, and shows himself an adept at concise yet perfectly understandable explanation of the intricate happenings in radio operation.

Mathematics are conspicuous by their absence, and this is evident on practically every page. Once again, this book is primarily for the amateur; but broadcasting fans who have become fed up on elementals may get a deal of detailed information and perhaps the benefits of vicarious experience by reading Mr. Ballantine's analyses of C. W. transmitters and receivers. Such fans should be warned, however, that they run the risk of becoming amateurs, for, according to the preface, Mr. Ballantine felt the need for a book that "would at once ignite the spark of my enthusiasm and furnish the material for its combustion."

"Radio Telephony for Amateurs," by Stuart Ballantine. 296 pages, many diagrams and illustrations. Second edition, revised. Price $2 postpaid, from The Wireless Press, 326 Broadway, New York City. Dealers and the radio trade generally will be supplied by The Wireless Press.

Tells How to Make Sets

PEOPLE who prefer to assemble their own radio receivers to buying them ready for operation will be interested in Federal Bulletin No. 125-W, "How to Make Radio Receiving Apparatus." This explains the functions of the parts, and illustrates the various receivers that can be assembled from them. It is available for free distribution and is published by the Federal Tel. & Tel. Co., Buffalo, N. Y.

Patent Information

EVERY radio experimenter probably has hopes of discovering some vital new principle some time, getting a patent and thereby achieving great riches. It happens, however, that thinking up an idea is one thing and getting a patent is another. For that reason those who are contemplating knocking at the door of the patent office would do well to inform themselves as to the fundamentals of patent law. Numbers of patent attorneys have written books on this subject, one of the most recent of which is "Patents, Law and Practice." This book, or rather booklet of fifty-six pages, certainly can be consulted with profit by any one who thinks or hopes he has a patentable idea. It is not designed to make every man his own patent attorney, for it is a dangerous proceeding for anyone except experts to undertake patent matters, but it does give a most excellent explanation of patent rules, regulations and laws in general terms. It includes not only information as to the law and practice in the United States, but also in foreign countries, and gives a schedule of charges in all countries.

Patents, Law and Practice, by Richards and Geier, Patent Attorneys, 277 Broadway, New York City. 56 pages. For free distribution.