

Simple Instructions for Beginners This Issue

Radio Digest

THIS NUMBER Illustrated 50,000 COPIES

Vol. 1. No. 1

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E. C. Rayner

CHICAGO, ILL., SATURDAY, APRIL 15, 1922

PRICE TEN CENTS

RADIO TALKING MOVIES

SCIENCE TRIUMPHS IN RADIO RECORDS

NEW INVENTION RECORDS
ARTIST'S VOICE BY RADIO

B. F. Missner, Inventor of "Electric Dog," Registers High C's of Mme. Dux

B. F. Missner, of the experimental research laboratory of the Brunswick-Kollender Company, has succeeded in recording successfully Mme. Dux' dulcet high C's by radio.

"The result," said Mr. Missner, in commenting on the triumph, "is that when the record is put on for freddie consumption, those who hear it will get all the verve and go, the first high trill, which is only to be obtained by a singer's debut. Facing a great audience for her initial appearance, her rendition is naturally more inspired, than when she is merely standing in front of an unresponsive horn that gulps down her words."

The opera star, in making the record, sang on the stage of the Chicago grand opera company to the usual audience, with the exception that in the audience was a transmitter sending her voice waves, via radio, to the Brunswick-Balke-Kollender recording laboratory.

General Squires in New Patent Suit

Alleges American Telephone and Telegraph Company Infringing His "Guide Waves" Rights

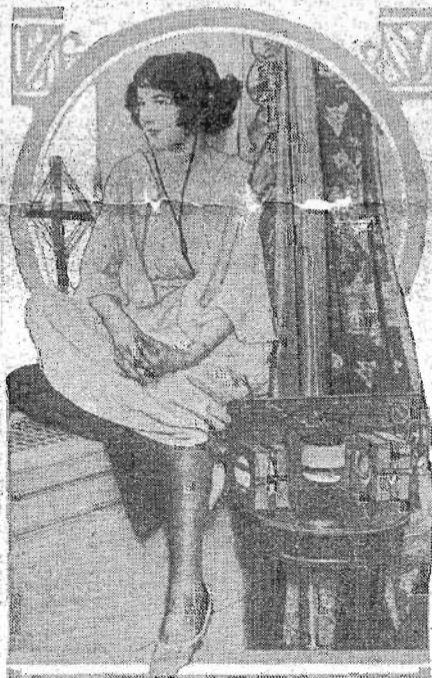
WASHINGTON.—Suit has been filed in the United States District Court for the Southern district of New York by Major General George O. Squier, Chief Signal Officer, U. S. A., against the American Telephone and Telegraph company charging the infringement of several patents he holds for radio inventions.

The patents that General Squier claims to be infringed on are those the patent office held permit radio communications to be "guided" through the air instead of being broadcasted promiscuously, and further permit the sending and receiving of several radiophone or telegraph messages over a single wire.

CHICAGO SETS RADIO SHOW WEEK, JUNE 26

ANNOUNCEMENT has been made by Milo E. Westbrooke of a Radio Show to be held in Chicago from June 26 to July 1. The show will be held in the Leiter building. In addition to manufacturers' displays there will be shown the few initial parts necessary for the beginner to put together the "Junior Radiophone." Demonstrations will be given daily on receiving and sending so the working parts will be understood.

RADIO GOOD MORNING KISS SENT THIS CHARMING MISS



Ethel Hurt, in Her Room, McAlpin Hotel, New York, Receiving Her Radio Morning Kiss from Her Sweetie in Brookline, Mass.

Thief Steals Receiving Set; Police Looking for Antenna

PEORIA, ILL.—The first theft of a radio set was reported to the local police. George Reagan, 218 Bowland Avenue, complained to the police that some one had ransacked his home and taken a radio set with batteries. Police are investigating to see whether the antenna was stolen.

MICHIGAN ALUMNAE WILL HEAR GLEE CLUB

April 29th Set as Date for "Michigan Night" Broadcasts

The University of Michigan has set April 29 for the "Michigan Night" program, which will be broadcasted to Michigan alumni. The program will last two hours and will consist of talks by President Burton, Coach Yost, Football Captain Dunn, Carl Johnson and Ernie Vick, former track stars. The varsity band, glee club, mandolin and guitar club will play.

CHICAGO MAN SUCCEEDS IN SYNCHRONIZING MOTION PICTURE AND RADIO VOICE OF WELL KNOWN ACTOR

H. J. Powers, Jr., Registers
Bacon, "Lightnin'" Still, a Moving
Pictures with Aid of 9 C T

The talking movies via radio are here. The success of the first experiments in producing Radio talking moving pictures has just been announced by the inventor, H. J. Powers, Jr., associated with the Erlanger theatrical interest in Chicago. Synchronizing the human voice with moving pictures and broadcasting this voice to a receiving station was recently demonstrated successfully in the Colonial theater with Frank Bacon, the master actor of "Lightnin'" in the stellar role.

Bacon at 9 C T

Mr. Bacon, who had previously posed for the moving picture film to be used in the demonstration, was stationed in the sending room of station 9 C T, located in the tower of the Wrigley building. A small moving picture machine and the sending apparatus of the station served as his audience. At the Colonial theater another audience waited before a receiving set with loud speaker and a projecting machine prepared to show a duplicate film of the picture shown at the Wrigley building. As a preliminary the receiving set tuned in with 9 C T and a Victrola record of Mr. Bacon's voice was heard. At exactly 5 o'clock in the afternoon a signal was given and both moving picture machines were started. Mr. Bacon's voice was heard at the same time the picture was shown on the screen at the theater.

To Synchronize with Clock

Synchronization of the voice via radio and the pictures is being developed by Mr. Powers with a simple clock work device. Substituting a synchronous motor for the motor now used in the ordinary projecting moving picture machine will eliminate the human element that entered into the first experiments and will make the registration automatic.

Pictures and Voice Register

In the film used for the experiment Mr. Bacon was shown breaking a water glass, ringing a bell, blowing a whistle, firing a revolver, etc. In the preliminary test the sound effects and the voice were heard at the same time that the pictures appeared on the screen. On repeated tests and experiments conducted during the evening the voice and sound effects registered perfectly with the film.

Talking Movies in Home

The invention of talking motion picture via Radio opens up vistas of possibilities in its use. It will be only a short time (Continued Page 2.)

Keeping Fit by Radio To Be Broadcasted

Series of Calisthenics to Bring "Gym" Into Every Home

H. J. Powers, Jr., of the Colonial Theatre, inventor of the Radio Talking Movies, is soon to conduct a series of calisthenics via Radio. He will call his new course "Keeping Fit with Radio!" By arrangements with the Kimrock Athletic Club, located in the McCormick Bldg., and a broadcasting station, these exercises will be broadcasted at intervals during the day.

BROADCAST BETWEEN ACTS

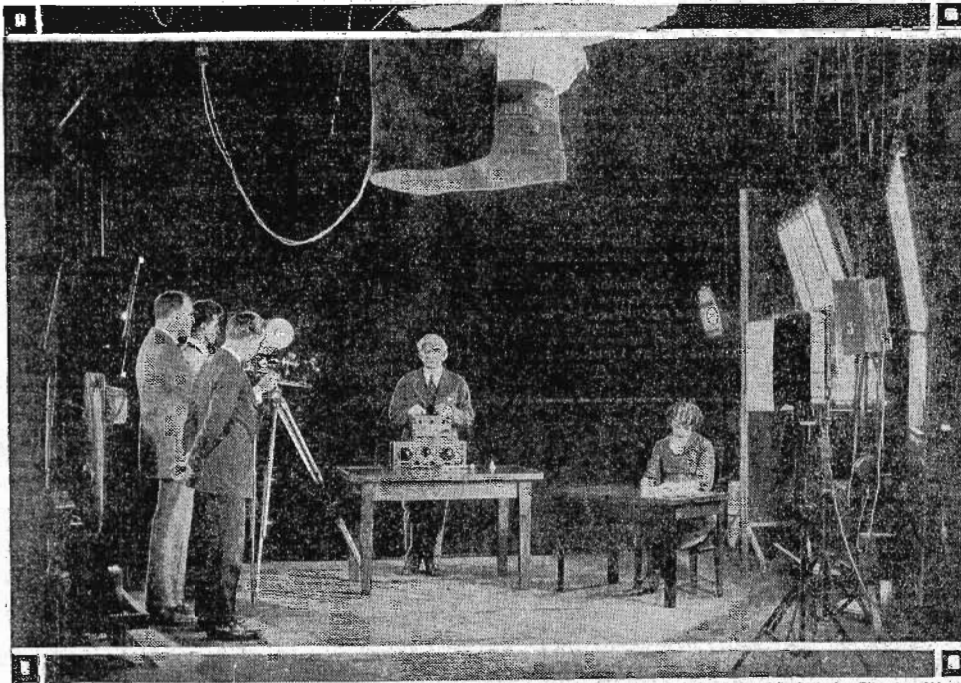
Music-Box Revue Cast Listens In on Other Shows

NEW YORK.—The cast of the "Music Box Revue" have installed a receiving set to get broadcasts between acts. As the other theatres install sending sets the cast plans to hear excerpts of the other plays they are unable to attend.

NEWARK HOLDS SHOW WEEK APRIL 13 to 16

NEWARK, N. J.—A radio show will be held at the Hotel Robert Treat here April 13 to 16, inclusive. The Newark Ledger is conducting the show and silver loving cups will be awarded to the amateurs who build and exhibit the best and most unique receiving and transmitting sets. Musical radiophone concerts and talks by men prominent in Radio development will be features of the show.

REGISTERS VOICE WITH MOVING PICTURES



Copyright Rothacker Film Co., Chicago

Beginning experiment that proved talking movies possible. Harry J. Powers (left), inventor, watched W. J. Rothacker direct Frank Bacon in short speech. The camera recorded Bacon's action and the stenographer took down his words.

TALKING MOVIES

(Page 1)

...now, care... attractions and Broadway hits can be enjoyed by the whole family while gathered around the fireside. A few twists of the knob on the receiving set after the lights have been doused and the automatic starting of the picture machine will bring the latest show right to the home. Grand opera will not only be heard but the artists will be seen, as they warble their arias in the auditorium.

Talking movies by the aid of Radio will not only bring joy to the home folks but the head of the house will enjoy them while traveling on a train or the ocean greyhounds. Even the attendance at a talking movie on an airliner is a future possibility.

Revolutionize Amusement Business
"The perfecting of the invention of Radio talking movies will revolutionize the amusement business," said Mr. Powers in commenting on his new discovery. "Any great star like Mr. Bacon will be able to reach the masses. It will not only join the speaking stage but it has great possibilities. It will enable the poor as well as the rich to see and hear the greatest actors and operatic stars at rates far below the present price of theater tickets."

Sermon of Such Power Radio Fans "Kick In"

New York Minister Surprised at Sum Received

New York.—A recent sermon sent broadcast by Rev. Ernest M. Stires made it possible to have an increased collection. Many checks were sent in by those who listening in on his excellent address, although they didn't regularly attend any church. The sum received was much more than that found in the regular collection box at the services. If this holds true, a great many churches will be able to solve their financial troubles by radiophone.

COUNTRY CLUB GETS "BUG"

Members Cleveland Club Will Receive Broadcasts

CLEVELAND.—One of the local country Clubs here is planning to install Radio sets for the receipt of broadcasts for their members. Members spending the weekends at the club will be enabled to white away the hours after a game of golf with the latest broadcasts. Late news and stock report broadcasts will especially interest the club members.

Broadcast Favorites Draw Better Than All Other Theatrical Stars

Broadcasting Gives Ballad Singer Larger Audiences Than Ever Before—Listening in Creates Desires Among Radio Fans to See Artist

Usually sales are induced by an unsatisfied desire. This seems to work out well with actors who use radiophones in preliminary work. Artists who have performed before radiophones have had many compliments paid to them by letter. Later when they played a nearby city in person there has been an increased number of admirers present. They were eager to see the artist heard at home through their receiving set.

Fans Acquainted with Stars
A ballad singer on a tour mentioned she would be pleased if her radio audiences in any of the towns on her tour would speak to her after the performance. In every theater she has played since and at every performance there have been persons who have identified themselves as part of her radio audience. They paid admissions just because she aroused their curiosity.

The psychology of all this is based on a creation of an unsatisfied desire.
Well Worth the While
The manager of a large vaudeville circuit was rather skeptical about this method of advertising. When he asked how the newspapers would feel if the news were

A BED SPRING ANTENNA

Peorian Claims Concerts via Bed Springs Keep Him Awake

PEORIA, ILL.—A local man complains that his bed springs catch the various messages broadcasted by Radio stations. He wants to know if there isn't a way to stop the noise. Radio experts say that the wires of a bed spring would make an excellent antenna. Peorians are wondering whether they will be kept awake at night listening to concerts, market reports and gossip between stations.

Form Women's Radio League

NEW YORK.—Miss Abby Putnam Morrison, daughter of David Mitchell Morrison, banker, has been elected president of the Women's Radio League of America. Many prominent New York society women have enrolled including Miss Evangeline Brewster Johnson, Mrs. Vincent Astor and Miss Alice de Lamar. During the war Miss Morrison was a first-class radio electrician in the United States navy. Recently she acted as radio inspector of apparatus on ships in New York harbor.

sent out free of charge he was told that the first feature of the daily program of the Metropolitan District of New York is an hourly summary of the news of the world with particular stress being laid on the local news, and that it has helped the papers' circulation wonderfully.

"Our Mary" Has Personal Set

San Francisco, Cal.—The grand opera manager and singer, Mary Garden, requested the hotel management of a local hotel to install a radio transmitting set for her use in broadcasting, while the opera season was on in the metropolis of the coast. It was satisfactorily arranged and now the radio fans of the coast will have the privilege of listening to her voice broadcasted from her radio station in her private hotel suite.

College to Debate by Radio

Ashland, O.—Only one debate in twenty-two years has been lost by the Ashland College. The debaters of this college have challenged Harvard, Cornell and Princeton by radio. It is intended that the contestants will remain in their own cities and deliver their speeches into the transmitters of their sending sets with the opponents and judges listening in at various points. (Use of amplifiers will permit quite a number of persons to hear the debates.)

To Broadcast College Courses

NEW YORK.—The New York University has announced the plans for the installation of a station at its Washington Square division for the broadcasting of educational courses. Classes will be conducted in all the various courses of the university and a college education at home by Radio will be a fact when the station is placed in active operation.

Listen In for Liberty Bell

PHILADELPHIA.—It is planned at the Sequicentennial Celebration to tap the Liberty Bell and the sound will be carried by broadcasting to all parts of the country. President Harding's address will also be sent out by Radio.

Good Antenna Is Lightning Rod

WASHINGTON.—The Bureau of Standards reports there is no danger of lightning with antennae if correctly installed. The antenna really act as a lightning rod and protects the building.

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Looking Ahead

Benjamin F. Miessner, authority on Radio, author of "Radio Dynamics" and inventor of the "Electric Dog," will continue his informative series, "Characteristics of Vacuum Tube Amplifiers."

Harry J. Marx will give more of his "Simple Instructions for the Beginner," and the loose leaf sheets of the symbols used in circuit diagrams.

Radiophone Broadcasting Stations will be larger and brought up to date. This feature is worth waiting for.

Famous Broadcasting Stations—the ones you hear—will be illustrated every issue.

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FIND MISSING YOUTH BY WWJ BROADCAST

Toledo Scoutmaster Gets Description Listening in on Detroit News Concert and Locates Boy

Detroit, Mich.—The Detroit News Radio Station (W W J) interrupted its concert long enough to give a description of a missing youth. The next evening after giving out the description the boy was on his way home in charge of his brother. His speedy return was due to the fact that a Toledo scoutmaster was able to put two and two together and get results.

Scoutmaster F. J. J. Lehman was listening to a concert at his sons' radio station. The concert was interrupted to make a request that all members of the News Radio family assist a Detroit mother in locating her missing boy, Alvin Pruitt. His description followed:

In a Saturday's paper, Dr. Lehman read an article about a boy at the Juvenile Home who claimed to be named Stevens and have his home with his aunt in Missouri. The aunt sent word that no boy by the name of Stevens was missing, but that her nephew Purvitt had not been seen for some time.

The similarity of names caused Dr. Lehman to call up the Matron at the home and the description of the boy there tallied exactly with that of the missing Detroit lad. Monday, Pruitt's brother took him back to Detroit.

This is believed to be the first time Radio has ever been used to locate missing persons.

INVENTOR WINS HIS CIRCUIT SUIT

United States Court Decides in Favor of Armstrong and His Valve

NEW YORK.—Edwin H. Armstrong has at last definitely established his claims as inventor of the circuit whose application in Radio broadcasting has been so prominent in the past few months. The decision of the United States District Court of Appeals in favor of Mr. Armstrong, plaintiff, as against Lee De Forest, inventor of the Audion, or three-electrode vacuum valve, will create a niche for Mr. Armstrong in the history of Radio.

It was in 1912 that he first developed his modification of the accepted three-electrode vacuum valve receiving circuit, while still a Junior student at Columbia University. From then until now a decade has passed before he has received formal recognition of his work. After the decision, he remarked that he had one more thing to put over, after which he was going abroad for a rest. What he has in mind as the "one more thing" remains a mystery.

Blame Ma's Shears in Phone Receiver Loss

PHILADELPHIA.—Many apartment owners here are reported to be suffering the loss of their telephone receivers in the lobbies of their buildings. The young Radio fans have been purloining the receivers by use of their mothers' shears. One owner is reported to have lost all his receivers in one raid.

STATE CONVENTION IOWA CITY IN APRIL

A state Radio convention will be held at Iowa City, Iowa, the latter part of April under the auspices of the Iowa University. Radio equipment houses will send apparatus to the convention showing the latest equipment. This will be the first Radio Show in Iowa. The University officials are making extensive preparations to make the Convention and Show a big success. A big attendance is expected.

ELECTRIC LIGHT IS USED FOR ANTENNA

NEW INVENTOR OF MAJOR GENERAL SQUIER

Receiving Plug Inserted After Light Bulb Removed—Transmitting Connected—Same Way

Washington, D. C.—Now comes a new invention in which the music, lectures and other sounds can be received without the usual antenna, the receiving set being connected directly to an electric lamp socket. If this proves efficient as it has on preliminary tests than there will be no congestion of radio broadcasting through the air. The tests were made and announced by the inventor, Major General Squier, the chief signal corps officer of the army.

Only recently, or within the past week, was this new discovery made and a public demonstration given at the signal corps headquarters. The whole operation of installing the device for receiving consists in removing the bulb from a lamp socket and inserting the receiving plug. The transmitting station is connected with the lighting system in the same manner.

The invention will bring to every home having a lighting system a means of hearing concerts which previously have been broadcasted through the air and received through the antenna.

One of the main features claimed for this invention is that it will relieve congestion in the air. The bone of contention at the present time.

No doubt the sending of messages by this means would be somewhat limited, but the inventor says it is possible to broadcast over great distances. Such tests have not been carried out at this time. The reported invention is very new.

LOOK TO YOUR LAURELS BOYS AND GIRLS! THIS YOUNG LADY IS A GOOD OPERATOR



Alice Daly, San Francisco, One of the Crack Amateurs of the Pacific Coast, at Her Home Station

Boy Makes His Own

Set

San Francisco, Cal.—"Naw, I would not buy one of those fixed up sets," says Vallimer Gilbert, a school boy of 16. "It's more fun to make your own. I can buy an audion now, maybe. And perhaps I'll get a sending set, but no matter how much money I had I wouldn't trade my outfit for a ready-made."

Young Gilbert knew little of his parentage until news came to him recently that a grandmother of his had died and left him her fortune of \$180,000. Now he thinks the money will spoil all of his fun. He says he is not going around buying things, as he gets more fun out of making them.

KEEP FIRE BRIGADERS AMUSED BY CONCERTS

Village Stove Replaced by Receiving Set

Yorkville, O.—For the purpose of speeding up his volunteer firefighters, Fire Chief A. T. Malasky has decided to install a receiving set in the village building. The main object is to tempt more volunteers to loaf around the municipal building, thus making them immediately available for quick action when the alarm is sounded. The chief expects the fellows to stick around listening to the concerts broadcasted from KDKA of Pittsburgh. But what will the chief do when there is no concert in the air and a fire breaks out?

FIRE BOATS GET NEW SETS

Fire Commission Finds Novel Idea Big Improvement

NEW YORK.—The fireboats are being equipped with Radio stations to enable the fire department to keep in touch with them. Fire Commissioner Drennan states that it has been almost impossible to get messages to the boats once they had responded to a call. With the new sets the fire chief will be in constant touch with them.

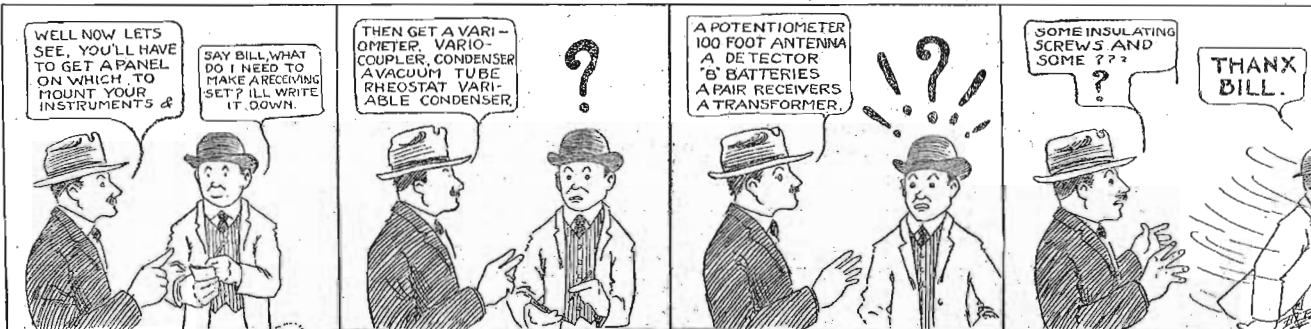
RADIO IN KEITH THEATERS

Manager Plans to Listen In on Debut of All Acts

NEW YORK.—Estimates are being furnished E. F. Albee, head of the Keith vaudeville interests to equip his residence as well as all the theaters in the Keith's circuit with Radio stations. The Radio sets will enable him to keep in constant communications with the managers of his various houses and get dope on applause of new acts.

HOW TO BEGIN—

NUFF SED!



Radio Digest

Illustrated

TRADE-MARK

E. C. RAYNER, Publisher
123 WEST MADISON STREET
TELEPHONE STATE 4844-4845
CHICAGO, ILLINOIS

New York Office 232 W. 46th Street
Detroit Office 28 Rowland Building

PUBLISHED WEEKLY

SUBSCRIPTION RATES

Yearly.....\$5.00 | Foreign.....\$6.00
Single Copies, 10 Cents

Entry as second-class matter applied for at the postoffice at Chicago, Illinois, under Act of March 3, 1879.

In a new scientific field where many writers are contributing articles there will arise some controversy over the expressions of opinions and statements made from time to time. Some of these controversies may be taken into the courts for settlement. The priority of inventions may be claimed as well as the merits of some part entering into the construction of the radio apparatus. The Radio Digest is an outlet for those expressions and the publisher disclaims any responsibility for opinions or statements made in connection with radio apparatus. The news will be printed as it comes to us.

Vol. 1 Chicago, Saturday, April 15, 1922 No. 1

Salutation

THE RADIO DIGEST, ILLUSTRATED, promises in this its first number, to do its part in disseminating the news and spreading educational information of Radio. It is born for the purpose of being a medium devoted to the best interests of the manufacturers, the retailers, the amateur and the great host of those who have recently become interested in this fascinating science. Its columns will be open for the discussion of any problem devoted to the best interests of this new, big industry. It will strive to secure the most reliable news, the best technical information obtainable from men of authority and publish the same in such form that will be truthful, entertaining and instructive.

Wave Lengths May Be Solution of Government's Action

Steps taken to protect our Radio Stations
COMMITTEE after committee has been called by the secretary of commerce to devise new codes of radio laws, especially to take into account the new situation brought about by the entrance of the radiophone. While it is desired to regulate broadcasting stations the department of commerce wishes to protect the radio amateur whose activity in these lines has been chiefly instrumental in bringing the radiophone up to its present efficiency.

Broadcasting is growing at such a tremendous rate that it seems necessary to form some laws regulating this branch of the business before it has gained too much ground. Broadcasting for personal amusement and advertisements without regard to the desires of the audience should be regulated.

In some instances the amateur has gone a little beyond his domain and he should use care to keep within the field that means so much to every user of the radiophone. Amateur phones with bad modulation, plate supply noises and illegal outputs should be discarded.

One of the most important needs of the department of commerce is a basis that will give protection for the radio amateur. This is quite an undertaking and it must be considered from every angle before any great action is taken.

The novice who purchases an outfit just to listen in on concerts or hear the market reports usually is a person who does not know how the radiophone works. He knows only how to tune in the wave length to receive the message he desires to hear. Such a person does not care to find out the inner workings of the device. He asks the price, pays for an outfit and learns only just what is necessary to hear what he most desires. He listens in and hears all kinds of disturbances, leaky power lines, amateurs and other noises, and they all annoy him because he does not know radio. He is very much of a neophyte in this crowded beginners' field. When he finds that an amateur interferes, he is naturally perplexed. This brings up the question as to who should have the right-of-way.

A great deal has been said about sharp wave lengths. These help to solve the problem. No doubt there will be a great objection to raising the broadcast wave length, but it will never be any easier to do than right at the present moment. Later it will be more difficult. If this were done there never would be conflict between the amateur and the concert listener.

Campaigning by Radiophone

The Audience and Speaker Stay at Home

IN the next presidential campaign there will be considerable change in tactics, the usual campaign funds will be eliminated, there will be no touring of candidates, the hiring of halls, auditoriums and outdoor pavilions, the candidate will stay at home and make his speeches, not from the front porch, but into his transmitting instrument of the radiophone. At certain hours of the day or evening he will make his speech, and those who care to hear him may tune up their receiving sets.

Voters by the millions may listen in and make notes, a thing that cannot be done very well by the average person. The entire campaign may be followed with precision, and the notes gathered can be used to check up later on other speeches.

There will be no need of large campaign funds. The strides that radiophony is taking will almost equip every household in the United States by 1924. The whole system will have reached such a stage that listening to a speech will require no more effort than reading the daily newspaper.

The one nice thing about this method of campaigning is that an obnoxious speaker can be tuned out. It will not be necessary to hear him, as it is now when cornered in a crowded hall.

While the main effect of a speech consists in the mannerism of the speaker, there now comes a new phase in radio speechmaking. The speaker must learn how to hold and attract his unknown audience. While it may be possible to make a radiograph to record and send the facial expression and gestures to impress the listener, yet in the meantime the voice must be the one and only thing to hold the attention of the unseen audience.

No doubt that the broadcasting of political speeches will open up a new angle to speechmaking, and a campaign can be run more systematically and the results gained in a better way.

About Radio Control

Editorial Comment from Various Sources

NO DOUBT there will be need of some control in the use of radio apparatus. The situation is expressed through newspaper editorials. The main trend of thought is to protect the amateur who has been chiefly responsible for the development of the radio telephone. Any restrictions should not put undue burdens on him. However, Congress should legislate laws to prevent undue abuse of this scientific apparatus.

"In twelve months," says the New York Times, "radio phoning has become the most popular amusement in America. The radiophone is a good deal more than a toy. Imagination cannot set bounds to its development. A 'national asset' must not be allowed to pass into uncontrolled hands."

"The world owes the amateur much," says the Detroit News, "moreover, it is the tradition of the present age, wise by hard bought experience, to welcome the assistance of inquiring minds in its search for the mysterious services nature may perform. That some form of regulation is becoming necessary no one denies. But it will not take the form of harassing the enthusiastic amateurs who are doing a marvellous utility."

"The Indianapolis News desires speedy action. 'It is important that whatever is done be done quickly,' it says, 'because the service is expanding at an astonishing rate. Broadcasting evidently will have to be controlled and a definite code established.'"

"The atmosphere is 'all in a mess,' so cluttered up and littered over with messages of all sorts and conditions," says the Columbus Dispatch, "that the proverbial din of a society reception is reduced by comparison to something approaching what we used to call a 'dead silence.'"

"The only solution," says the Rochester Herald, "seems to rest upon the fixed establishment of wave lengths, reserving the longer lengths for the sending of important government messages, etc. But it is going to be no easy task to convince the thousands of amateurs that they have not the right to use the air as they see fit."

The New York Herald also wants proper protection for users. "Radio provides so much entertainment and pleasure to so many persons, old and young," that paper says, "that its development must be encouraged in every way and one of these ways is to protect the art from abuse by ignorant persons."

Looking into the future the Champaign News Gazette says: "So far the wireless sends only sound and electric waves. Next discovery will be a way to send sight waves through the air. Then you'll look into a glass on your wireless receiver and see what's happening thousands of miles away."

"We greet with pleasure every new success," says the Brooklyn Eagle, "and the impression that radio telephony has come to say is fast becoming universal."

Declaring that the radiophone "has started a veritable craze" in this country the Wichita Beacon says this "makes it necessary for the government to invoke a power which is one of the most ancient and established but new in its application because of changing conditions."

Insisting that what is needed is a way to permit privacy in radio phone conversations the Muskegon Chronicle continues: "Inventors will find the way. Ten years ago many scientists hooted the idea of sending several phone messages over the same wire simultaneously, one couple unable to hear the other. Invention has accomplished that marvel."

"We may retain the phrase 'free as air' in which there will always be truth," says the New York Tribune. "But we must realize that use of the air for some purposes can no longer be entirely free."

The Deseret News of Salt Lake also believes that individual radio phones will be worked out. "What man can imagine he can do," it cites, and "therefore while the project may seem visionary calling it perfectly hopeless seems like taking a chance on being regarded an antique and reactionary by a generation that is to come."

With proper development of the radio phone the Lynchburg Star believes that "communities and people will be killed more closely together than ever before, and the line which separates rural and urban districts will be wiped out entirely."

RADIO INDI-GEST

Now What Do You Think of That?

Ghost Business Explained by a Scientific Gazabo

SOMEbody is always taking joy out of life, and in the radiophone waves there comes the story of the haunted house which recently filled spaces in newspapers. The Newport News gives an account of this as follows: "I was going to get me a wireless telephone and listen to the pretty music and stuff," said a local man yesterday, "but since E. J. O'Brien, that scientific gazabo, has explained the Canadian ghost business by placing the blame on wireless currents, I'm afraid to put up my aerials."

"Not for mine!" he went on. "Suppose I'd be tuned up to hear John McCormick sing 'Machushin' in Pittsburgh—if one ever really sings in Pittsburgh—and then suddenly feel a chill cold grisly hand creep up the back of my neck and tear off an ear! Hot dog! No wireless telephoning for mine, I'll say!"

There have been many peculiar happenings in Antigonish. The family who lived in this Canadian valley had to move from a certain farm house because ghosts kept insulting them, sometimes in the presence of guests. Very embarrassing to say the least. The MacDonalds farmer folk got so they were afraid to shut their eyes, fearing they would open them on the ghost of Haroun al Raschid or that of one of the unusually cruel Tartar warriors.

But its all wireless energy, says O'Brien, in a newspaper dispatch. Here are wireless currents, going from wireless station to wireless station; wireless telephone to wireless telephone. So strong are the currents that they are liable to become hectic and set a barn or a swimming hole afire.

Some local wireless telephonists are said to be alarmed; but not so with F. O. Goodwin, the city electrician. He has the wireless telephone "bug," and will cling to that particular hobby despite all ghostly manifestations.

"The O'Brien theory doesn't look good to me," he said.

He had just been telling of hearing the champion prize fight news over his wireless telephone from the ringside, when he was asked if he didn't fear an electrical ghost would set his house afire or crack him on the chin. He laughed and replied in the negative.

He didn't believe there would be any danger in wireless telephoning, if every man had a 'phone and kept it busy all the time. That would put a lot of electricity to work; but he didn't think it would cause any fires or such.

There are other things, however, to fear the worst. "Just last night I was fooling with my radio things and suddenly felt a numbness clear up my arm. At first I thought I'd been visited by those electrical haunts; but later decided I simply had received a shock."

It has been suggested that those operators who fear the juice-ghouls hang a horseshoe over their door, carry a rabbit's foot in their pocket, and keep their fingers crossed.

Radio Tympanum a New Human Ear

Floyd Hanson, of Neilsville, Wis., a barber, is the owner of an ear that is baffling scientists.

A few nights ago he heard musical tones which, in a few moments, developed into grand opera proportions. His audience laughed at the idea when he asked whether she, too, heard music. Hanson said he heard the concert for more than half an hour.

Next day he read in a Chicago paper the musical program sent by radio and at once recognized the music he had heard. Neilsville is 350 miles from Chicago.

Scientists have applied the name "radio tympanum" to the ear, which is regarded as unique anatomically.

Radio Shows There Is Nothing Secret Now

Albert E. Proffitt, of Providence, R. I., discoverer of a new link between the radio and the telephone by which he can listen in on neighbors' telephone lines, demonstrated its efficiency when he and a newspaper man heard a Pawtucket swain in a supposed secret conversation with the Providence lady of his choice, and listened to two women discussing a dress worn by a newly-wed at church.

The receiving set used by Proffitt is located in the attic of his home. A short aerial, attached to 25-foot poles on the roof, are used. The apparatus is of the four-step audio frequency amplifier circuit type, home made, with modifications.

Radio News

A dandy girl is Nelly Bates,
She doesn't kiss, she oscillates.

Kisses by Radio

Thus ran the headline of an article of recent date, when some love-sick swain tried his luck at long distance kissing from somewhere off the Newfoundland Banks. The object of his adoration lives somewhere in Brooklyn. We were just wondering if the blush accompanied the kiss, which would indicate perfect reception, or whether it sounded like some terrible interference or possibly a cow in some nearby pasture pulling its hoof out of the spring mud.

WWJ FIRST NEWSPAPER PLANT

DETROIT NEWS STATION ESTABLISHED AUGUST 1920 WITH THE DEFOREST TYPE

Many Headliners Made Debut in the News Broadcasting Station—Some Showed "Radio Fright"—Frank Tinney "Spoofed"

Significant in the development of radio broadcasting as a social service has been the remarkable reception of the daily concert and commercial reports of the Detroit News, the first newspaper in the United States to install a radio transmitting station as a part of its regular equipment.

Late in August, 1920, the News installed its first transmitting set and after ten days of concentrated experimental work announced to a wondering public that the local, state and national congressional primary elections would be broadcast by the new station.

60,000 Detroit Radio Fans

It has been estimated that today there are more than 60,000 radio sets in operation in Detroit as the result. Most of these have been installed within the past 18 months and the public interest in the progress of the domestic adaptability of the radio service in Detroit has been phenomenal.

Every week-day since its public announcement the News has delivered a varied program of music and oration to a constantly listening audience. During the recent Lenten period this program has been featured by a special half-hour each evening in which a leading prelate told thousands of the meaning of the Word.

In its edition of September 1, 1920, referring to the announcement the day previous, the News said: "The sending of the election returns by the Detroit News radio-telephone Tuesday night was fraught with romance and must go down in the history of man's conquest of the elements as a gigantic step in his progress."

"In the four hours that the apparatus, set up in an out-of-the-way corner of the

News building, was hissing and whirring its messages into space, few realized that a dream and a prediction had come true. The news of the world was being given forth through this invisible trumpet to the waiting crowds in the unseen market place."

De Forest Type Used First

The original apparatus of the News consisted of a De Forest type OT-10 transmitter. The wave length used was 200. Under perfect conditions it had a range of 100 miles. At the time there were only 300 operators in the territory then reached. Two programs of phonograph music were broadcast daily—one at 11:30 a. m. and the other at 7 p. m. Only occasionally were speakers and singers used.

Reports from Detroit suburban communities that the concerts were being successfully received occasioned awe and almost incredulous comment. When the steamer W. A. Bradley, speeding in the night across Lake St. Clair, sent a message to the Marconi station at Ecorse, Mich., thence relayed by wire, stating that the first concert actually was being wafted across the dark waters, interest was further heightened.

First Radio Dancing Party

Regarded as epochal at the time was a dancing party, supported by radio music, given in the home of C. F. Hammond, of Detroit. The service then extended itself all the way to his home in Windsor, Ontario, 1920, the results of the world's series contest between Cleveland and Brooklyn were carried instantly to waiting fans. The first returns of a national election ever broadcast were sent out the following month, when Harding defeated Cox.

Concerts appropriate to the season were broadcast at Christmas time, 1920. The number of radio amateurs was rapidly increasing and many Christmas stockings, metaphorically at least, contained radio apparatus that gave impetus to the new creation.

Attorney Sings First Song

On New Year's day, 1921, a human voice, for the first time, as far known, singing a New Year's melody of cheer, went out across uncounted miles through the invisible ether that is the medium of the wireless telephone. Louis Colombo, Detroit attorney and famous baritone, sent his resonant tones into the mouthpiece of the Detroit News radio set at midnight on New Year's Eve.

Another event that was regarded as an astounding achievement at the time was the receiving of a radio concert at a banquet held in the Detroit Masonic Temple. A three-wire antenna had been strung along the ceiling of the banquet hall.

Beginning of Theatrical Broadcasts

The original transmitter of the News set in the meantime had been found inadequate for the growing requirements and had been practically rebuilt. A two-wire antenna, 290 feet in length, then was erected. As the result reports began coming in from points remote in the south and west that the concerts were coming through quite audibly. Code messages from the U. S. Navy radio station built in Bordeaux, France, and from stations in Nauen, Germany, and Hawaii were received.

During the summer of 1921 the phonograph concerts and news bulletins occasionally were supplemented by music and recitations furnished by theatrical talent. Edmund Vance Cook, the children's poet, was the first literary man to send out his compositions across miles of space of wireless.

Eight People in Radio Department

In December, 1921, the News radio department kept two technical men and a program manager busy. The staff since has grown to eight persons. In December last the present ambitious program of the News was inaugurated. Phonograph music was relegated to an incidental place on the daily schedule and stage favorites were engaged to delight the now numerous

radio patrons with their most popular offerings. Ernest Ball, composer of popular songs; Frank Tinney, comedian; Van and Schenk, Percy Wenrich and other headliners made their radio debut in the News radio auditorium. Market quotations have found a permanent niche in the daily program.

Stage favorites, perfectly at ease behind the footlights and in the spotlight, were overawed by the ominous little receiver that carried their numbers to thousands of homes. They showed symptoms of "radio fright." The new device was as much a mystery and a source of wonder to them as to any uninitiated visitor.

Frank Tinney Thinks It Hoax

Frank Tinney was so mystified that he actually wondered if he was not being hoaxed. Only when he heard music relayed back from Windsor, Ontario, by telephone could he be convinced that a trick was not being played on him.

In commenting upon this incredulity of stage folk, the News, in a December issue, said: "The receiver is not a very appreciative instrument, at least in appearance. One can't tell from the looks of the telephone whether his number is liked or not."

"This was quite baffling to Ernie Ball. He sang one or two of his most popular numbers, heard no applause and finally looked at the telephone in a manner that registered blind rage. And then he stuck his tongue out at the instrument, which seemed to relieve his feelings a lot, for he swung immediately to another selection."

Miss Applause of Invisible Audience

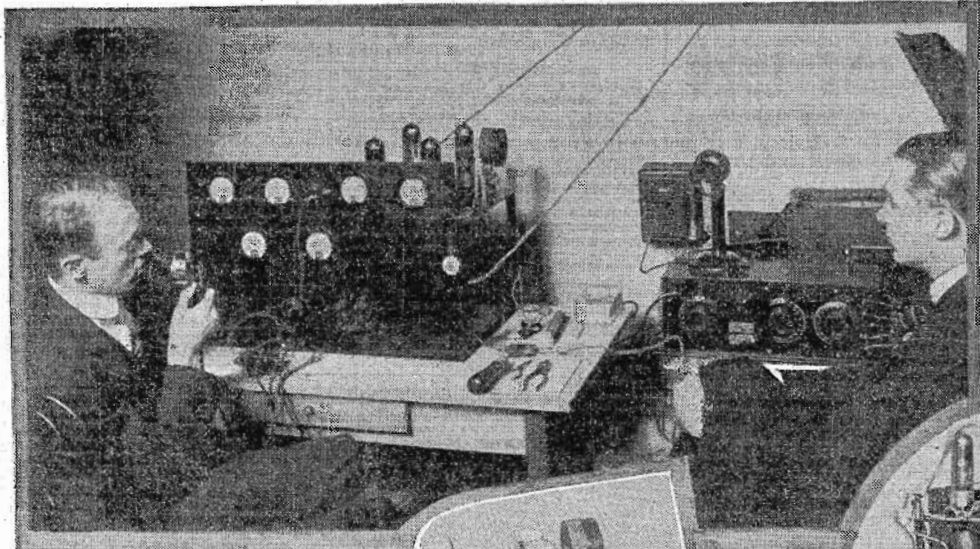
"In the case of Mr. Tinney, it was hard to convince that personage that this phenomenon was actually happening. He seemed to think someone was trying to spoof him. Again and again he demanded to know if the thing were on the square. It was that uneasy. Of all the entertainers that appeared that week, Mr. Tinney probably suffered the most because of the lack of applause. The nature of his offering was such that it was almost necessary for him to have some demonstration of how folks liked what he was saying. This demonstration, however, in all cases was not long in coming, for at the intermission of every concert some of the appreciative 'listeners' flashed back their thanks and asked for more."

(Continued on Page 6)

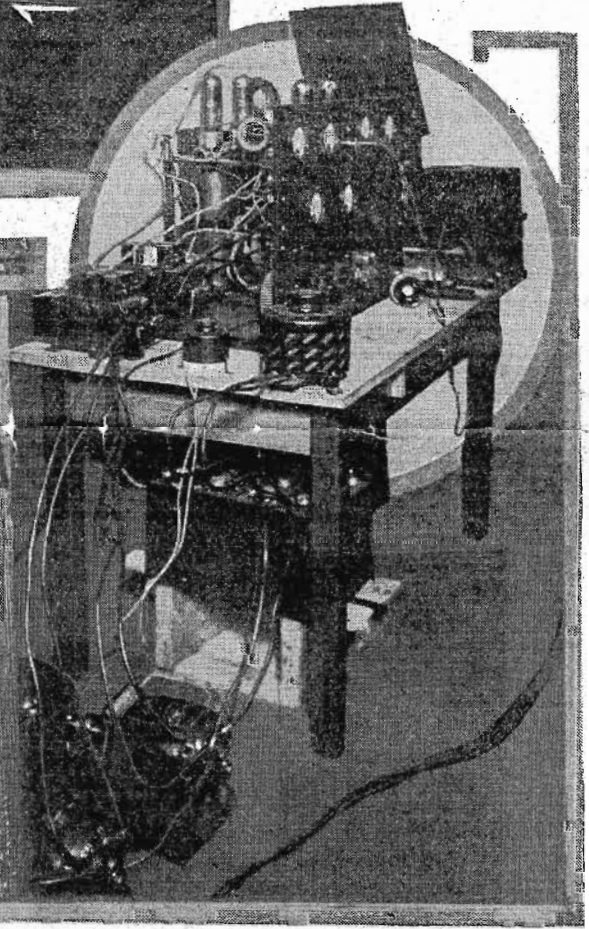
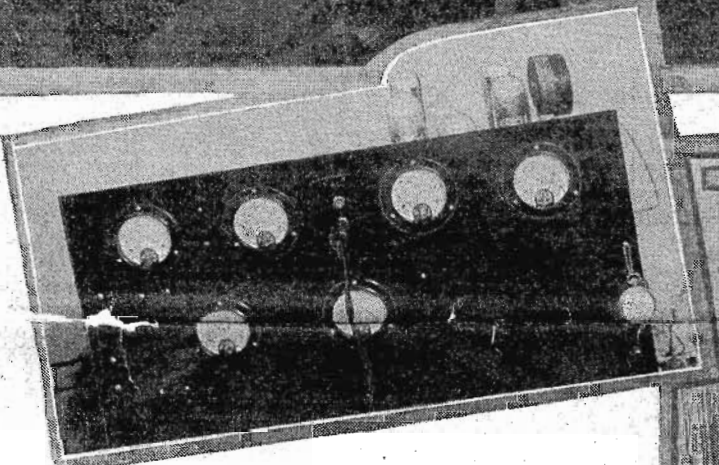


Fred A. Lathrop, Technical Director WWJ, Broadcasting Market Reports; Miss Fannie Brice and Frank Tinney (Inserts)

FAMOUS NEW 9 C T AMATEUR STATION



The transmitter (tubes shown protruding from behind panel), is of the continuous wave type, employing 4 O-T type vacuum tubes. In the lower picture, the motor-generator set, used to supply the filament current is shown. The cabinet in front of Thorne Donnelley (left of top picture), contains the receiving units. 9 C T has a remarkably clear and sharp note and can be heard for many miles around Chicago.



THORNE DONNELLEY (RIGHT) AND J. ELLIOTT JENKINS, IN THE STATION; OUTSIDE VIEW OF TOWER SHOWING AERIAL

Thorne Donnelley and J. Elliott Jenkins, Chicago's "society radio fans," have established one of the most efficient of amateur broadcasting stations in the tower of the Wrigley building. Their call number is 9 C T. The two fans recently obtained permission from the department of commerce to broadcast musical programs and other radio-telephone programs, many of which have been picked up by thousands of amateurs throughout the middle west.

Mrs. Frederick D. Countiss, who made the arrangements for Miss Anne Morgan to deliver her talk on devastated France over Jenkins' and Donnelley's station, is a frequent visitor at the station.

A notable feature of the Wrigley tower station is its drum or barrel type aerial, which Donnelley and Jenkins have found to be quite effective.

ARCTIC EXPEDITION IS RADIO EQUIPPED

Details of Trip to Be Broadcasted

New York, N. Y.—The arctic trip headed by Amundsen will leave Seattle, Washington, June 1st to travel through the northern seas far past the North Pole. This will be the first dash in history wherein the party will keep in touch with the outside world by means of a radiophone.

The expected trip will take from three to five years. The object of the trip is purely scientific in nature. They will cover two or three thousand miles through polar areas. Amundsen expects to emerge from the Arctic seas between Spitsbergen and Greenland. The ship will be equipped with an elaborate transmitting outfit and details of the trip will be broadcasted. They will also have receiving sets to keep posted on the developments at home.

To Trace Freight by Relays

NEW YORK—It is reported that a large brokerage house is anticipating the use of radio in tracing lost freight shipments between New York and points west. Chains of relay stations following the various railroads used will be organized. By relaying the numbers of the cars containing the shipments, their location at any time will be definitely established.

RADIO AUTHORITY SPEAKS

Detroit Engineers Hear Noted Speaker Last Meeting

DETROIT, MICH.—C. W. Hubbell, former city engineer of Detroit, designer of Pontiac's filtration plant, and candidate for the national presidency of the American Association of Engineers, gave an address by radiophone from Detroit March 27 receivable over local amateur radio sets. It was announced here today by N. W. Strait, secretary of the Pontiac chapter of engineers.

The address was delivered in Cass Technical High School, Detroit. Mr. Hubbell will outline the aims of the engineers' association for the benefit of the public. A. F. Parkhurst, a radio authority, also spoke.

The meeting was held under the auspices of the Detroit chapter of the American Association of Engineers.

To Nab Bootleggers by Radio

WASHINGTON.—Prohibition Commissioner Hayes announced recently radio stations will be installed along the Canadian border in Michigan to apprehend the border "bootleggers." Both telegraph and telephone will be used. Grand Rapids, Detroit, Negaunee and Gaylord will be reached from a station at Lansing.

W W J FIRST PLANT

(Continued from page 5)

Another feature of the expansion of the News program in December last was the incorporation of local orchestral music. During the Christmas program, comprised chiefly of Christmas carols, speeches by Alex J. Groesbeck, governor of Michigan, the Rt. Rev. Fr. John P. McNichols, S. J., president of the University of Detroit, and Mayor James Couzens of Detroit were broadcast.

Detroit Orchestra Breaks Into Radio

The first radio concert by the nationally-known Detroit Symphony Orchestra was broadcast February 22, 1922. The frequent concerts of this organization, now regularly broadcast by radio, have resulted in enthusiastic expressions of appreciation from people in every walk of life. Half of the United States now is the auditorium of the Detroit Symphony Orchestra, thanks to the radio.

Special Set Built to Order

On February 1, 1922, a new Western Electric transmitter, with a 500-watt input and a radius of 1,500 miles was installed by the News. Reports of successful reproduction 2,300 miles away have been received since its installation. The new set was built to the special order of the News

and is the only apparatus thus far constructed by the manufacturers.

Testimonials daily flood the radio department of the News from all corners of the globe, as to the efficiency of the new transmitting set. People have danced to Detroit radio music in Fort Pierce, Fla. Symphony concerts have been heard in Calais, Maine. Eureka, S. D., reported that its residents enjoyed Babe Ruth's remarks in the News transmitter. Contributions for the Detroit Symphony Orchestra, during a recent campaign, have come from grateful admirers in a score of states.

Among the letters of appreciation are messages from tropical Honduras, Central America, Alaska, Saskatchewan and Alberta, Canada, Cuba and from officers on Atlantic-bound vessels. Wyoming ranchmen write their thanks for the entertainment. The Detroit News radio has earned its messages into lonely places. Its radius has conclusively been proven to be infinity.

Friends Hear Over Wire 'Phones

After calling your friend over the house telephone, place the receiver of the radiophone to the transmitter of the house telephone and he can hear the concert just as well as if he had a receiving set. Recently a New England telephone company had all its subscribers doing this to listen in on the Chicago opera.

HISTORY OF RADIO STARTED IN 1885

INDUCTION USED IN QUARTER-MILE RANGE

Vacuum Tube Oscillator Invented 1919
Most Important Recent Development

Thirty-seven years of progress have made Radio telephony the exact science it is today. Starting with the use of the induction system in 1885, experiments were carried out in England which traversed the then remarkable distance of one quarter-mile. Great developments were brought about improvements until in 1905 Dr. J. A. Fleming, consulting electrical engineer and Professor of Applied Science at London College, London, England, invented the two-element (filament and plate) thermionic vacuum valve detector.

Probably the next most important development was the introduction of the third element, a grid, to Dr. Fleming's vacuum valve, by Lee DeForest, an American, in 1906. In 1912, Edwin H. Armstrong, an American and a student in Columbia University, developed the vacuum valve circuit which bears his name, and which has been responsible to a large degree for the popularity of radiophones of late.

A few of the milestones in the progress of radiophony are as follows:

- 1885—Induction system used in England. Quarter-mile range attained.
- 1894—Conduction system experimented with in England. Transmission successful over distance of one and one-half miles.
- 1897—English collieries experiment with induction system. Successful to depth of 350 feet, from surface to galleries of mine.
- 1899—Induction system develops range of eight miles in England.
- 1900—Electrostatic system of A. F. Collins proves successful. Distance traversed, two hundred feet.
- 1900—Collins' electrostatic system range increased to three miles.
- 1902—Prof. J. Rummer's radiophone covers range of twenty miles at Kiel, Germany.
- 1906—R. A. Fessenden develops high frequency alternator system with range of twenty miles.
- 1906—Telefunken arc system used in Germany. Range of twenty miles attained.
- 1907—Fessenden improves high frequency alternator and increases range to 100 miles.
- 1908—Collin-Jeance arc system used at Eiffel tower station. Thirty mile range attained.
- 1908—F. Majorana develops arc oscillation generator and liquid microphone system. Communicates successfully from Rome to Sicily, a distance of 300 miles.
- 1908—Arc transmitter of V. Poulsen successful over 150-mile range.
- 1909—Collin-Jeance arc transmitter attains 100-mile range.
- 1910—H. P. Dwyer uses arc system to transmit from San Francisco to Los Angeles, a distance of nearly 500 miles.
- 1911—350-mile range between Nauen, Germany, and Vienna, Austria, successfully traversed by radiophone.
- 1912—Rome to Tripoli, 600 miles, covered by G. Vanni, employing arc oscillation generator and liquid microphone.
- 1913—Nauen, Germany, station transmits 550 miles successfully.
- 1915—Oscillation wave transmitter covers distance between New York and California, 2,500 miles, successfully.
- 1915—Vacuum tube oscillators employed by Arlington Naval station in transmitting successfully to Honolulu, Hawaii, Naval station, a distance of 5,000 miles.
- 1918—Radiophones attain range of 100 miles between aircraft in flight and 150 miles between an aircraft in flight and a ground station.
- 1919—British Isles and Canada linked by radiophone. Vacuum tube oscillator system employed.

Newark Firm Installs 100-Mile Range Plant

L. Bamberger to Broadcast with New Station, WCR

NEWARK, N. J.—L. Bamberger & Co., of Newark, N. J., has completed the installation of a Radio station of one kilowatt power with a station range of 100 miles and a potential range of 1,000 miles. The station is in operation during the daytime on each half hour and the call letters are WCR. It will be used for sending out educational information, lectures, entertainments and news features.

U. S. Department of Commerce Gives Radio Amateurs Free Rein

American Operators Prove Valuable Asset to Government in Time of War and Emergency—Aid in Development of Art

In no other country in the world is the amateur radio operator as free from restraint as in the United States. The only restrictions placed on his activities are with regard to wave lengths and licensing. This is to prevent confusion in the air lanes.

The amateur operator is not necessarily a small boy. Many amateurs are mature men and women who possess most efficient radio stations. The term "amateur" operator as distinguished from "commercial" operator is used simply to designate operators who are in radio merely for love of the art.

The radio "novice" is one who has only a receiving set for the purpose of "listening in." Of amateurs there are more than 13,000; of novices, 600,000.

To the amateur operators is due much of the credit for the position the United States occupies in radio work. The rapidity of the practical development of long distance radio communication has been largely the result of tests and experiments conducted by amateurs in determining the efficiency or inefficiency of equipment.

Fully 90 per cent of the radio operators in the American military or naval services during the war were recruited from the ranks of amateur operators.

The amateurs have also been of valuable assistance to the Department of Commerce with its limited inspection force in helping to administer the radio laws. They

Tube Howling Stopped by Grounding Lining

Grounded Tin Foil Gives Stable Tube Action

There is one way to reduce the annoying howls and noises coming through the receiving set. Line the set with tinfoil, sticking it on with shellac. Do not use paint or glue as these are not good insulators.

If the sheet tinfoil cannot be obtained in any store it may be procured from cigarette packages to serve the same purpose. Also place aluminum sheets between the vacuum tubes and ground them the same as the tinfoil.

Theater to Employ Radio Music

DES MOINES.—Patrons of the theater operated by B. F. Elbert here will soon be treated to music broadcasts. The broadcasts will substitute the regular orchestra. A receiving set with capacity enough to listen in KYW and KDKA is under consideration.

have served as radio policemen in holding the best within proper limits and in preventing the encroachment of amateur work on commercial activities.

Aid in Emergencies.

The development of the radiophone should accelerate rather than restrict further expansion of the amateur field. When entire towns have been devastated by fire, storm or flood, the radio amateur has frequently provided the only means of communication. Service of this kind will always be needed.

Without the co-operation of amateurs it would not have been possible for the Department of Agriculture quickly to demonstrate the practicability of an agricultural news broadcast service.

DANCED TO ORCHESTRA

WWJ Transmits "Jazz" Music to New York Party

DETROIT, MICH.—The Detroit personnel of the Famous Players' moving picture organization announced a dance and radio party held one evening in the reception room of The Detroit News Building.

The party brought its own orchestra and its own receiving set and held its dance with the orchestra in person until 10:30, when the party moved from the reception room to the radiophone concert auditorium, where the orchestra played for two dance numbers danced by a similar Famous Players' party held that night in the Hotel Commodore, New York City. Over The News radiophone a greeting was sent to the New York party, which included Adolph Zuker, president of the Famous Players.

Radiophone to Amuse Boat Crews

NEW YORK.—All members of the New York tow boat exchange are being equipped with radiophones to listen in on the broadcasts. The innovation is largely for the purpose of amusing the crews while idle, although the phones will be used for commercial exchange messages.

Fudge Gives Way to Broadcasts

Chocolate fudge and bacon bats have given way to Radio concerts among the college co-eds at Knox college. Listening in for the approach of the principal will be an improvement over the old method of "grab and run."

RADIO SENDS NEWS TO COLLEGE PRESS

UNIVERSITIES TO INSTALL
CW PLANTS FOR DAILIES.

President of College Editorial Association Is Interesting Other Schools

ANN ARBOR.—To demonstrate the possibilities of the radio as a news communicator for daily publications, the editors of the Michigan Daily, the official student publication of the University of Michigan, are conducting a series of experiments by transmitting news by radio to conference colleges. Tests made during the basketball season have proved so successful that the Western Conference Editorial Association, of which Brewster P. Campbell, of Detroit, managing editor of the Daily, is president, is now preparing to distribute the service to Iowa, Minnesota, Purdue, Wisconsin and possibly Chicago.

While the system is still in an embryonic stage, Michigan and Purdue have been able to handle reports with great facility, beating the wire system for more than a year. College editors place great hopes in the future of the radio service and the engineering departments of the schools have become interested in the mechanical end of the endeavor.

Amateurs Interfere.

The scheme has not been developed without experiencing difficulties, the greatest of which was the interruption caused by amateur operators who kept the ether agitated during the early evening when news messages were sent. After that trouble was overcome by relaying news at a late hour when the air was still, there remained the problem of convincing college heads that the expenditure of sums for new radio equipment was justifiable. These and many other difficulties the students have surmounted and they are now prepared to operate a daily radio news service to all colleges in the Middle West that have proper outfits.

While the radio news system is not functioning regularly, the plan is formulated that will insure continuous operation next fall. The Michigan Daily favors the installation in all colleges of equipment capable of using the continuous wave system that will permit the operating during the busy hours of the evening without difficulty and allow the work to be completed before 10 p. m.

Survey Equipment.

In the meantime college newspaper editors have decided to make a survey of their equipment and operators so that definite plans may be adopted for the development of the Western Conference Radio News Service at the May conference of the Western Conference Editors' Association.

ANTENNA AND RADIOPHONE ON DOCTOR'S CAR



Dr. David Cotrell, Chicago Physician, at Right; at Left Jobo Kinsella, Who Installed Set. Doctor Radiophoning (Insert)

Characteristics of Vacuum Tube Amplifiers

By Benjamin F. Miessner

Editor's Note.—Mr. Miessner is undoubtedly well known to many of our readers. While still a student in Purdue University in 1913, he invented the Electric Dog, which, by means of Selenium cells and relays, would follow a light. During the war he was associated with John Hays Hammond, Jr., inventor of the radio-controlled torpedo. He is now working on research problems in acoustics and radio for the Brunswick-Balke-Connell Company, Chicago, and is author of "Radio Dynamics," published by Van Nostrand Company.

Mr. Miessner will, for the first of his series of articles, take up the study of Electrons, the theory of which must be comprehended in order to understand intelligently the operation of vacuum tube amplifiers. His series of articles will include vacuum tube characteristics, high frequency amplification, audio frequency amplification and detail tricks of operation.

INTRODUCTION

The subject of my paper, Vacuum Tube Amplifiers, is one of very great interest and importance in the art of communication. It is one branch of this art which, since its conception a dozen or so years ago, has grown with such meteoric rapidity and to such phenomenal proportions that it has left the others completely outdistanced and dimmed by comparison.

In the brief span of a few years, it has completely revolutionized radio reception; its achievements in wire telephony and in the realm of pure physics rank with the greatest of scientific works. A by-product of its development, the vacuum tube oscillator, is rapidly coming to the fore in radio transmission and promises soon to render the time honored spark system entirely obsolete. It is gradually pushing forward into the field of ares and alternators and announcements of units as powerful as the highest powers obtainable by these old systems may be expected

to be surpassed. Fully appreciate the wonderful accomplishments of the little Aladdin's lamps, which we unconsciously use every day, let us retrace our steps a few years.

Cocher Used First

When I was a boy of 15, I made a spark-coil-coherer radio outfit that would work

from the house to the wood shed, and, if you too went through that stage of radio, you will believe me when I say that I was thrilled by the wonder of it. A few years later, about 1910, when I was a Navy operator in charge of the Washington station, the best Navy and commercial equipment used electrolytic detectors or crystal rectifiers and telephones. The operating range jumped up quickly then by the replacement of insensitive relays by highly sensitive telephones.

Then came the Fleming two-electrode valve, which was always on a sensitive spot, and finally De Forest's three-electrode Audion. The insertion of that third, or grid, electrode in the two electrode valve, marks the beginning of the revolutionary process which is doing such wonderful things in radio and other fields today. Soon the operation of the three electrode began to be understood, and the possibilities of using it as a throttle or control of large power with little effort, were realized, and then came the Vacuum Tube Amplifier.

Value of Valve Appreciated

Since it consumes no appreciable power, this type of amplifier is practically a pure potential-operated device, and this is the secret of its ability to control relatively large currents when influenced by only minute changes of potential. Again, since it consumes no power, it cannot withdraw energy from the limited source to be amplified and for this reason, cannot damp out that supply energy. This is very important in receiving selectivity.

Since the controlled part, a high velocity stream of very minute particles called electrons, has no appreciable mass, there is no appreciable lag in its action. Its response to the control potential is instantaneous in the sense that a lapse of less than one hundred millionth of a second may be so considered. Its ability to oscillate at wave lengths of only a few meters, proves this conclusively.

Old Amplifiers Crude

Other amplifiers had been prepared and used previously. The telephone amplifier, a combination of receiver and transmitter with their diaphragms mechanically connected, was used, and still is used to some extent, but the vibratory parts in comparison are enormously heavy and their inability to follow the wave form of the actuating force, makes this amplifier a crude device.

Another type which I experimented with years ago is an electric generator, with field coils energized by the currents to be amplified and the armature yielding the amplified currents. But this also is crude. While the controlled member, the magnetization of the generator field, has much better characteristics than the telephone

repeater, the scheme in general also has several serious disadvantages.

Field of Amplifier Broad

The technical aspect of vacuum tube amplifiers covers a very broad field of invention, research, engineering, and operations. Entire books have been written about it. A brief paper such as this might cover one of these divisions of the subject in a general way without going into details. I might even summarize the whole field in a very superficial manner, but neither of these kinds of treatment of the subject I am afraid would be quite satisfactory, answer the questions, or clear up the doubts in your mind about your own amplifier problems. What you want chiefly, I believe, is the best general methods and circuits for particular purposes.

You want to know, I take it, what methods are available for high frequency amplification on long and short wave lengths, and the various little tricks of making them work; their various advantages, disadvantages and limitations. You are probably most interested in short wave length amplification, and want all of the information you can get on that; the features of transformer, impedance, and resistance schemes.

Perhaps you would like to hear more about amplification by super-audible beats, or a circuit for three stages of high detector and two stages of low frequency amplification with four tubes. Maybe you would like to increase selectivity by audio frequency coupling. You may not care to hear about tube characteristics, but I'm going to tell you anyway, as you may not understand their importance. These details of the general subject form the basis of my paper.

PART I

Electrons

The operation of vacuum tubes cannot be understood without an understanding of the fundamental laws of physics underlying it. These fundamental laws center around the electron theory of electricity and matter. Of course, all of you understand that the smallest unit or divisible part of matter is the molecule, and that this unit may consist of one or more atoms of one element, as in the case of an elementary substance like oxygen, or two atoms of different elements, as in the case of water, the molecule of which contains two atoms of hydrogen and one of oxygen. So far, this is the elementary physics and chemistry since Dalton's atomic theory. Another property of substances, however, has been discovered which has resulted in the formulation of the Electron Theory. This theory explains the passage of electricity between two electrodes in a vacuum by considering an electric current to be a stream of negatively charged

particles called electrons. These particles exist in all substances. The atoms of these substances are conceived to consist of further divisible units, namely a central positively charged nucleus surrounded by electrons in fixed orbits of rotation about it.

Electrons Move Constantly

The number of these electrons and the geometry of their motion is responsible for the differences in different substances, all consisting of atoms of this type. The electrons are in constant rotation irrespective of the temperature of the substance. As the temperature rises from absolute zero (273° below 0° Centigrade), the molecules begin to vibrate, and at the boiling point of a substance, vaporization occurs. In addition to the electrons held together by forces within the atom, other free electrons exist in all substances, their number increasing with the conductivity of the substance. When a good conducting substance is raised to a high temperature, some of these free electrons near the surface of the substance attain an amplitude of vibration sufficient to move them beyond the surface, and an electronic evaporation occurs, similar to molecular evaporation in fluids when the space beyond their surfaces is not saturated.

This evaporation continues until the space surrounding the heated body becomes saturated; that is, until the combined charges of the free electrons in that space produces a space charge sufficiently large to repel emerging electrons back into the heated substance. This action again is analogous to molecular saturation with evaporating fluids. If now, a positively charged body be brought near this saturated space, the negatively charged electrons will be attracted to the body.

Attain Great Velocity in Vacuum

In air at atmospheric pressure, this can occur only to a very limited extent because of the presence of gas particles with which the electrons collide. If, however, the two bodies be placed in a high vacuum, the large gas particles are removed and the electrons will be attracted to the positive electrode with a velocity depending on the difference in potential between the two. The mass of an electron is about one eighteen-hundredth that of an atom of hydrogen, which is the lightest of all atoms. Its diameter is less than one billionth of an inch ($\frac{1}{100,000,000}$ centimeters).

Its velocity may reach 30,000 miles per second in a high voltage tube.

It is now clear that an electric current can pass in only one direction through an evacuated space because only a positively charged body can attract the electrons.

Editor's Note.—The second of the series of articles by Mr. Miessner will appear in the

Inventor of Vacuum Valve Tells Its History

Grid Added in 1907

Probably no other single invention has done so much for radio as the Vacuum Valve. Its invention and development have opened multitudinous doors in the realm of applied science. And yet, it is very simple in construction.

Dr. Fleming, inventor of the filament-plate, or two element type vacuum valve, consulting electrical engineer, and professor of Electrical Engineering at the University College of London since 1884, has been in constant touch with the Radio world since its conception. In an article in the Manchester Guardian, Manchester, England, he says:

"The thermionic valve is an invention which is the keystone of the arch of modern Radio telegraphy. Without it this kind of telegraphy would have a very restricted use. With it we can telegraph from England to Australia at the rate of a hundred words or more a minute. We can speak telephonically to flying aeroplanes or airplanes 100 miles away, and miles high in the sky. We can talk across stormy oceans many hundreds of miles as easily and often better than we can speak across the city by means of a telephone exchange. In short, the thermionic valve is an invention worthy to stand in the same category of merit as the steam engine, the power loom, the sewing machine or the petrol engine. Moreover, unlike these inventions, it is extremely simple in construction.

British Radio Commission Acts

In the year 1919-20 an Imperial Radio Telegraphy Commission, appointed to consider the scheme of intercommunication between all parts of the British Empire, reported to Parliament the conclusions at which they had arrived. These were broadly as follows: (1) That the Imperial Radio stations should be established at distances of about 2,000 miles, connecting the various communities of the Empire; (2) that the wireless system employed should be that making use of the thermionic valve; (3) that the stations be planned by a Radio Commission composed of experts and that the construction of these stations should be entrusted to the

Engineering Department of the General Post Office and the corresponding Indian and Dominion authorities.

"The report of this Radio Commission has just been issued and forms interesting reading to experts in wireless telegraphy. The general reader will, however, find its technicalities unintelligible in the absence of a little explanation. The first question he will ask is: What is this thermionic valve to which the committee attaches so much importance?

What Vacuum Valve Is

"The thermionic valve consists merely of an incandescent electric lamp, comprising a glass or silica bulb which is highly exhausted of its air and contains a filament of tungsten wire which can be rendered intensely hot by an electric current passed through it. It differs, however, from an electric lamp by having the filament surrounded by two metal cylinders. The outer one is a cylinder formed of a solid plate of nickel and the inner one is either a spiral wire or a cylinder of nickel gauze or network. These two cylinders do not touch each other or the filament, and they are attached to wires which are sealed through the wall of the bulb.

Electrons Explained

"To explain the operation of this device we must remind the reader that modern research has shown that the atoms of which material substances are composed are themselves formed of still smaller atoms of electricity called electrons. An atom of matter is a very small thing. If 250,000,000 atoms of copper or gold were put in a row, like marbles, touching each other the row would only be an inch long. But an electron is still smaller. Its diameter is probably only one hundred-thousandth of that of an atom. Electrons are of two kinds, called positive and negative, and an atom is a sort of solar system in which a number of negative electrons revolve round a nucleus composed chiefly of positive electrons. In the case of metals some of these negative electrons escape easily from the atoms and probably jump about from atom to atom like bees in a

garden fitting from flower to flower. The speed with which these free electrons dart about is sixty miles per second.

Thermionic Action

"The state we call an electric current in a wire is merely the free electrons as a whole drifting in one direction or surging to and fro without ceasing their irregular motion. When a wire, say, of tungsten is made very hot some of these free electrons escape from its surface, and this is called thermionic emission. If then, a wire of cold metal which is electrified positively, the escaping electrons are attracted to it, and the movement of negative electrons from the hot wire to the cold plate, creates a thermionic current. Since, then, negative electricity can pass from a wire to a cold metal cylinder but cannot pass in the opposite direction, such a lamp, with cylinder enclosing the filaments, acts toward electricity as a valve in a pump acts toward water. It allows a flow to take place in one direction only. The writer of this article, who was the first to use in 1904 such an appliance in wireless telegraphy, called it an oscillation valve, a name subsequently changed to thermionic valve.

De Forest Adds Grid

"In 1907 an addition was made to it by an American inventor, De Forest, consisting in the interposition of a zigzag of metal wire between the filament and the metal plate of a Fleming oscillation valve. This zigzag formed the starting point for new developments by numerous inventors in England, America and France, which have finally given us the remarkable appliance called a three-electrode thermionic valve or electron valve, which cannot only detect but magnify feeble electric oscillations, and, more important still, can generate very powerful vibratory electric currents if the circuit connecting the outer cylinder to the filament contains a battery or dynamo creating a steady electric voltage, and if this circuit is properly connected to another circuit joining the perforated plate or grid with the filament.

Generate Electric Waves

"In this form it is called a transmitting valve, and we can by it generate the very powerful high frequency to and fro oscillating electric currents in an aerial wire which are necessary in radio telegraphy or telephony. These electric vibrations generate the electric waves which travel away through space from the aerial. The aerial wire, therefore, resembles a sort of lighthouse which is radiating invisible light. Transmitting valves are now made with silica or glass bulbs about the size and shape of a Rugby football. A large number can be harnessed together so as to generate enormous oscillatory currents.

"At their great Carnarvon Radio station on the side of Snowdon, Marconi's Wireless Telegraphy Company have built a valve panel containing about sixty large valves, which can put into the great aerial wires currents of three or four hundred amperes. The electric waves so generated can be detected by suitable receiving thermionic valves at all parts of the habitable earth.

Other Continuous Waves

"There are two other methods of creating the continuous electric waves now used in Radio telegraphy. One of these is by means of a high-frequency alternator, which is a complicated kind of dynamo not very different in principle from the alternators used for producing the low-frequency electric currents employed in electric lighting. Machines of this kind are installed in the great wireless stations at Long Island City at St. Assise, near Paris. Again, there is another method which makes use of an electric arc. The thermionic valve has, however, great advantages in point of first cost as against the high-frequency alternator, and it is superior to the arc generator because it gives a pure form of electric wave, less contaminated by mixture of waves of various lessened wavelengths, called higher harmonics, and has other advantages in economy of power in signalling.

HENRY FORD A RADIO FAN; GETS LICENSE

Listens to Radiophone of Atlanta Newspaper—Bitten Badly by "Bug"

Will Equip His Plant

Plans to Use Transmitter to Broadcast Program for Benefit of Employees

DETROIT, MICH.—While in a newspaper office in Atlanta, Georgia, the other day Henry Ford listened in on a radio receiving set installed in the office of that publication. "Henry" was much pleased with the working of the set and left the impression that he had become quite a radio fan.

Henry Ford has many ways of keeping in the public eye other than making flivvers, buying railroads and negotiating with the government for power dams and nitrate plants.

He now intends to install a transmitting radiophone in his Highland Park plant to supply entertainment for his employees. He will use this as a means of putting "pep" into the workmen. He recently made application through his counsel for a license to have an elaborate transmitting set installed in the factory from which music may be broadcasted by radio. He is now authorized by the government to make this installation. It will be an outfit especially adapted for sending and receiving music and entertainments. His plan is eventually to have radio sets in all of the houses of his employees.

Business by Radiogram Is Perfectly Natural

Minneapolis Dealer Uses Radio to Connect Branches

MINNEAPOLIS, MINN.—Spectacular deliveries by airplane of a year or two ago have nothing on the part that radio service is destined to play in business affairs in the near future. Such equipment is already being used with satisfactory results by the Allierburg Auto Electric Co., of Minneapolis and St. Paul, to transmit business messages between their branch offices.

This company sent what is undoubtedly one of the first radio orders received by a Cleveland manufacturer, it being forwarded through the American Radio Relay league a storage battery company a few days ago. A great many of the service stations of the company throughout the country are equipped with radio receiving outfits and quite a few with transmitting sets as well.

An order for 10 new radio batteries was sent from Minneapolis at 8 p. m. and first picked up in Cleveland about 8:30 by Station A. U. N. The operator passed it to Station S. E. B. Y., which is nearer the battery company's offices, where the message was copied and delivered. An acknowledgment of the order was radiophoned from the battery company's radio laboratory (Station C. J. S.) at 6 the next evening, through Station S. A. U. N., and thence westward by way of Toledo. The men in the order department at the company's offices say a radio order looks just like any other order on their books. They expect a great many more of the same kind before long.

RADIO TO STOP UPRISINGS

Wire Cutting Rebels in Mexico to Be Foiled

MEXICO.—President Obregon has installed a receiving set. While the set is not intended to receive very much broadcasting it has been very effective in stopping many uprisings. The first acts of the rebels is to cut all telegraph wires. They cannot do this with radio. To stop this wire cutting the government intends to install an elaborate system of radio. Every large city in the republic will have a government station according to the present plans.

BLIND MAN JIGS TO TIME OF KDKA TUNE

MONTGOMERY, ALA.—Blind Bob Taylor, who sells candy and chewing gum on the streets of Montgomery, had quite an unusual experience Tuesday night at the radio station of the Montgomery Light and Water Power Company. He was permitted to "listen in" and during the period he was listening a lively musical air was played in Pittsburgh which he heard distinctly during the time he danced a lively jig.

SEAMAN OWES LIFE TO RADIO'S REMEDY

A SEAMAN on a freighter off the coast of Florida needed medical attention but there was no doctor aboard. The radio was brought into action and the call was taken up by a surgeon in the Hudson hospital. A description of the symptoms was sent by radio and a simple remedy was received in return. The return radiogram the next day said that the patient had a temperature of over 100 but had returned to normal.

KING OF "FLIVVERS" LISTENS IN



Henry Ford is shown in the foreground listening in on the radiophone of an Atlanta, Georgia, newspaper. He was pleased at the performance of the apparatus and proclaimed himself an ardent radio "bug"

EQUIPMENT IS BIG FACTOR IN RANGE

"How Far Can I Hear?" Only Answerable by Knowledge of Station

One of the first questions asked by the novice when he is looking over outfits for the purpose of making a purchase is, "How great a distance can this radio music be heard?" This question is one that cannot be very well answered.

Radio can be compared to the effect one obtains while standing at the shore of a pond that is still and tossing a stone into the water. A circle of waves will start about the place where the stone dropped. If the pond is large enough there will be no waves perceptible at the edge. However, one could not pick out a single spot and say, "On this side the waves are visible and on the other side they are invisible. Therefore, there are none on this side."

This is much the same as in the situation of a receiving set, but with this important difference: The distance that a receiving set will receive audibly will depend on the receiving set. A concert may be quite audible on one set and on another may not be heard at all.

A part of this difference may be due to different hookups, the degree of amplification employed and the sensitivity of the phones. A great deal of difference may be found in the batteries employed in supplying current to the set. Owing to the importance of the batteries there is one type especially made for the purpose and an automobile battery cannot be used with the best of results.

SET YOUR WATCH BY TIME SIGNALS

NAA, Arlington, Sends Time Signals Daily on 2,650 Meter Wave Length

The naval radio station at Arlington (N. A. A.) broadcasts radio signals so that you can set your watch. The signals are flashed on a wave length of 2,650 meters, commencing at 11:55 a. m. and 9:55 p. m. (Eastern Standard) every day. The final signals at 12 noon and 10 p. m. are for the meridian 75 degrees west of Greenwich. Every tick of the standard clock in the naval observatory is transmitted by a dot. The twenty-ninth second of each minute is omitted as also are the last five seconds of the first four minutes and the last ten seconds of the last minute.

Thus, beginning at 11:55 a. m. and 9:55 p. m. the following procedure: 29 dots, one blank, 25 dots, five blanks, 29 dots, one blank, 25 dots, five blanks, and so on through the first four minutes. In the fifth minute 29 dots, one blank, 20 dots, ten blanks, and then the final dash denoting the hour.

HOME NEVER LIKE THIS

Penitentiary Installs Station to Amuse Prisoners

JACKSON, MICH.—The prisoners at the Michigan state penitentiary are being amused by radiophones both at work and play. Recently a receiving set was installed at the prison and the 1700 prisoners listened in on the broadcasts. Two other sets will be provided for the prisoners while they are working in the clay pit and on the prison farm.

CONTINUOUS WAVE PROVES EFFICIENT

SPARK TRANSMITTERS NOT FAVORED NOW

Difference Between Two Methods Easily Understood—Radiophones Use Continuous Wave

The general efficiency, range, selectivity and simplicity of the continuous wave or CW transmitting circuits has given great impetus to Radio telegraphy. Its low cost as compared with the old style spark transmitter is another factor in its popularity. With only fifty watts input, messages have been successfully sent across the Atlantic Ocean.

The difference between the continuous wave and the diminishing or damped wave transmission is comparatively simple and easily understood. In CW transmission, a wave of constant amplitude, or with each peak as high as its predecessor, is generated. The wave is perfectly uniform and travels through space without change, its maximum range of travel being dependent upon the initial power at the source, or point of generation.

The damped or discontinuous wave, generated by a spark transmitter, might be likened to the action of a pendulum without a source of power to keep it swinging. The amount of time between the pendulum's beats is the same each time, but the space covered by the swing diminishes with each swing. In other words, the peak of the discontinuous wave diminishes in height each beat, while the CW peaks, like the amounts of space covered by the pendulum in a clock that is running, are ever the same height.

Generation of CW

Although there are several distinct methods of generating a continuous wave, the vacuum tube oscillator is probably the most satisfactory. In this method, the electrode vacuum tube is used. It will be noticed by users of this type of tube for receiving, that oftentimes when the filament current (controlled by the rheostat) is increased to a certain point, a hissing or singing noise will be heard in the telephone receivers. At this point the phenomenon is known as self-oscillation of the vacuum tube.

In the vacuum tube oscillator, the design of the tube and the circuit used are particularly for the purpose of aiding this self-oscillation or generation of CW. The wave is impressed on the antenna of the transmitting station, from which its radiations are picked up by the antenna of the receiving station.

Selectivity of CW

The CW is extremely selective, or in other words, its wave length is very sharp or constant. This means that a receiving station must be adjusted to the identical wave length of the CW transmitting station if the signals of the latter are to be heard. On account of this selectivity of CW transmitters, there is very little interference when two CW stations are transmitting at the same time with wave lengths but a few meters apart.

Inasmuch as all the power transmitted by a CW station is impressed on one sharp wave which is not damped, but continuous, there is great economy of power. The average CW transmitter, compared to the average spark transmitter having the same power input, will have an operating range of over five times that of the latter.

ICW Is Explained

Interrupted continuous wave (or ICW) transmission is also possible with the vacuum tube oscillator. Indeed, to employ a CW set for eode Radio telegraphy, the ICW is necessary in order to create an audible tone in the telephones at the receiving station. The ICW is obtained by use of some mechanically operated interrupters, such as a commutator, which "chop" the continuous wave up into "pieces" of uniform length and of such number per minute, that they are within the limitations of pitch of the human ear. Ordinarily, CW oscillations occur over 10,000 times in a second, a pitch greatly beyond the maximum pitch audible to the human ear.

Radiophone transmitting stations are really CW generators which send out an ICW when sound waves hit the diaphragm of the phone transmitter. The sound waves modulate the wave form and so cause interrupted continuous waves, upon which have been impressed the forms of the sound waves generated by the sounds at the transmitting station, be they the result of voice, music, or common everyday racket.

Choirless Church Has Radio Choir

The congregation of a certain church hears the choir sing by radiophone. The members of the congregation assemble on a week day evening in the church and the choir gathers at a local music store. By means of the broadcasting station and a receiving set installed in the church, including an amplifier, the congregation hears the voices of the choir in its accustomed place in the church.

Radiophone Broadcasting Stations

*Corrected to April 10, 1922. This List
Will Be Corrected Weekly. Form
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Explanatory.—In the following tabulation, RADIO DIGEST will attempt each week to make it easy for the reader to hear all the broadcasting stations in his vicinity. Hence the alphabetical classification, by states and then by cities, is used. Stations whose schedules of operating hours are known (those having C, N, R, etc., under "Program" in the following tabulation), are listed at the end of the table, alphabetically by call letters, under the head "Station Schedules." Having picked a station, use the "Station Schedule" list to learn its operating hours and what you will hear during the various hours. The following abbreviations are used in the "Program" column of the tabulation: A—agricultural bulletins, etc.; C—concerts; E—educational; F—fire; H—health reports; I—instruction (radio); L—lectures or speeches; M—market reports; N—news; P—police; R—religious; T—time signals; V—vaudeville or entertainment; W—weather reports. An asterisk (*) designates code telegraphy.

State and City	Call	Wave Lengths	Miles Range	Program	By Whom Operated
Alabama:					
Montgomery	WGH	360; 485	.....	
Arkansas:				W; R; E; A; M; C.	Montgomery Light & Water Power Co.
Pine Bluff.....	WOK	360	.....	
California:					
Berkeley .....	.....	360	.....	Not known.	The Pine Bluff Co.
Gridley	KFU	360	.....	C.	Maxwell Electric Co.
Hollywood	KGC	360	.....	C.	The Precision Shop
Los Altos.....	KLP	360	.....	C.	Electric Lighting & Supply Co.
Los Angeles.....	KJS	360	.....	C; N.	Colin B. Kennedy Co.
Los Angeles.....	KOG	360	.....	Not known.	Bible Institute of Los Angeles, Inc.
Los Angeles.....	KOL	360	.....	Not known.	Western Radio Electric Co.
Los Angeles.....	KYJ	360	1,000	Not known.	Arno A. Kluge.
Los Angeles.....	KZC	360	.....	C; M; W; N.	Leo J. Meyberg Co.
Monterey	DDV	360	.....	N; C.	Western Radio Electric Co.
Oakland	KLS	360	.....	Not known.	Noble Electric Works.
Oakland	KZM	360	.....	C.	Warner Bros. (also operate 6XAM).
Oakland	KZY	360	.....	N. C.	Hotel Oakland (Preston D. Allen).
Pasadena	KLB	360	.....	C; R; N.	Atlantic-Pacific Radio Supplies Co.
Pomona	KGF	360	.....	Not known.	J. J. Dunn & Co.
Sacramento	KVQ	360	.....	Not known.	Pomona Fixture & Wiring Co.
San Francisco.....	AGI	360	.....	C; N.	J. C. Hobrecht (Sacramento Bee).
San Francisco.....	KDN	360	.....	C; I.	Signal Corps, Presidio.
San Francisco.....	KGB	360	.....	C; M; N; W.	Leo J. Meyberg Co.
San Francisco.....	KUO	360	.....	Not known.	Edwin C. Lorden.
San Francisco.....	KYU	360	.....	Not known.	The Examiner Printing Co.
San Francisco.....	.....	360	.....	Not known.	The Radio-Telephone Shop
San Jose.....	KOW	360	.....	C.	The Emporium.
Stockton	KJO	360	.....	C.	Chas. D. Herrold.
Stockton	KWG	360	.....	C.	C. O. Gould.
Sunnyvale	KJJ	360	.....	N; M; C.	Portable Wireless Telephone Co.
Colorado:					
Denver	KIZ	360; 485	1,000	C.	Reynolds Radio Co. (also operate 9ZAF).
Denver .....	.....	360	.....	T; W; N.	Fitzsimmons Hospital.
Denver .....	.....	360	.....		Y. M. C. A.
Connecticut:					
Hartford	WQB	425	900	C.	C. D. Tuska Co.
New Haven	WCJ	360	.....	Not known.	A. C. Gilbert Co.
D. of C.:					
Washington	WDM	360	.....	R; L; C.	Church of the Covenant.
Washington	WDW	360	.....	Not known.	Radio Construction & Electric Co.
Washington	WJH	360	.....	I; V; C; H.	White & Boyer.
Washington	WWX	1160; 1980*	.....	W; M.	Post Office Department.
Washington	3YN	360	.....	I.	National Radio Institute.
Georgia:					
Atlanta	4CD	200-375	.....	N; C; L.	Carter Electric Co.
Illinois:					
Chicago	KYW	360	1,000	C; L; N; M; R.	Westinghouse Electric & Mfg. Co.
Chicago	WBU	360	.....	P; F.	City of Chicago.
Rock Island	WOC	360; 485	.....	Not known.	Karlowa Radio Co.
Indiana:					
Indianapolis	WLK	360	.....	C; V; N; L.	Hamilton Mfg. Co.
Indianapolis	WOH	360	.....	Not known.	Hatfield Electric Co.
Richmond	WOZ	360; 485	.....	Not known.	Palladium Printing Co.
Iowa:					
Des Moines	WGF	360	.....	Not known.	Register-Tribune.
Iowa City	9YA	360	.....	M; N.	University of Iowa.
Kentucky:					
Louisville	9ARU	200	.....	N.	Darrell A. Downard.
Massachusetts:					
Medford Hillside	WGI	360	1,000	N; C; L; I; H; R; M.	Am. Radio & Research Corp.
Springfield	WBZ	360	.....	C; N; L; R.	Westinghouse Electric & Mfg. Co.
Michigan:					
Detroit	WWJ	360; 485	1,000	C; V; N; M.	The Detroit News. (Was WBL.)
East Lansing	WHW	485	.....	M.	Stuart W. Seelye.
Minnesota:					
Minneapolis	WLB	360; 485	.....	W; M; C; N.	University of Minnesota.
Missouri:					
Jefferson City	WOS	485	.....	M.	Missouri State Marketing Bureau.
Kansas City	WOQ	360; 485	500	M; W; C; L.	Western Radio Co. (Also operate 9XAB.)
Nebraska:					
Lincoln	9YY	360	300	C; N.	University of Nebraska.
Omaha	WOU	360; 485	.....	Not known.	Metropolitan Utilities District.
Omaha	WOV	360	.....	Not known.	R. B. Howell.

State and City	Call	Wave Lengths	Miles Range	Program	By Whom Operated
New Jersey:					
Jersey City	WNO	360	500	C; N; L.	Jersey Journal.
Jersey City	2AI	200		Not known.	Jersey Review.
Newark	WCR	360		Not known.	L. Bamberger & Co.
Newark	WJZ	360	2,000	N; L; C; W; A; R.	Westinghouse Electric & Mfg. Co.
New Mexico:					
Roswell		360		Not known.	Roswell Gas & Electric Co.
New York:					
New York	WDT	360		Not known.	Ship Owners' Radio Service.
New York	WJX	360		Not known.	De Forest Radio Telephone & Telegraph Co.
New York	WYCB	1,450		N; C.	Amateur Radio Reserve.
Rochester	WHQ	485		Not known.	Rochester Times-Union.
Schenectady	WGY	360		Not known.	General Electric Co.
Schenectady	WRL	360		Not known.	Union College.
Ohio:					
Akron	SUX	200	200	C.	Radioart Store.
Cincinnati	WLW	360		Not known.	Crosley Mfg. Co.
Cincinnati	WMH	360; 485	300	C; N; L; W; V.	Precision Equipment Co. (Also 8XB.)
Cleveland	WHK	360	60	C.	Warren R. Cox. (Also 8 ACS.)
Columbus	8BYV	200		C; N.	Electrical Specialty Co.
Columbus	8YO	275		T; M; L; N.	Ohio State University.
Dayton	WFO	360; 485		Not known.	Rike-Kumler Co.
Dayton	WA-1	360		Not known.	U. S. Army.
Fairfield	WL-2	360		Not known.	U. S. Army.
Hamilton	WRK	360		Not known.	Doron Bros. Electrical Co.
Toledo	WHU	360		Not known.	Wm. B. Duck Co.
Toledo	WJK	360		Not known.	Service Radio Equipment Co.
Toledo	WSZ	360; 485		Not known.	Marshall-Gerken Co.
Oregon:					
Portland		360		Not known.	Hallock & Watkins.
Portland		360		Not known.	Northwestern Radio Mfg. Co.
Portland		360		Not known.	Ship Owners' Radio Service.
Pennsylvania:					
Johnstown		360		Not known.	Hack's Electrical Store.
Philadelphia	WGL	360		Not known.	Thos. F. J. Howlett.
Pittsburgh	KDKA	360	2,000	N; C; L; R; V; T; M.	Westinghouse Electric & Mfg. Co.
Pittsburgh	KOV	360	750	C.	Doubleday-Hill Electric Co.
Pittsburgh	WRB	360	200	Not known.	Newspaper Printing Co.
Rhode Island:					
Westerly		360		C; L.	Whitall Electric Co.
Texas:					
Dallas	WRR	450		N; W; C; R.	Police & Fire Signal Department.
Dallas		360		Not known.	Radio Equipment Co.
Washington:					
Seattle	KFC	360		N; C; V; H.	Northern Radio & Electric Co.
Seattle	KHQ	360		Not known.	Louis Wasmer.
Seattle	KJR	360		Not known.	Vincent I. Kraft.
Wisconsin:					
Madison	WHA	360; 485; 800	500	W; C; N; M.	University of Wisconsin.
Canada:					
Montreal		1,200	200	C; N; L.	Marconi Telegraph Co. of Canada, Ltd.
Toronto		450		Not known.	Canadian Independent Telephone Co.
Toronto		1,200		Not known.	Marconi Telegraph Co. of Canada, Ltd.

Station Schedule

A G I, San Francisco, Calif.
 Mondays, 7:00-9:00 P. M., concert and instruction in radio.

K D K A, Pittsburgh, Pa.
 Daily except Sundays, 10:00-10:15 A. M., 12:30-1:00 P. M., 2:00-2:20 P. M., 4:00-4:20 P. M., music; 7:30 P. M., bedtime stories; 7:45 news; 8:00 P. M., vaudeville and features; 8:30-9:30, music. Saturdays, 3:00-4:00 P. M., concert. Sundays, 10:45 A. M., 3:00 P. M., and 7:30 P. M., church service.

K D N, San Francisco, Calif.
 Daily except Sundays, 1:30-5:30 P. M., markets, news and concert; 7:10-7:30 P. M., financial news and weather. Mondays, 8:30-9:30 P. M., concert; Thursdays, 7:30-8:30 P. M., concert; Saturdays and Sundays, 8:15-9:00 P. M., concert.

K P C, Seattle, Wash.
 Every evening, news, music and entertainment.

K F U, Gridley, Calif.
 Mondays and Thursdays, 8:00-9:00 P. M., concert. Sundays, 3:00-4:00 P. M., concert.

K G C, Hollywood, Calif.
 Mondays and Fridays, 7:30-8:30 P. M., concert.

K I Z, Denver, Colo.
 Daily, 8:30 A. M., weather; 7:30 P. M., news; 9:00 P. M., weather. Sundays, 8:00-10:00 P. M., concert.

K J J, Sunnyvale, Calif.
 Tuesdays, 8:15-9:00 P. M., concert. Fridays, 7:30-8:15 P. M., concert.

K J O, Stockton, Calif.
 Wednesdays, 7:00-8:00 P. M., concert.

K L P, Los Altos, Calif.
 Mondays, 7:30-8:30 P. M., industrial news and concert. Thursdays, 8:30-9:00 P. M., concert. Sundays, 4:00-5:00 P. M., concert.

K L S, Oakland, Calif.
 Tuesdays, Fridays and Sundays, 12:15-1:00 P. M., concert. Saturdays, 7:30-8:15 P. M., concert.

Your Directory—

TO AID the beginner and to help him realize full benefits from his receiving station, RADIO DIGEST has compiled the foregoing list of radiophone broadcasting stations. To use the "radiophone directory" to its maximum advantage, the reader should note the broadcasting stations nearest, and attempt to tune them in at the wave lengths given.

Broadcasting stations with regular schedules of operating hours, are given below. Doubtless many such stations have been omitted inasmuch as their schedules have not been reported to RADIO DIGEST. These will be added as reported. The kind of program broadcast by a station during its various operating hours is also given.

In fact, the reader, by means of RADIO DIGEST'S radiophone directory, can pick out his favorite program, the station he desires, or the time which he prefers to listen in. Time, in the following list of stations having schedules, is always given in the time used at the city at which the station is located, as for example: "KYW, Chicago, Illinois," indicates that the schedule of KYW is given in Central Standard time, the time which is in use in Chicago.

The stations are listed alphabetically by call letters. The list, therefore, acts as an index to the foregoing table.

K Q V, Pittsburgh, Pa.
 Daily except Saturdays and Sundays, 4:30-5:00 P. M., concert. Mondays, Wednesdays and Fridays, 9:30-10:30 P. M., concert. Sundays, 1:00-1:30 P. M. and 4:00-5:00 P. M., concert.

K Q V, Pittsburgh, Pa.
K Q W, San Jose, Calif.
 Wednesdays, 7:30-8:15 P. M., concert. Sundays, 5:00-6:00 P. M., concert.

K V Q, Sacramento, Calif.
 Daily except Sundays, 5:30-6:30 P. M., concert and news. Wednesdays and Saturdays, 8:00-9:00 P. M., concert.

K W G, Stockton, Calif.
 Daily except Sundays, 4:00-5:00 P. M., news and markets. Tuesdays and Fridays, 8:00-9:00 P. M., concert. Sundays, 2:00-3:00 P. M., concert.

K Y J, Los Angeles, Calif.
 Daily except Sundays, 4:00-5:00 P. M., concert, markets, news and weather. Mondays, Thursdays and Saturdays, 3:00-9:00 P. M., same program.

K Y W, Chicago, Ill.
 Daily except Sundays, 9:30 A. M., 10:00 A. M., 10:30 A. M., 11:00 A. M., 11:30 A. M., 12:00 M. and 2:45 P. M., stock quotations and markets; 3:15 P. M., 4:15 P. M. and 9:00 P. M., news and markets; 7:00 P. M., stock report summary; 7:30 P. M., children's hour; 8:00-9:00 P. M., concert; 9:00 P. M., news. Sundays, 3:30 P. M., church service.

K Z C, Los Angeles, Calif.
 Daily except Sundays, 5:00-5:30 P. M., news and on Tuesdays, Wednesdays and Fridays, same hour, concert.

K Z M, Oakland, Calif.
 Daily except Sundays, 7:15-7:30 P. M., news. Tuesdays, 7:30-8:15 P. M., concert. Fridays, 8:15-9:00 P. M., concert.

K Z Y, Oakland, Calif.
 Daily except Sundays, 3:30-4:30 P. M., concert; 6:45-7:00 P. M., news; Wednesdays, 7:30-8:15 P. M., concert. Saturdays, 8:15-9:00 P. M., concert. Sundays, 11:00 A. M. to 12:15 P. M., church service; 3:00-4:00 P. M., concert.

(See page 12, column one)

STATION SCHEDULE

(Continued from page 11)

- W B Z, Springfield, Mass.**
Daily except Sundays, 8:00 P. M., concert news, lecture. Sundays, 3:00 P. M., concert; 7:00 P. M., church service.
- W D M, Washington, D. C.**
Sundays, 12:30 P. M., church service; 3:00 P. M., lecture; 7:30 P. M., church service.
- W G H, Montgomery, Ala.**
Daily, 11:05 A. M. and 5:05 P. M., weather. Tuesdays, Thursdays and Saturdays, 8:30-9:30 P. M., educational, agricultural, stock quotations and concert. Sundays, 8:30-9:30 P. M., religious program.
- W G I, Medford Hillside, Mass.**
Mondays, 8:15 P. M., news. Tuesdays and Thursdays, 8:15 P. M., children's hour. Wednesdays, 8:15 P. M., concert. Fridays, 8:00 P. M., radio instruction. Saturdays, news.
- W H A, Madison, Wis.**
Daily except Sundays, 12:35 P. M., weather; 2:30 P. M., markets; 12:00-1:00 A. M., university news (code). Mondays, 9:00-11:30 P. M., university news (code). Tuesdays and Thursdays, 10:00-12:00 P. M., amateur communication (code). Fridays, 7:30 P. M., concert; 8:15 P. M., concert; 9:00-12:00 P. M., amateur communication (code).
- W H K, Cleveland, O.**
Thursdays and Sundays, 7:30-8:00 P. M., concert.
- W J H, Washington, D. C.**
Tuesdays, 7:30-8:30 P. M., radio instruction and vaudeville. Wednesdays, 9:00 P. M., concert and radio instruction. Fridays, 8:30 P. M., concert; 9:00-12:00 P. M., health lecture.
- W J Z, Newark, N. J.**
Daily except Sundays, hourly from 11:00 A. M. to 6:00 P. M., music; 11:00 A. M., 12:00 A. M., 5:00 P. M. and 10:00 P. M., weather; 2:05 P. M. (except Saturdays), shipping news; 12:00 A. M. and 3:00 P. M., agricultural; 8:52 P. M., Arlington time signals. Tuesdays, 7:00 P. M., children's hour; 8:20-10:00 P. M., concert. Thursdays and Saturdays, 8:20-10:00 P. M., concert. Sundays, 8:00 P. M., church service; 8:20-10:00 P. M., concert.
- W L B, Minneapolis, Minn.**
Daily, 12:00 M., weather and stock quotations; 7:30 P. M., markets. Wednesdays, 8:00 P. M., concert.
- W L K, Indianapolis, Ind.**
Tuesdays, 8:00-8:55 P. M., concert; 9:00-10:30 P. M., vaudeville and news. Thursdays, 8:00-8:55 P. M., concert, lecture and news. Sundays, 8:00-8:55 P. M., concert, religious.
- W M H, Cincinnati, O.**
Daily, 11:00 A. M. and 4:00 P. M., weather. Days and Saturdays, 8:15-10:00 P. M., concert, lecture.
- W N O, Jersey City, N. J.**
Daily, 10:01 P. M., news, concert.
- W O Q, Kansas City, Mo.**
Daily, 11:30 A. M., 3:00 P. M. and 7:30 P. M., markets and weather; 8:30-9:30 P. M., concert.
- W O B, Hartford, Conn.**
Tuesdays, Thursdays and Saturdays, 8:00 P. M., concert.
- W R E, Dallas, Texas.**
Daily, 7:00 P. M., police news, sports, weather; 8:30-9:30 P. M., concert. Sundays, 11:00 A. M. and 7:30 P. M., church service.
- W W J, Detroit, Mich.**
Daily except Sundays, 11:20-11:55 A. M. and 3:30-4:00 P. M., music; 7:00-8:30 P. M., concert, etc.
- W W X, Washington, D. C.**
Daily, 10:00 A. M., weather; 10:30 A. M., markets; 3:00 P. M., markets (code); 7:30 P. M. and 8:00 P. M., markets; 9:30 P. M., weather.
- Y N, Washington, D. C.**
Daily, 6:30-7:30 P. M., radio instruction (code and radiophone).
- Z C D, Atlanta, Ga.**
Tuesdays, Thursdays and Sundays, 7:30-8:00 P. M., news and concert.
- Z O, Columbus, O.**
Irregular, time signals, news, markets, etc.
- B Y V, Columbus, O.**
Mondays, Wednesdays and Fridays, 7:30 P. M., concert, news, etc.
- U K, Akron, O.**
Mondays, Wednesdays and Fridays, 6:30-7:30 P. M., concert.
- A B U, Louisville, Ky.**
Mondays, Wednesdays and Fridays, in evening, police news (code).
- Y A, Iowa City.**
Irregular, markets, news, etc.
- Y Y, Lincoln, Neb.**
Daily, 12:00 M. and 7:30 P. M., news, concerts.
- Berkeley, Calif. (Hotel Claremont).**
Sundays, 1:00-2:00 P. M. and 6:00-7:00 P. M., concert.
- Denver, Colo. (Y. M. C. A.).**
Daily, 10:00 P. M., time signals, weather, news.
- Denver, Colo. (Fitzsimmons Hospital).**
Thursdays, 3:00-9:30 P. M., concert.
- Montreal, Canada (Marconi Station).**
Tuesdays, 8:00-9:30 P. M., concert, news.
- San Francisco, Calif. (The Emporium).**
Daily except Sundays, 10:00-11:00 A. M. and 2:30-3:30 P. M., concert.
- Westerly, E. I. (Whitall Elec. Co.).**
Daily, in evening, concert.

Impossible to Receive Broadcasts With the Lightning Switch Grounded

Important Instructions to Follow in the Construction of Antenna Given Beginners—Securing of Proper Wire a Big Factor

Now that radiophone concerts are being broadcasted by large stations, and the beginners in the Radio game are buying apparatus, the first question which usually arises is in regard to the antenna or aerial. To begin with, the best sort of an aerial to have if possible is one on the roof, or on the outside of a building. Some people may say that they get music by using the bed spring, water pipe, gas pipe, etc., which is perfectly true, but they are either near the broadcasting station or else they are using very sensitive apparatus. If they changed over to an outside aerial, their signals would increase more than one hundred per cent.

For receiving, one wire used for the aerial is just as efficient as four or six, the main thing being the height, for if the aerial is low, it has a tendency to pick up "static" or atmospheric disturbances.

After many years of experimenting with various types of aeriels the writer has found that the best length is from 100 to 150 feet, and as high as possible, clear of any obstructions.

The aerial wire should be either solid or stranded copper wire (stranded preferred) No. 14 B&S gauge. Aluminum or phosphor bronze wire may be used, although aluminum has a tendency in time to crystallize and break. Phosphor bronze is very good owing to its superior tensile strength, but it is very expensive.

Make Happy Hours for the Bedridden

Broadcasts Amuse and Inform

The radio is proving its real worth in hospitals and sanatoriums or in private homes where it is being used to shorten the hours of an invalid. The weary hospital patient or those confined to their bed need not worry any longer about what is going on in the outside world and become despondent because they cannot get out.

The sick one, in a hospital or home equipped with a simple set, may now don the head phones and hear the gossip and news of the outside world. A variety of lectures, sermons, songs and instrumental music fill the air. The weather forecast from all corners of the country is available and time signals from Arlington, Va., enable the correct setting of the timepiece. Many women and veterans confined to the hospitals are enjoying the use of the radiophone.

Older persons, beside the various selections of music broadcasted, enjoy the church sermons from different cities. One woman remarked that after hearing Methodist, Baptist, Presbyterian and many other services that she hardly knew what denomination she really was.

The wireless waves make isolation a thing of the past and are not only an advantage to the commercial world, but social life is also being benefited by various forms of entertainment.

WIRE TELEGRAPH TO STAY

A. T. & T. Engineer Declares Radio Will Only Supplement

LANSING, MICH.—F. L. Rhodes, engineer for the American Telephone & Telegraph company, declared recently that an exhaustive study by the A. T. & T. indicates that wire communication would never be supplanted by radio, but that radio, in the next few years would develop into an important supplementary service to the telegraph and telephone lines.

He appeared as a witness in the hearing before the state public utilities commission on the Michigan State Telephone company's request for permission to establish permanent rates. Mr. Rhodes blamed the lack of secrecy surrounding Radio communication for its inability to replace wire lines. He also stated that static conditions, which had not been conquered, sometimes handicapped Radio transmission.

Approximately the entire day was taken up with witnesses explaining the mechanical relationship between the A. T. & T., the Western Electric and the Michigan State. Indications were that testimony of much the same description would be offered again.

Where the lead-in is joined to the aerial the joint like all others should be soldered as this is very important in Radio, to prevent corrosion. The lead-in should be brought to either a knife switch or lightning arrester which has been approved by the National Board of Underwriters and from this to the top of a No. 4 insulated wire. For the lightning lead-in should be 4 or 5 feet long. The ground and the ground are soldered to it is about the best ground that can be had. And last but not least, DON'T try to receive with the lightning switch grounded, as you may have to wait a long time for the message to come in.

Send Your Pulse to Heart Specialists

New Discovery Permits Long Distance Diagnosis by Broadcasting Heart Beats

WASHINGTON, D. C.—Discovery has been made by Major General George O'Squire, Chief Signal Officer of the United States Army to diagnose troubles of the heart in patients far removed from the hospital.

A demonstration was given before a group of physicians in the Signal Corps laboratories at Washington recently. A heart transmitter was designed especially for the occasion was placed over the heart of the patient under examination. The passage of the blood through the various valves of the heart set up vibrations in the air chamber of the instrument. These vibrations were led to an amplifying device consisting of a group of standard vacuum tubes. The vacuum tubes when

connected to which was attached a super-sensitive loud speaker that delivered the sounds created by the heart to a listening audience. Several subjects suffering from various heart troubles were examined for the benefit of attending doctors.

Later experiments along the same lines have proven, it is claimed, that these sounds can be transmitted by radio over great distances. This means that in the future heart specialists living thousands of miles away can diagnose and prescribe for patients whom they never see. For instance, a man taken to a hospital in a small city in the Middle West, and by radio a heart specialist in New York, listening to the palpitations of his heart, can prescribe a treatment or direct by wireless the operation.

HEARS WIRE TALK WHILE LISTENING IN

Switchboard Repairman Hears Local Gossip

PROVIDENCE, R. I.—A switchboard repairman of this city is claimed to have discovered a means of listening in on telephone lines with a radiophone set. He says he heard a conversation between two parties in different cities describing a gown worn by a bride. This repairman states that he has discovered three circuits. The outfit used to pick up this conversation is located in the attic of his home and it uses a short aerial attached to twenty-five foot poles on the roof.

Mr. O. L. Whittemore, who is in charge of the radio laboratory in Washington, states that he has discovered three circuits. If the antenna runs parallel to a telephone line and the amplifier is very sensitive it is quite possible and very likely to hear the conversation on the telephone lines. If, for instance, a cable runs into an apartment house carrying all the telephone lines and he wires the antenna can be placed parallel to them, then almost any conversation may be heard through the radiophone. If such is the case then it is no more ethereal by this means than to listen in on a party telephone.

Broadcast Scenario Lessons.

NEWARK, N. J.—Sending scenario lessons for aspiring movie authors over the ethereal waves was accomplished by Anita Loos over station WJZ here the other evening. In her talk Miss Loos told how she had had a disheartening struggle before she was a success in scenario writing.

BOSTON CITY HALL HAS LOUD SPEAKER

MAMMOTH NEW RECEIVING EQUIPMENT INSTALLED

Special Opening to Be Arranged Between Mayors Curley and Hyland Over WJZ

BOSTON, MASS.—Mayor Curley and other officials at City Hall will no longer be uninformed in radiophone matters, for was learned the installation of a big diaphone receiving set is to be started in city hall. The work is to be done by one of the big radio equipment manufacturing concerns and will not cost the city a penny.

The apparatus will be set up in the room used by the new commercial and industrial bureau near the mayor's office. It will consist of the latest model receivers with powerful amplifiers, batteries and vacuum tubes. An expert radio engineer will come here from New York to teach one of the city hall electricians the running of the set.

Work will be started early Monday morning on the erection of the aeriels of antennae which will be strung from high poles on the roof. Wire connections will be made with the aldermanic chamber on the second floor where a mammoth "loud speaker" will be placed in such a position that several hundred people may be able to hear concerts, and programmes whenever thrown open to the public.

Arrangements are now being made by William McInister, head of the commercial and industrial bureau, to have Mayor Hyland of New York talk from Station WJZ, Westinghouse, Newark, N. J., to Mayor Curley and a special audience on the day of the formal opening of the new service. While no definite date has been set for this address by Mayor Hyland it is expected to take place soon.

VAUDEVILLE HOUSE TO GET BROADCASTS

Galesburg Theater to Install Radiophone for Patrons

GALESBURG, ILL.—Contracts have been let by the Plaza theater company for the installation of the latest and most improved radiophone obtainable. This will enable the theater to give its patrons in addition to its regular high class vaudeville the newest and most wonderful form of entertainment known to science. The installation will be tuned to receive only government reports, grand opera concerts and speeches of noted men, with a range sufficient to take in all of the music and news broadcasted from governmental and the larger private sending stations, and it provides for the amplification, by means of extraordinarily large transmitters, of all the sounds received, to such an extent that all patrons of the theater will be able to hear it. It will eliminate all amateur sending stations and ground noises which have heretofore been the bane of Radio telephoning enthusiasts. The great height of the Plaza roof affords a most ideal place for the receiving antenna and good results are anticipated by the management.

Panama Hears WWJ Concert with World's Largest Station

DETROIT, MICH.—"I got a concert 200 miles off the eastern coast," said Grant W. Jones, chief electrician for the Government in charge of the Panama Canal locks, who came to The News station recently. "I wanted to see the outfit The News has. We have the largest radio station in the world down in Panama and radio has become a craze."

"I am keenly interested in The Detroit News station," he said. "The Pittsburgh high school boys seem a unit in their interest in radio, and I am being besieged every day for drawings for parts and equipment, and would have my entire class hours devoted to radio if the boys had their way."

"We heard the concert on the ship clearly and distinctly all the way through," said Mr. Jones. "As you know once the waves reach the ocean they clarify and travel much better than on land. Our sending station at Panama allows us to reach almost around the world. Government employes, soldiers, sailors and even the native Panamanians are making amateur sets by the score."

KYW Listeners Give to France

Miss Anna Morgan of New York recently appealed to 200,000 radiophone listeners from the broadcasting station K Y W, Chicago. The first dollar received from this appeal was much appreciated by Miss Morgan. "The dollar thus solicited and received gave me more pleasure than any contributions I have ever received," said Miss Morgan.

Simple Instructions for the Beginner

By Harry J. Marx

Lack of knowledge on the operation of his set has disgraced many a new Radio Fan. Furnishing the instructions is oftentimes overlooked in the haste with which people are buying radio outfits at the present time. Then again, explaining the intricacies of radio circuits, is no easy job for the average salesman. This article is briefly intended to describe the operation of a few of the simple hook-ups and also to furnish a series of comments on the most common questions that arise. Space is lacking to go very much in detail, so this will be the first of a series of articles covering the operation and description of all the apparatus in the different radio circuits.

The Crystal Detector Set

Very few realize the similarity of the crystal detector set to the vacuum tube sets. If we keep the similarity in mind, we will avoid the many pitfalls that menace the fan who graduates from the crystal detector stage to the tube set. Fig. 1 shows us the hook-up of one of the simplest of Crystal Detector Sets. The aerial, ground connection to the water pipe, two slide tuning coil, fixed condenser, detector and head receivers make up the list of necessary apparatus. The cost of this outfit would run about \$15 to \$20 and in addition, it has the advantage of being easily converted into a vacuum tube set, the next step the radio fan contemplates. This crystal set has a receiving range of about twenty miles, more or less according to the atmospheric conditions of the vicinity and the effects of local interference.

In order to make the theory of the circuit as simple as possible, we will describe the Radio Waves as a series of waves, traveling through the air, walls of the buildings or other structural obstacles. These waves are like vibrations of the strings on a musical instrument. These electrical vibrations are absorbed by the aerial and are led to the tuning coil with its adjustments and then to the detector. The detector is simply a one way valve, that will permit the passage of the vibrations going in one direction, it acts as a sieve in straining through the desirable element. Having converted the vibrations into a series running in one uniform direction, we pass it on to the head receivers, which make the waves audible to the ear. Like a hot water heating system our electrical circuit must have its return pipe and from the receivers it flows on through to the ground. The condenser is connected across the receivers to give continuity, that is to say it acts somewhat as the reserve tank that gives us a steady flow and strengthens the tone of the message.

Tuning

Tuning this set means that we want to adjust our apparatus to the proper wave length. In the same way that we adjust the string of a tuning fork until we get the right tone to match the key of a piano or a tuning fork. The first step is to see that our crystal detector is adjusted properly. To do this we can take a set of doorbell batteries and the doorbell to act as a test-buzzer for the bell ringing operation except that we add the detector to the circuit, as shown in Fig. 2. Now adjust the contact whisker or wire on the crystal until the point of contact is obtained where the bell operates best. Keep this adjustment and hook up the apparatus. Take the right hand slider of the tuning coil and set it to the bottom. Then slide the left one or aerial connection back and forth until the signals are loudest. Now repeat the operation with the right slider and tuning is completed.

There is one point that is not usually realized by the new beginner, a crystal detector set as shown has but very little tuning range. The wave length is limited, and the tuning range varies but little. If then the natural wave length and the location is favorable to the reception of the nearest broadcasting station, the reception will be clear enough to satisfy the first craving of the fan. Location and weather conditions may however make the crystal detector set impractical and the results will be rather discouraging. In this case, the amateur should avoid any further waste of time and money in experimenting further with the crystal set. Take a tip and start in with a vacuum tube set, it will save money in the end and will give unquestionable results.

Vacuum Tube Set

If poor results fail to absolutely discourage the crystal set fan, he soon begins to look around to find what apparatus he will require to convert his outfit to the vacuum tube type. In Fig. 3 an effort has been made to make the outfit as cheap as is consistent for good results. Wherever possible the former instruments are utilized, and at the same time the circuit is of such a type that more can be added as the pocket allowance permits. The additional parts are one or two variable condensers, a grid leak and condenser, "A" and "B" batteries, filament rheostat, vacuum tube and socket. The hook-up is shown in Fig. 3. Now for comparison let us follow the

LIST OF APPARATUS

CRYSTAL DETECTOR SET

- 100 Feet Copper Aerial Wire
- 3 Insulators
- 12 Insulator Plates
- 1 Porcelain Insulator
- 1 Water Pipe Ground Clamp
- 100 Feet No. 14 Insulated Wire
- 1 Two-Slide Tuning Coil
- 1 Crystal Detector
- 1 Galena Crystal
- 1 Set Head Receivers
- 2000 ohms or better

VACUUM TUBE SET

- Additional apparatus required:
- 1 or 2 Variable Condensers
- 1 Grid-Leak and Condenser Unit
- 1 Vacuum Tube Set
- 1 Tube Socket
- 1 Filament Rheostat
- 1 6 volt, 60 ampere Storage Battery
- 1 22 volt "B" Battery
- Amperage of Storage Battery could be more than 60.

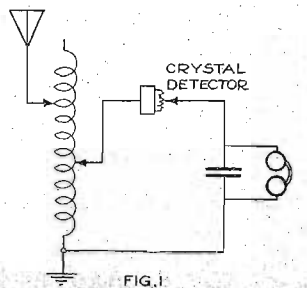


FIG. 1

path of the waves or vibrations through the vacuum tube set.

As before, the vibrations are caught by the aerial and are led through to the tuning coil and also to the grid leak and condensers. The condenser serves the same purpose as before while the grid leak gives a slight negative value to the current and also allows the vibrations to trickle through. That is to say, it allows only a certain amount to pass through depending upon the capacity or resistance of the two parts. From there it goes to the grid of the tube, now tube operation requires considerable technical language to explain and the reader can read through other articles in the magazine for details. We will take the simplest method of describing the path without the confusion of attempting an explanation of the theory. When it reaches the grid, it passes through the battery, which supplies additional current to help operate the receivers. Now in addition, we also have the filament which you will notice is hooked up to the tuning coil slider besides its separate battery for operation and the rheostat to control the flow of current to the filament. This filament current flow also reinforces the grid current by adding to the vibrations going to the plate and on through to the receivers. The main point then in the vacuum tube set is the fact that our tube acts as a valve that not only accomplishes as much as the crystal detector, but in addition, by adding the strength of the batteries, magnifies the impulses that are received. A condenser can be hooked up in parallel across the receivers as before but the flow of the vibrations is well under control and the advantages are not as apparent as before. The purpose of the condenser connected across the tuning coil is to act as an absorber for the outside interference currents that will creep in. It will catch these and partially prevent

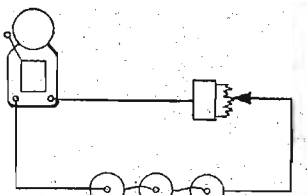


FIG. 2

them from going over to the rest of the circuit. The condenser shown in dotted line between the aerial and the tuning coil is inserted at the option of the operator. If the aerial is long enough and the ground is favorable, it may be necessary to cut down the natural wave length. Therefore this condenser will tune down but not up, a common error among amateurs.

Tuning the Tube Set

Taking up the tuning of this set, our procedure is somewhat different from before. The first step is the control of the current to the filament. Keep the receivers on and then turn the rheostat from the off position gradually allowing more current to flow into the filament, as it heats up and lights up, it will be indicated by a soft purring sound in the receivers, this will continue as the resistance of the rheostat is decreased up to a point where the purring changes to a sputtering, howling, hissing or may even choke and give no sound at all. Push the rheostat back until the best position is reached just before the point where the loud noises are reached. Allowing too much current flow only shortens the life of the tube and diminishes the tone rather than improves it. Keep the right hand slider of the tuning coil as shown in Fig. 3 at the bottom position and the left hand up. If the aerial condenser is in circuit turn this from full to zero. The plates inside of each other, to the position where the rotating plates are outside of the fixed plates. Make this tuning movement gradual and listen for reception of waves. It may be necessary to move the left hand slider in conjunction until the operator becomes acquainted with his set and finds the point at which the condenser must be set, to receive the various broadcasting stations. When the reception is loudest and clearest, the right hand slider can be adjusted in the same manner. Then take the variable condenser between the grid and filament wires and adjust this for best position. Slight readjustments can now be made on any of these parts, without varying much from the established positions. Don't go at the tuning end of operation in a haphazard manner and expect to get results, it's just like trying to trim the roof of a building before the foundation is started.

Purpose of the Apparatus

Now to explain a few facts about the tuning, the condenser as explained before cuts down the range of the aerial, and as we move the plates out we are doing the equivalent of shortening our aerial. The more coils we add the more we increase the range of our aerial. If you are limited in the length of your aerials, add on more coils or to the coil length, don't get the impression that seems to be so general, that by adding to the number of wires in your aerial you are increasing the wave length—wave length is best increased by the length of the aerial, not breadth. Also, an aerial with insulation is as good as the bare wire, except that it is heavier. See that you have the proper insulation of the aerial, or you will lose the reception through leakage.

A common trouble is found to be caused by poor ground connections. A meter in the water pipe circuit sometimes acts as a perfect insulator and kills the ground value. A ground connection on a dirty or painted over pipe will not make good contact. Gas pipes are rarely as good as the water pipe, as the water itself acts as a conductor. Another point, make your connection to the pipe at the place where the pipe enters the ground, as it eliminates unnecessary pipe resistance. In making your ground and aerial connections don't use any wire smaller than No. 14. This is a point often overlooked and yet will cause a lot of trouble. As far as possible joints should be soldered or at least attention should be paid to see that good contacts are made at all the connection points.

The question is often asked, "What is the life of a crystal?" Every crystal varies, there is no average that can cover the question. It depends upon its sensitivity, handling and care. Avoid handling as much as possible, the touch of the fingers gives an oil coating that kills the sensitive feature that is so desirable. If washed daily with a soft brush, soap and

water or carbon disulphide its usefulness will be prolonged.

Vacuum Tube Hints

In the same manner, numerous questions are asked concerning the vacuum tube and its handling requirements. Strange to state people will persistently ask whether the house lighting current can be used instead of the 6-volt battery. Try taking an automobile headlight and put your house lighting current through it, the experiment will not be quite as expensive and will convince you that it can't be done! The vacuum tube filament is designed to operate on a six-volt circuit, similar to the usual auto headlight bulbs and excessive current will simply melt the filament. The maximum amperage or flow of current, not pressure, should be one ampere. Even this is merely the maximum limit, but it will be found that about half of that will be sufficient under the usual operating conditions. As the tubes grow older, it will be noticed that they demand more current for operation.

After about four months' use, it would be advisable to remove the tube and place it in an oven. Heat the oven gradually until the glass gets just too hot to handle and then bake at this temperature for about fifteen to twenty minutes, then let it cool very slowly. It will then be found to have renewed sensitivity and will require less current to operate. Of course after repetition even this will fail in time, but you have increased the natural life two or three times with the extra care you have taken.

Howling

Many amateurs are continuously complaining of howling. Oft hand it is difficult to state the exact cause as it may be the result of a number of things. Examine the wiring and see if it is neatly done, avoid too much slack in the wires which means avoiding tangled loops that would create induced currents in the circuit. Possibly the filament current is too strong. Some other station tuned to the same wave length may be causing the trouble, or occa-

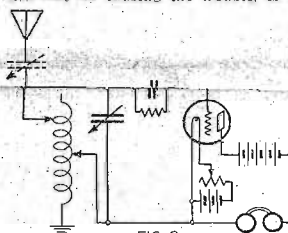


FIG. 3

asionally the trolley line and wires near by if parallel to the aerial or lead in will cause trouble. A high tension cable close to your aerial, especially if it runs parallel, will spoil the best reception. Very often, due to high steel buildings or peculiar natural conditions an amateur will find himself in a dead area, or at least one where the reception encounters considerable interference. Sometimes this can be remedied by raising the aerial higher or making it longer—if not, the answer would be to grin and bear it or try working with some friend that is more fortunate. As a parting word, don't be discouraged because you can't find things are not just right at the start. Radio means a little headwork and plenty of pep and push!

F. S. wishes to know: How high must the antenna be?

Answer—From thirty to sixty feet is high enough for amateur stations.

H. J. L.—"What is the natural period of an antenna consisting of four wires, 150 feet long and 60 feet high?" Answer: About 150 metres for the T type and 200 metres for the L type.—John Bailey.
















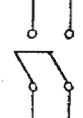
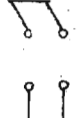
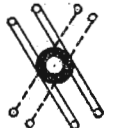
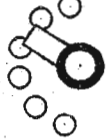






William Russell—Can you tell me what causes my tubes to get all blue inside when I use them? Answer: If you have reference to a bluish vapor, it is caused by the use of excessive current heating up the glass and metallic parts of the bulb. If there appear any other colors it is because the tube is defective.

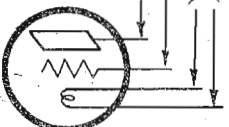

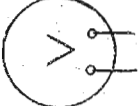
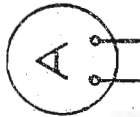
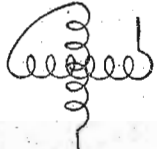
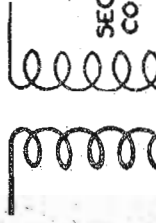
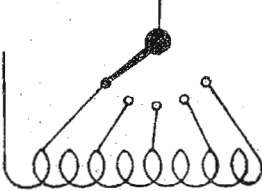
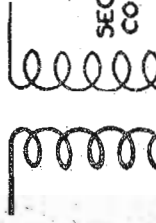

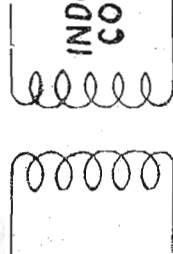
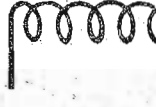
F. Berman—Can I hear daily concerts with a pair of 75 ohm receivers, a galena detector, a fixed condenser, a two-slide tuning coil and a two-wire 50-foot aerial? Answer: No. You will need a more powerful pair of phones, about 2,000 ohms. Your aerial is too short by about fifty feet and if you live more than twenty miles from the broadcasting center I would not advise assembling this set.

Leon Ols—I live on the second floor of a three-story apartment. Would there be any objection to running an aerial between the posts on the back porch, to be taken down when not in use? Would sixteen feet be long enough for receiving purposes? Answer: You can put up a very good aerial on your back porch as suggested, but make it longer than sixteen feet if you can. Sixteen feet will give results with a good outfit, but if you can make it longer it will work better.

Radio Digest Illustrated

No. 1.

-  AERIAL
-  LOOP AERIALS
-  CONNECTED WIRES
-  CROSSED WIRES NOT CONNECTED
-  "B" BATTERY 22½ VOLTS OR UP.
-  "A" BATTERY 6VOLTS
-  GROUND
-  CAPACITY GROUND
-  BINDING POST OR CONNECTION
-  CONDENSER
-  VARIABLE CONDENSER
-  FUSE
-  KEY
-  SINGLE POLE, SINGLE THROW SWITCH
-  SINGLE POLE DOUBLE THROW SWITCH
-  DOUBLE POLE SINGLE THROW SWITCH
-  DOUBLE POLE DOUBLE THROW SWITCH.
-  DOUBLE POLE DOUBLE THROW CONTACT SWITCH
-  BRIDGING CONTACT SWITCH (6 POINT)
-  TRANSMITTER
-  RECEIVER
-  LOUD SPEAKER
-  INDUCTIVE WOUND COIL
-  NON-INDUCTIVE WINDING
-  RESISTANCE WINDING

-  VACUUM TUBE
PLATE
GRID
FILAMENT
-  HONEY COMB COILS
-  VOLTMETER
-  AMMETER
-  VARIOMETERS
-  CHOKE COIL
-  TAPPED COIL
-  SECONDARY COIL
-  TICKLER
-  INDUCTANCE COIL
-  PRIMARY COIL

FOLD

YOUNG

Questions and Answers

John Peters writes: "I am not allowed to use an outside aerial. How do I ground the inside wires that run around the molding and where do they end?"

Answer—Connect one end of the wire to the aerial connection on your instrument, run the wire up to the picture molding, laying it out nice and straight so that it cannot be seen. The distant end is not connected to anything. The aerial must not be grounded, but the ground wire from your instrument can be connected to a radiator or water pipe.

W. Schmitt, Chicago, Ill., asks: "Where can I get No. 14 insulated copper wire?"

Answer—Try any electric supply house.

John Kass asks: "(1) Will you please tell me if there is any possibility of connecting a tuning coil with a sending set and how? (2) Do you have to have a license to send any distance?"

Answer—(1) A tuning coil such as used in a receiving set would be of no use in your sending outfit. A sending set is tuned with an oscillation transformer and condenser. (2) Absolutely yes. You are not allowed to do any sending unless you have a license. You can receive, but not send.

Radio Editor—Is a loose-coupler as good as two variometers and a variocoupler for receiving? **J. A. BURNS.**

Yes. The only reason variometers and a variocoupler are used is on account of the small amount of space required when placed in a cabinet.

Radio Editor—What is the best size of wire to use in winding a tuning coil? **R. E. COOPER.**

Either No. 22 or 24 silk or cotton covered wire. After winding the coil shellac it and let it dry. When it is thoroughly dry scrape the insulation off with a sharp knife where the sliders move.

Radio Editor—I have a loose-coupler, crystal detector and fixed condenser. My aerial is 75 feet long, and about 50 feet high. Can I improve my set without using a vacuum tube? **S. E. GILMAN.**

By connecting a variable condenser in your aerial circuit it will both improve your set and also bring in signals much clearer.

Radio Editor—I am using an Aerola Jr. receiving set but seem unable to pick up KDKA using a loop aerial. Can you suggest a remedy? **R. WALKER.**

Why certainly! Get a vacuum tube set and put up an outside aerial about 150 feet long and 100 feet high, and then you can pick them up.

Radio Editor—The writer has a relative who lives alone with two deaf and dumb uncles, about sixty miles from Chicago, and has little opportunity of coming in contact with the outside world. What sort of an outfit is suitable to receive concerts and other information? Are concerts sent out every day? **F. L. S.**

Answer—An outfit with vacuum tube detectors, complete with headphones and batteries can be purchased for about \$70 from electrical shops or department stores. Concerts are sent out every evening from the Westinghouse K Y W station on the roof of the Commonwealth Edison building, together with news bulletins, news features and speeches.

Radio Editor—I am using an audion bulb with a storage battery that will give a total output of 12 volts. I am using only six of these volts, however, and when the cells get low, I use another cell, making eight volts, and when this cell runs low I have the battery recharged. Will it make any difference in recharging the battery? **E. S.**

Answer—You certainly are taking a chance when you put eight volts on the filament of your tube, even if the cells are nearly exhausted. Incidentally, using the battery when it is nearly discharged, is not the best thing for it, as a storage battery should never be allowed to run entirely down. The best way is to use only six volts and then if you have a charging outfit, charge the battery up about every third night if it is used every evening. Just connect the charger on before going to bed and in the morning the battery should be fully charged. It is well to test with a hydrometer, though, as an overcharge is about as bad for the battery as leaving it fully discharged. Keep the battery at about the same charge and it will last for years.

Radio Editor—Please tell me if a regenerative receiver will work well using a telephone line as an aerial. **V. K.**

Answer—It is not advisable to use the telephone line. Put up a single wire aerial about 100 feet long for the best results.

Q. Could the cardboard tubes you mention in the diagrams of the radiophone receiving set be sheilded on the outside and inside without interfering with the efficiency of the set?—**Radio Nut.**

A. It is not advisable to shellac the tubes after the windings are on. This does what the electric engineers call "increasing their capacity" and makes the

tuning less sharp. Tubes may be sheilded before winding if desired, but it is not necessary.

Is it necessary to have a government license to operate a receiving set? **L. T. N.**

It is only when you desire to transmit messages or broadcast that Uncle Sam requires you to take out a license.

Radio Editor—Will you kindly explain the meaning of the regenerative receiver? I am using honeycomb coils on a long wave set. Do the coils replace the tuning unit or are they connected in series with the aerial? **A. E. C.**

A regenerative receiver is one that uses the vacuum tube with the plate circuit of the tube fed back to the primary coil. It is not possible to get regeneration without a vacuum tube. Your honeycomb coils are regenerative if you use three of them at once. They are the tuning unit with the exception of the necessary variable condensers.

Thomas Hall—Can I improve my range by placing a 43-plate variable condenser

poise stretched directly under the aerial and about four feet from the ground.

Alva Ernst—"What is meant by natural wave length of an aerial, and how is it calculated?" **Answer—**Natural wave length is the length of the wave, usually measured in metres, produced by the aerial's capacity and induction. Roughly speaking, the natural wave length can be calculated by multiplying the length of the aerial by 4 1/2, and to change from feet to metres divide by three. This will give you the natural wave period of a single or double wire horizontal or vertical swing aerial.

William K. Stussy—Kindly let me know what I would need and the construction of a loud speaker (magnavox style), suitable for a set equipped with a loose coupler, A. P. detector and two stage radiotron amplifier.

Answer—It is not practical to make a home-made magnavox receiver. A loud speaker may be made by coupling a single sensitive receiver, such as the Baldwin or Browne, to a horn or to your phonograph. You can purchase a coupling device that is made for the purpose.

The radio frequency amplifier is undoubtedly best.

I. M. says, "I hear a constant hum in my receivers. The set works fine but the noise spoils all the music. What shall I do about it?"

Answer—Undoubtedly there is a high-voltage power line running near your home. If this is the case try placing the antenna at right angles to the power line and you will find that the interference will cease.

Radio Editor—Can I use insulated wire for the aerial?

RICHARD KENNARD.

Insulated wire will not make any difference if used for the aerial.

Radio Editor—I have a crystal set that works very well, but once in a while I hear howls and hums. What is the cause of this? **PAUL R. THORN.**

You may be located near some transmitting set that is testing and this is probably what you hear. You may also have a loose connection somewhere, as this will sometimes cause peculiar noises in the receivers.

Radio Editor—Can a good regenerative set be made using honeycomb coils? Will it work as well as a high-priced regenerative receiver, using two variometers and a variocoupler? Is the De Forest circuit using two primaries and one secondary as good as either of these? **W. M. H.**

The difference between the set using the honeycomb coils and the regenerative using the two variometers and the variocoupler lies in the fact that the former will give better results on longer wave lengths, while most of the latter type of set will not work on wave lengths over 500 to 800 meters. The honeycomb coil set is all right, but for short wave lengths the variocoupler and variometer circuit is hard to beat. These circuits are both regenerative, while the De Forest circuit you mention is not regenerative. All three circuits are excellent in their fields, and it is a hard matter to compare the relative merits of them. Each is supreme in its class.

Radio Editor—Please tell me where Station 2 X A I is located? **W. D.**

Station 2 X A I is the experimental license of W J Z. It is the call used when they are testing.

Radio Editor—How many meters will the set using the honeycomb coils tune to? Is this set a single circuit? Is it good in performance. **RADIO.**

This set will tune to any wave length if the owner wishes to buy the necessary honeycomb coils. These cannot be made at home with any degree of satisfaction. It is not a single circuit. It is an excellent set if made correctly.

Radio Editor—Can I add two steps of amplification to an Aerola Sr. set? Whose call letter is W R W? **R. P. A.**

You may add amplification to any set using an audion detector. W R W is located in Tarrytown, N. Y.

Radio Editor—How can I stop the party across the street from sending out code messages while I am listening to the concerts? **L. MORRIS.**

You cannot stop an amateur station if he is transmitting legally with a license and is on the right wave length. He has just as much right to the air as you have. Remember that there are many amateurs who have been in the game for years, and some of these men are carrying on important relay traffic. They have a great deal of money invested in sets, and as a rule, these old timers do not care much about the broadcasting. It is only fair for the beginner to remember that some of these very amateurs whom they are now blaming with the interference are the very men who made the radiophone possible as well as the sets that receive it. A little courtesy shown by both sides will serve to clear up a great deal of misunderstanding. The broadcasting station has no right to keep the air all the evening, and neither has the amateur. At the present time the broadcasting stations are sending out lengthy programmes that sometimes extend until nearly midnight. This sort of a performance is hardly fair to the amateur, who has to get off some important messages. Put yourself in the other fellow's place and do not think that you can have the air all to yourself any more than anyone else can.

K. C. B. wants to know: What would a complete receiving set to hear music cost? **Answer—**A complete home-made, short-wave regenerative set, including aerial, could be installed for \$30.00.

S. P. R. asks: I am using a gas pipe for a ground connection and am not getting good results. What shall I do?

Answer—A water pipe makes a good ground. Scrape or sandpaper the pipe before putting on the ground clamp.

L. A. G. inquires: Which is the best type of aerial?

Answer—A one wire antenna about 100 to 150 feet long is appropriate for receiving while a 4 or 6 wire "T" cage antenna is ideal for transmitting.

An Invitation—

WHEN "stumped" write the Question Department of RADIO DIGEST. A self-addressed, stamped envelope should be enclosed ALWAYS, as not all answers can be published. Only those of general interest will be printed in these columns. Other questions will be answered by mail.

When your question is of a highly technical nature and cannot be readily explained, send sketches and diagrams along with it.

The services of a trained staff of Radio Engineers are at the command of every reader of RADIO DIGEST. Don't hesitate to send in your troubles and let RADIO DIGEST worry about them.

RADIO DIGEST, however, reserves the right to refuse to answer any question which might lead to litigation.

In my ground circuit? Answer—To increase the wave length range of the circuit connect the condenser across the primary. If you place it in the ground circuit you will decrease your range, if anything.

Radio Editor—I want to purchase a receiving set and yet I am told that the new broadcasting stations are going to be on a higher wave length and I do not want to get a set that will not tune up high enough to receive them. Will you please advise me about this matter? **J. W. B.**

Up until the present time this department has no information regarding the wave lengths at which the new stations are going to operate. However, the station at Port Wood is operating on a wave length of 1,150 meters, and if you want to hear this station you will have to see that you get a set that will tune that high. At the present time very few of the regenerative sets will tune that high.

Radio Editor—Which is best, two steps of amplification and a Magnavox or three steps and an Amplitron? What voltage should be used in the third step? **C. L. NOLTE.**

The Magnavox will give the best results, but all these metal horns are more or less "tinny." For real results a wooden horn should be used. This lesson was learned a good many years ago by the phonograph industry, but the manufacturers of radio loud speakers have to learn it all over again. This department does not recommend the use of the third step or amplification as it usually is very "noisy" unless made exactly right.

Radio Editor—Where can I purchase drawings for making a receiving set? I want one that will receive at least 400 miles. **A. B. NELSON.**

Most of the publishers of Radio magazines carry drawings showing how to make sets. Several good sets have also appeared on these pages. More will follow. No one can give you a drawing of a set with a guarantee that the set will work 400 miles. Such factors as the skill of the builder and the operator as well as local conditions under which the station must work have too much to do with the matter.

John Owen—"What shape counterpoise shall I use in conjunction with a cage aerial 100 feet long and 60 feet high?" **Answer—**Construct a fan-shaped counter-

Earl Kullman encloses a standard heterodyne hook-up that is coupled to the secondary of an audion receiver and asks:

1. The size of each coil (five altogether) to receive P. O. Z.
2. Is there any advantage in using 110 volts on the oscillator through a filter?
3. Is an A. P. amplifier suitable for the oscillator and a W. E.-V. T. 1 as the detector?

Answer—1. Use two 1,000-turn coils for primary and secondary, with some small coil of such as 25 turns to couple the heterodynes. The heterodyne may have two 750-turn coils. You probably would get better results using an Armstrong hook-up with the other bulb as a step of amplification.

2. There is no advantage. It might work, however. The Navy tried this stunt some time ago, but has discarded it.

3. The tubes you mention are excellent for the purpose. Use 45 volts or more for the plate.

Q. Our house is over 30 feet high. If I stretch the antenna from the house to a tree I will have the desired length, but the wire will be only one foot above the roof. Will this affect the instruments? **W. L. H.**

A. If it is a tin roof it will seriously affect your instruments. But in any event you are courting trouble by such an arrangement. Better try to arrange your antenna so it will not traverse the entire roof.

Q. Would like to know if the antenna wire has to be bare or can it be insulated? Can it be less than 75 feet long? And can the ordinary electric light wires be used? **C. B.**

A. Antenna can either be bare or insulated, but it is not advisable to have it any less than 100 feet. Ordinary electric light wire can be used. Recommend 7-22 copper wire.

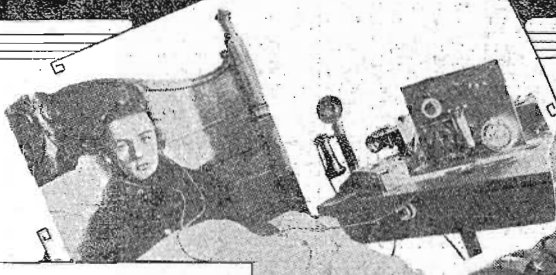
Q. My house is 20 feet high. A tree 60 feet distant is 26 feet high. Will an antenna stretched from the top of the tree to the top of the house be satisfactory? **H. J. M.**

A. Such an antenna would work, but it would be better if you could arrange to make it 100 feet long.

I. J. asks, which is best for amplification, radio or audio frequency.

Answer—Audio frequency with two or more steps of amplification will howl. With the radio frequency there is no howling and any number of steps may be used.

The Radio World in Pictures



JOY FOR BEDRIDDEN—While confined to bed, J. D. Cameron, Chicago, picks up concerts and news on apparatus of own make. U. & U.



"BLACK JACK" PERSHING RADIO FAN—General "listens in" on important army matters over radiophone in his office. U. & U.



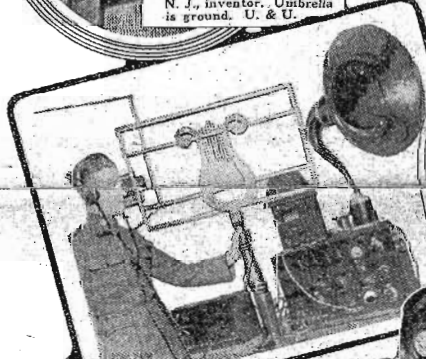
MAKING A "HOOTCH" CASE into a 400-mile receiver. U. & U.



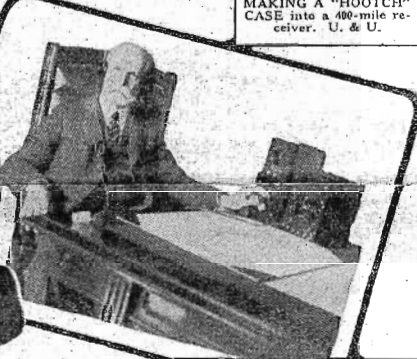
RING RECEIVER—A. G. Rinehart, 19, Elizabeth, N. J., inventor. Umbrella is ground. U. & U.



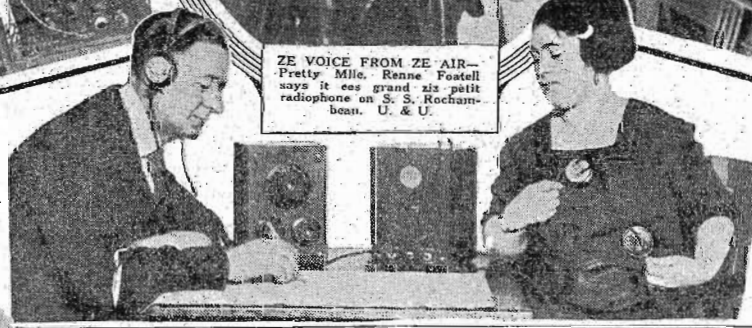
ZE VOICE FROM ZE AIR—Pretty Mlle. Renne Fostell says it es grand zis petit radiophone on S. S. Rochambeau. U. & U.



LYRE-SHAPED LOOP AERIAL—Radio antenna "dressed up" for parlor concert use. Designer, G. M. Dusenberry, U. S. A. U. & U.



"RADIO OF STATE"—Sec. of State Hughes victim of radio bug. Musical broadcasts furnish "interference" with affairs of state. Int.



"SHE LOVES ME, SHE LOVES ME NOT"—Emotion meter invented by Prof. Ransom Sutherland, Alabama. U. & U.



MATCH BOX LIGHTS WAY—Scout K. R. Hinman, 12, and brother show how small set works. U. & U.



JAZZ DANCING ON "L"—Strapping popular on "L" road when dancing broadcasts are received. U. & U.

RADIO JAZZ LATEST IN DANCING—Hotel Vanderbilt, New York, furnishes guests with musical dance broadcasts. U. & U.

