How to Make Canoe Receiving Set—This Issue

Radio Digest

WEEKLY Illustrated 10¢

TRADE-MARK

Vol. 1 CHICAGO, ILL., SATURDAY, JUNE 24, 1922 No. 11

RADIO PHOTO OVER SEA

SUMMER CONCERTS BY CAPITOL BANDS

SIGNAL CORPS TRUCKS TO RECEIVE MUSIC

Naval Station Will Broadcast Over 800 Mile Range of Washington

(Special to RADIO DIGEST)

WASHINGTON.—Plans are under way for broadcasting summer band concerts held practically daily in the parks of Washington. Transmitting microphones will soon be erected in the band stands at the White House and Potomac Park and connected by wires with the Naval Radio station at Anacostia, so that band concerts by the Marine and other bands can be broadcasted for the benefit of Radio enthusiasts within 800 miles from Washington.

Signal Corps Radio trucks may be stationed in out-of-the-way sections of the city to provide a means of listening in for those who are so unfortunate as not to possess receiving sets. The Naval station at Anacostia will broadcast on 410 or 412 meters, between 7 and 8 p. m. but it is not yet known when the broadcasting will start.

EASTERN FANS HEAR TRAINING CAMP PLEA

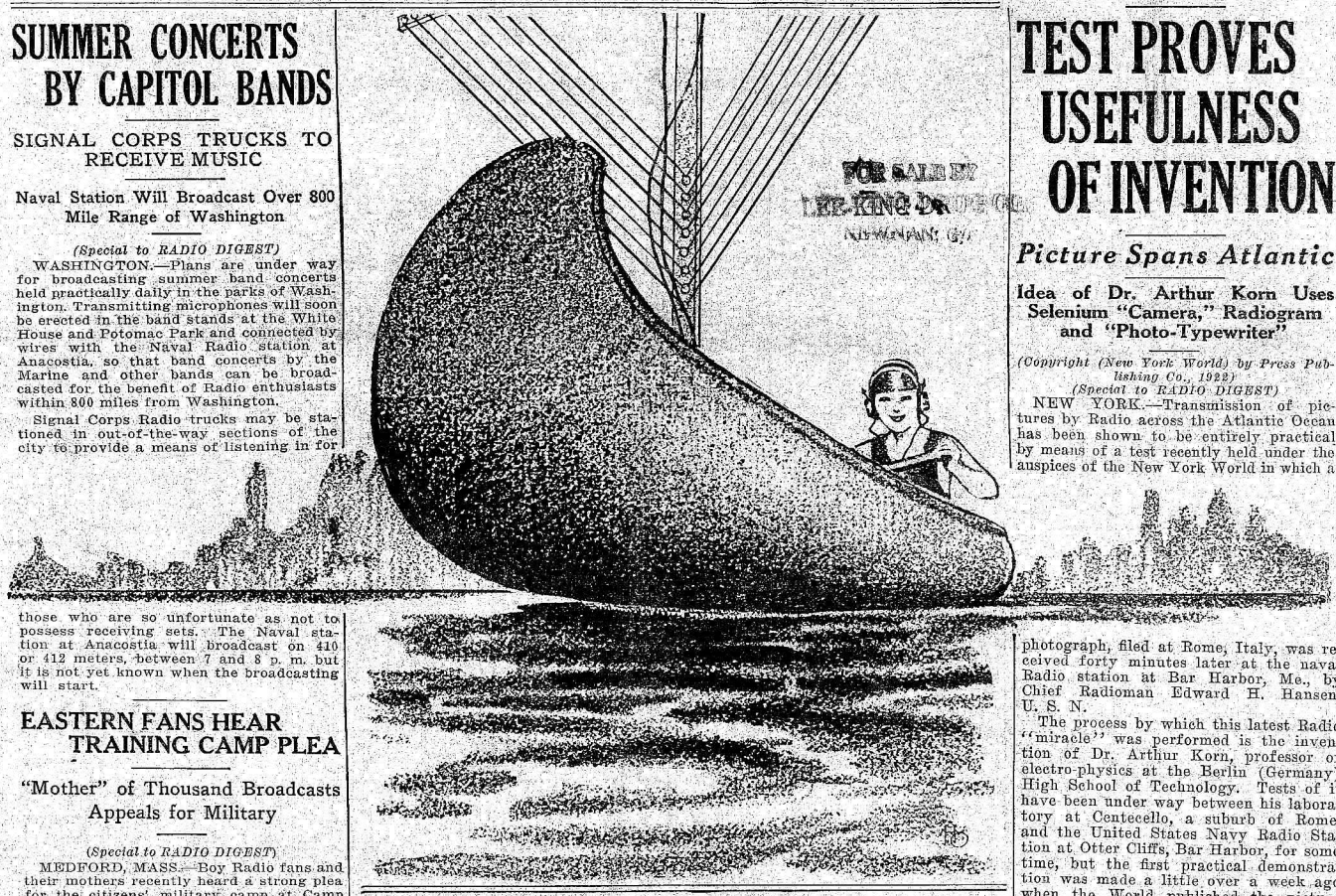
"Mother" of Thousand Broadcasts Appeals for Military

(Special to RADIO DIGEST)

MEDFORD, MASS.—Boy Radio fans and their mothers recently heard a strong plea for the citizens' military camp at Camp Devens this summer, made by Mrs. Clarence R. Edwards, wife of Major-General Edwards, commander of the First Corps Area, U. S. Army. Mrs. Edwards, the "mother" of thousands of service men and former service men of New England, made the appeal at the request of the Military Training Camps Association.

EVERYTHING BUT CAKE SENT BY RADIOPHONE

MIDDLETON, MASS. — Mendelssohn's wedding march was sent through the ether a few days ago, and picked up at Middleton, at the home of Mrs. Laura Peabody, whose son and daughter were both married in a double wedding ceremony. The two couples marched into the living room of the Peabody home by the Radio music sent out from Station WGI.



TEST PROVES USEFULNESS OF INVENTION

Picture Spans Atlantic

Idea of Dr. Arthur Korn Uses Selenium "Camera," Radiogram and "Photo-Typewriter"

(Special to RADIO DIGEST)

NEW YORK.—Transmission of pictures by Radio across the Atlantic Ocean has been shown to be entirely practical by means of a test recently held under the auspices of the New York World in which a photograph, filed at Rome, Italy, was received forty minutes later at the naval Radio station at Bar Harbor, Me., by Chief Radioman Edward H. Hansen, U. S. N.

The process by which this latest Radio "miracle" was performed is the invention of Dr. Arthur Korn, professor of electro-physics at the Berlin (Germany) High School of Technology. Tests of it have been under way between his laboratory at Centecello, a suburb of Rome, and the United States Navy Radio Station at Otter Cliffs, Bar Harbor, for some time, but the first practical demonstration was made a little over a week ago when the World published the picture given on page 2, and which was sent by Radio across the ocean, a distance of 3,232 miles.

Shows Basic Method Sound.

Over shorter distances and under more favorable conditions pictures have been

(Continued on page 2)

MOOSE WILL HEAR DEDICATION TALK

Illinois Order to Broadcast Speech at Opening of New Tower

(Special to RADIO DIGEST)

MOOSEHEART, ILL.—A Radio broadcasting station will shortly be established by the Loyal Order of Moose here on the new Campanile or bell tower to be dedicated during the week commencing August 21st. Speeches made at the monthly meetings of the Board of Governors of the Loyal Order will be broadcasted so that all the lodges of the Moose can pick up the proceedings. It is planned that each lodge room be equipped with a suitable apparatus for receiving speeches and matter sent out from Mooseheart; enabling them to keep in direct touch with national headquarters.

Form Organization To List All Calls

Indiana Fans Use Postcards to Correspond with Each Other

(Special to RADIO DIGEST)

INDIANAPOLIS.—All licensed amateur Radio operators in Indiana are interested in the "Unorganized Organizations." The men and boys included in this body are always interested in learning the various distances at which their sending sets are heard and are interested in the description of sets belonging to other operators. Members of the organization have postcards by which they correspond with each other. These postcards contain blanks for the names, address, station code, description of their sets and remarks. These are sent from man to man or boy to boy as the case may be.

BEATS ALL RECORDS ON TRAIN RECEPTION

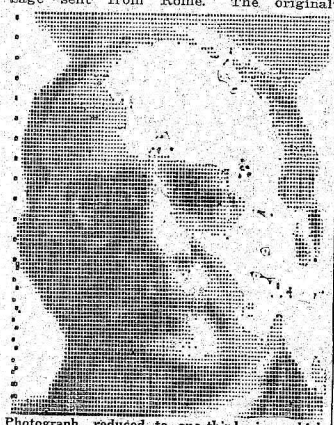
MEMPHIS, TENN. — While the members of a party were traveling on a train near Lula, Miss., the were "Listening in" on what was in the ether to while away the time. The train was traveling at thirty miles an hour and the party clearly heard the Hatfield Electric Company broadcasting station at Indianapolis, Ind., WOH. The location of the train was 530 miles from Indianapolis.

RADIO PHOTO

(Continued from page 1)

transmitted and reproduced by the Korn system with surprising clarity of detail. The picture produced herewith is evidence that the basic method is sound and that with refinements of the mechanical processes and certain elaborations of their use, the time soon may come when pictorial records of events will be available as speedily and as accurately as descriptions of them already are.

The small picture appearing below was photographed from the "translation" made at Bar Harbor of the picture message sent from Rome. The original



Photograph, reduced to one-third size, which was sent from Centecello, Italy, to Nauen, Germany, and then by Radio to Bar Harbor, Maine.

measured 7 by 9½ inches, so that the reproduction given is only one-third size. It portrays vividly the method used. The code message reproduced is a part of that used in transmitting the picture while the map shows the route traversed from Rome to Nauen, Germany, and from Nauen to Bar Harbor. A portrait of Dr. Korn is also given.

The feat was accomplished by an entirely new and distinct process. Before the war, Dr. Korn had invented and carried to some degree of perfection a method of transmitting photographs by wire telegraph. Opening of hostilities, however, brought to an end tests which had been arranged between several of the European countries.

Experiments Since 1900.

Since 1900 Dr. Korn has been working on his scheme. His efforts were entirely in the direction of wire telegraphy of pictures until more recently when the degree of perfection of Radio caused him to consider its use.

The first public demonstration of the Korn method of transmittng photographs thrugh the air took place a few months ago in Rome, where in the presence of the King and Queen of Italy, a photograph was Radioed to Berlin, where it was reproduced in a newspaper and actually on sale in the streets just one hour after the picture had been handed to the operator in Rome.

Since then many pictures have been sent by Radio from Rome to vessels far out at sea and to many European cities and reproduced at the receiving places as perfectly good half tone pictures.

Photographs Become Messages

Wherever it is possible to telegraph or Radio, there it is possible to send photographs, provided, of course, the instruments which decode them are present. Photographs under the Korn system are translated at the sending end into groups of letters, each letter representing a certain degree of darkness or lightness, and the code words formed by these groups are sent as is an ordinary message.

The Korn sending machine does the translating or coding automatically, and the receiving machine decodes back into a picture also automatically. Its accuracy is that of an ordinary telegram or Radiogram, and the operator of the receiving machine can detect and rectify errors in transmission more easily than a stenographer can correct misplaced letters on a typewriter.

The sending apparatus, as it exists now, is an exceedingly complex and bulky machine, built in Dr. Korn's laboratory for experimental purposes. The receiving machine is simple and portable, however. Without entering into a minute technical description of the process, the principles of it will easily be understood from the following:

How the Machine Works

If you look through a strong magnifying glass at a half-tone picture in a newspaper or magazine you will observe it to be made up of a multiplicity of tiny dots, the very light parts being of small dots widely spaced, the very dark spots of larger dots close together. In the original photograph from which such a half-tone is made there is an infinite number of values of light and shade; in the reproduction an approximation to these is obtained by the size and spacing of the dots. Prof. Korn, on analyzing photographs and half-tones, realized that for practical purposes all the values of light and shade could be reproduced with from 15 to 20 sizes of dots.

Suppose, for example, we take seventeen different sizes of dots and give to each a letter, say A for the smallest and P for the largest, the intermediate letters being for the intermediate shades. Now, if we can construct an apparatus which will automatically translate these seventeen values into seventeen corresponding letters and print these letters on a tape, we have a code which can be sent by wire or wireless to any place in the world, and if we have a typewriter that prints, instead of the letters indicated on the keys, the large or small dots which correspond to those letters, we can decode or translate that telegraphic or Radiographic message into a half-tone picture.

This is just what Prof. Korn did.

Point of Light Turns Trick

As has been said, the machine which does the coding is quite complex. In making a half-tone picture direct from a photograph, a wire screen with larger or smaller mesh, according to the fineness of the half-tone desired, is placed over the face of the picture and a negative photograph is taken through the screen, thus producing the dots.

The Korn apparatus uses no screen, but a point of brilliant light traveling over the photograph, being cut on and off rhythmically by a commutator in such a way that it strikes the picture at accurately spaced points, working very much like the light of a moving picture machine. An ordinary cabinet size photograph receives the light at about 1,000 points.

The light passing through the negative falls upon a selenium cell, the quantity

Dr. Arthur Korn, inventor of the wire telegraph and Radio schemes for transmission of photographs

passing through depending on the darkness or lightness of the spot through which it passes. Selenium is a mineral crystal endowed with the peculiar property of passing an electric current only when exposed to light and of changing its electric resistance according to the degree of light that reaches it. Selenium is exquisitely sensitive and the slightest variation in the light is accompanied instantly by corresponding variation in the electric current passing through it.

Selenium Controls Keys

Prof. Korn makes use of selenium by placing a cell of it in the transparent cylinder on which the negative is coiled, and as the latter slowly revolves the light that passes through the negative falls on the selenium. A current of electricity from a battery passes through the selenium, and its resistance is varied by the values of the light.

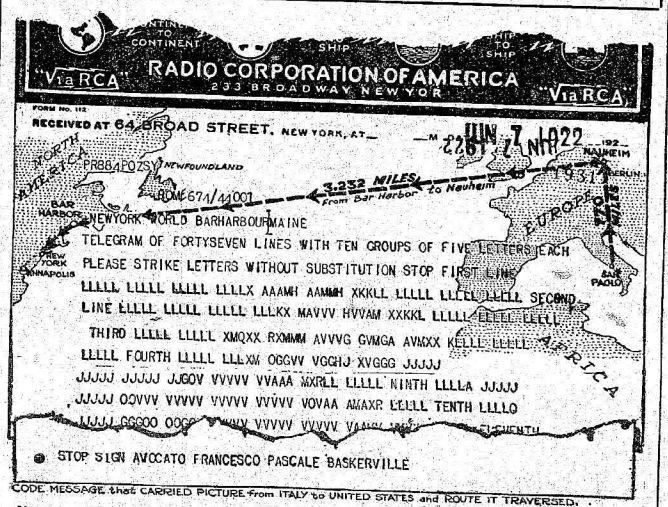
Each variation of resistance—of which in this case there would be seventeen—controls a key which drops to print a letter on a tape the instant it is actuated by the electric current. The mechanism by which the present Korn machine does this is too complex to describe here; suffice to say that it prints the letter which corresponds to the particular shade of the photograph.

"Words" Transmit Pictures

In "coding" a picture we get about 1,000 letters. These are grouped by spacing into about 300 "words" which are sent by Radio (or by telegraph) to any place. They are received by an ordinary telegraph or Radio operator or by an automatic telegraphic receiving apparatus.

To decode or turn this word message back into a picture a Korn decoding instrument is necessary. This is a form of typewriter into which a sheet of paper about twelve by fifteen inches in size is placed. With the printed message before him the operator copies it on the keys; these, however, do not print letters, but dots of the sizes and shapes corresponding to the letters. As the code allows for the blank spaces between the dots the result is a very much enlarged half-tone of the original photograph, and this needs only to be photographed down to the size wanted by the paper; the smaller it is the finer the half-tone. This decoding instrument may be attached to an automatic telegraph receiving machine in such a way that the code letters are entirely cut out and the telegraph machine prints the dots directly.

RADIOGRAM CARRIES PHOTOGRAPH FROM ITALY TO UNITED STATES IN RECORD TIME



CODE MESSAGE that CARRIED PICTURE from ITALY to UNITED STATES and ROUTE IT TRAVERSED.

RECEIVING RECORDS? WATCH 'EM GROW—

THE race continues! Amateurs who are able to beat the records listed below, or who can claim distance receiving records (100 miles or better) for stations not listed below, but which are given in the broadcasting directory, need only send in their records to be listed along with their names.

One condition exists. Every record aspirant MUST GIVE the NUMBER OF MILES represented by the record, if his letter is to be considered. Otherwise it will be thrown out.

Records to date are given below.

—Broadcast Editor.

Station, Miles Record, and By Whom Heard.

DD5—1,265—C. D. Mason, Cleveland, O.
KDAF—530—L. A. S. Spalding, Hudson, Mich.
KDKA—1,150—D. Keigley, Miami, Okla.
KDOW—1,700—W. A. Knight, Hudson, Mass.
DKYQ—2,250—C. M. Rice Jr., Worcester, Mass.
KDYQ—2,250—C. M. Rice Jr., Worcester, Mass.
KDN—700—E. Thornton, Walla Walla, Wash.
KFC—880—6BNG—Watsonville, Calif.
KFU—700—E. Thornton, Walla Walla, Wash.
KFV—150—E. Thornton, Walla Walla, Wash.

(Continued on page 9)

Radio Digest Illustrated

TRADE MARK

Published Weekly by E. C. RAYNER, Publisher
123 West Madison Street, CHICAGO, ILLINOIS

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

Entered as second-class matter April 27, 1922, at the postoffice at Chicago, Illinois, under the Act of March 3, 1879.

Vol. 1 Chicago, Saturday, June 24, 1922 No. 11

CONTENTS

Looking Ahead

The Vacuum Tube. The Seventh Article of the Series by Peter J. M. Clute. This Article is Section Two of Crystal and Vacuum Tube Detectors.

Standardized Series Covering Panel Units for Different Types of Tuners, Radio Frequency and Audio Frequency. There will be a Special Feature Showing the Circuits. This Series will be Written by Harry J. Marx. They will Start in a Future Number of Radio Digest.

"How to Make Department." Summer Ideas for Making and Using Sets will Predominate in the Coming Numbers.

Broadcasting Directory. Correct Station and Schedule Lists. The List Grows all the Time.

Famous Stations You May Have Heard. One or More of These Stations are Shown Each Week.

Radio Illustrated. You will see all of the Very Latest Pictures on This Page.

SUCCESSFUL TEST ON MOVING TRAIN

OKLAHOMA MAKES RECORD ON 100 MILE RANGE

Daily Paper Stages Tryout on Western Rails—Successful During Severe Storm

By Robert M. Reed

(Special to RADIO DIGEST)

OKLAHOMA CITY, OKLA.—The Daily Oklahoman co-operating with the St. Louis and San Francisco railroad, the Oklahoma Radio shop and the government station at Post Field, Okla., accomplished recently a feat yet to be equalled by any other Radio broadcasting station or railroad—the feat of receiving and transmitting messages on a moving train from a distance greater than twenty-five miles from the broadcasting station.

Equipped with a regenerative receiving set with four stages of amplification, a loud speaker, a 100-watt transmitter and a novel antenna, consisting of four, four-wire cage antennas strung from one car to the other, the car was attached to Frisco train No. 9 at Oklahoma City on the morning of May 30 and hauled to Lawton, Okla., a distance of 100 miles.

Encounter Electric Storm

At Mustang, Okla., thirty miles from Oklahoma City, a severe electrical storm was encountered but signals were received and little static encountered. In fact the signals and music came in so loud that they almost drowned out the static. Constant communication was kept up between WKY, Oklahoma City, and DM6, Post Field, and the phone conversations were heard with great clarity.

At Cement, Okla., sixty miles from Oklahoma City and forty miles from Post Field, the signals, music, weather reports and Liberty bond quotations were received with as much clearness as they were at Wheatland, Okla., only 16 miles from Oklahoma City.

With a thousand reasons why the apparatus should not have worked and only a few why it should, the entire run of 100 miles with constant communications kept up between WKY-DM6 and the train, marks an epoch in the use of Radio on moving trains.

CINCINNATI FIRM WILL RADIO KENTUCKY RACE

Results of Southern Special to Be Airphoned to Fans

CINCINNATI, OHIO.—For the first time in the history of Radio there will be broadcast by the Crosley Manufacturing Company of this city, an account of a horse race as it is announced by the caller in the judge's stand at the Latonia Race Track. The race picked out for this unique plan is the great Kentucky Special, to be run about 4 p. m., June 24th. This will be a one and one quarter-mile race for three year olds, with a $50,000 purse added, and will be one of the most important races of the year.

Arrangements have been made with a telephone company by which the voice of Jack Dempsey, when he is calling the position of the horses at the various stages of the race, will be carried to broadcasting station WLW over the wire phone. At the station the voice will be amplified and transmitted by Radio to the thousands of persons throughout the country who will be listening in. In other words, owners of receiving sets and their friends will be able to hear Dempsey, who is famous nationally for his ability to call horses at the various posts, announce the exact positions of the horses throughout the race, and will know the winner as soon as the great event is over.

SHOW IN BALTIMORE STARTS JULY TENTH

BALTIMORE, MD.—The Export and Import Board of trade in conjunction with the Maryland Radio Association will hold a Radio exposition in the Fifth Regiment Armory starting July 10th. It is estimated that there will be 100,000 people in attendance. Admittance will be free at the gate to all amateurs by invitation. The message of the Association will be made known to all third district amateurs.

FOLLIES WILL JAZZ TO AIRPHONE MUSIC

NEW YORK—The Ziegfeld Follies of 1922-23 beauties will dance this year to the jazzy music of the snappy Radio waves according to a person who knows. A large cabinet-grand Radio receiving instrument has been installed in the theatre to receive Radio music from broadcasting stations throughout the country. Radio dealers expect an increase in sales through "Johnnies" buying portable sets.

PETITE MISS LISTENS IN AT TEE

© INT.

Miss Virginia Rea, Coloratura Soprano, stopping in her round on Eastern links to hear the news

ALL COOKING BY RADIO

Muncie Food Show Puts on Unique Culinary Stunt

MUNCIE, IND.—While an admiring and awe stricken crowd of women looked on, a loaf of bread was baked to perfection recently by Radio at a local pure food show. The actual cooking was done by electricity, current for which was controlled by Radio. Bacon was fried in the same manner. Various foods were to have been cooked in the same way each night of the show. It was said to be the first attempt at Radio cooking and was pronounced a success. The Radio apparatus was placed in one end of the long Chamber of Commerce auditorium and the electric heater in the other.

EXPERIMENT WITH STATIC

Compass Stations of Navy to Conduct Special Tests

(Special to RADIO DIGEST)

WASHINGTON—Plans for the study of the well-known static in connection with its possible relation to storm centers, have been announced by the Navy Department for the summer months. All Radio Compass stations, especially those along the southern and gulf coasts, will co-operate with the Weather Bureau in taking Radio-compass bearings on all static disturbances three times daily, in an effort to determine whether or not there is any connection between the center of electrical disturbances and the centers of storms.

PLAN BETTER RADIO SERVICE FOR FARMS

HOUSE COMMITTEE GIVES FAVORABLE REPORT

Resolution to Furnish Farmers with Daily Market Prices of All Kinds

(Special to RADIO DIGEST)

WASHINGTON, June—The House Committee on Agriculture has favorably reported out of committee the resolution directing the Department of Agriculture and the Post Office Department to investigate the feasibility of furnishing market prices of cotton, corn, wheat, live stock, and dairy products by Radiophone to the farmers. The committee in reporting the resolution out says:

"The resolution reported herewith directs the Department of Agriculture and the Post Office Department to make an investigation as to the feasibility of supplying growers and producers with daily Radiophone reports of the market prices of cotton, corn, wheat, live stock, and dairy products; and to ascertain the expense of furnishing these Radiophone market reports. It contemplates that the broadcasting would be done by the air mail service, Post Office Department, and directs that service to furnish a statement of the manner and means by which these reports may be furnished, what would be necessary for the different cities, towns, and individuals to do to receive the service, and what it would cost to provide the equipment necessary for receiving such reports. It directs the Department of Agriculture and the Post Office Department to make a report of their investigation and findings, with such recommendations as they may see fit to submit, within 30 days from the passage of the resolution. The adoption of the resolution does not involve any expenditure on the part of the Government but merely directs an investigation as to the feasibility and cost of this market news service Radiophone.

Spring New Scheme For Wired Radio

Farmers to Get Market Reports by Using Local Power Line Sets

(Special to RADIO DIGEST)

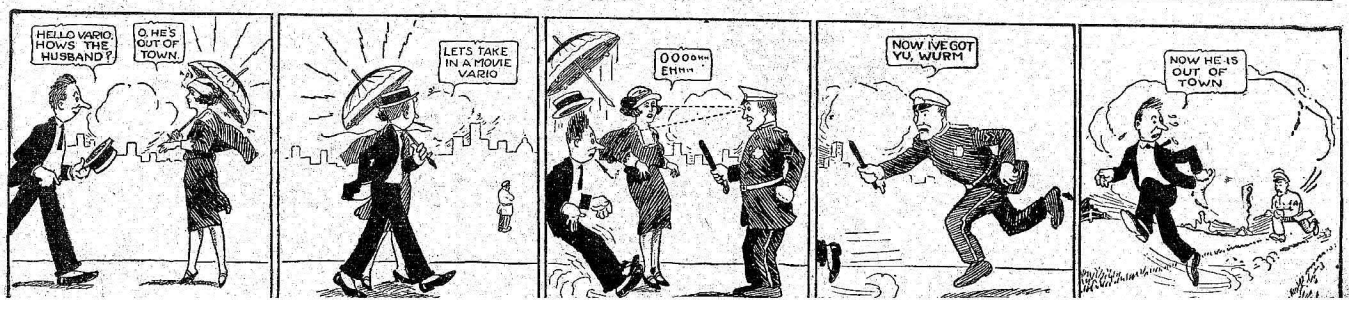
NEW YORK—A new scheme for "wired Radio" is in contemplation by certain Radio experts, by means of which millions of farmers now out of the regular broadcasting range will be enabled to "listen in" to market and agricultural reports with small crystal sets, which have a receiving range of 15 to 25 miles.

The scheme takes into consideration the broadcasting of speech by means of the electrical power lines which cover the country with a network of wires. A sending station may be at one end of a wire which penetrates many miles into the "backwoods," and any farmer who is located less than thirty miles or so from this wire, anywhere along the route, can "listen in" with ease, on a low-priced crystal outfit.

Detroit News Orchestra Nightly Feature on WWJ

DETROIT, MICH.—The Detroit News has organized the Detroit News Orchestra, which will be a regular nightly feature of the News' WWJ Radio programs. In addition to these programs, the orchestra will also play elsewhere under the auspices of the News as a compliment to its readers.

THE ANTENNA BROTHERS — Spir L. and Lew P. — OUT OF RANGE



How to Make a Canoe Receiving Set

Receiving Set Readily Installed in Any Canoe

With the summer and vacation time confronting us, the Radio amateur begins to contemplate the trips to the seashore and the mountains. His receiving set is not forgotten. Receiving should take a natural place in the routine of summer sports.

WORKSHOP KINKS? EARN A DOLLAR—

THERE are many little kinks worked out at home that would aid your fellow Radio worker if he only knew about them. There are new hook-ups, new ways of making parts and various unique ways of operating sets that are discovered every day. RADIO DIGEST is very much interested in securing such material. Send them in with full details, including stamped envelope so rejected copy may be returned. The work must be entirely original, not copied.

RADIO KINKS DEPARTMENT,
RADIO DIGEST,
123 West Madison St., Chicago, Ill.

Radio sets are found installed on the automobile, in the summer camp, at the seashore, in the mountains, on the sail boat, yacht, canoes and row boats. Even the aeroplane is found equipped with this source of recreation that has fascinated the entire country. As a part of a series that RADIO DIGEST is presenting, on the application of the Radio receiving set for summer-time recreation, the installation in a canoe is illustrated and described.

The loop aerial adapts itself as the most practical for canoe installation. The cross-pieces are made up of two lengths of wood, 6 feet long by 2 inches square, crossed and joined at the center. Dowels are glued in the arms of the frame, as shown, about 1 inch apart, inserting eight dowels in the end of each arm except on top where nine are inserted. The frame is then shellacked with a good grade of waterproof shellac.

The winding consists of No. 14 wire run around the dowels, as indicated in figure 1. Two binding posts are placed on the horizontal cross-piece.

At the base of the vertical arm the threaded pin is inserted. This pivot screw passes through a baseboard and is fastened with a thumb screw from the other side. The baseboard is about 1 inch thick and 6 inches wide and long enough to rest on the gunwales of the canoe. Four hook clamps, passing through the ends of the baseboard clamp the board to the gunwales of the canoe.

The loop aerial is not adapted to use with the crystal set or even a detector vacuum tube set. It is usually very difficult to receive signals sufficiently loud to make them audible and for that reason where the loop aerial is to be used, at least one stage of Radio frequency is advisable.

In Figure 2, a good 1-stage of Radio frequency with vacuum tube detector circuit is shown. It is very desirable to add more stages if the expense is not beyond the limit of the amateur.

LOOP AERIAL USED ON CANOE

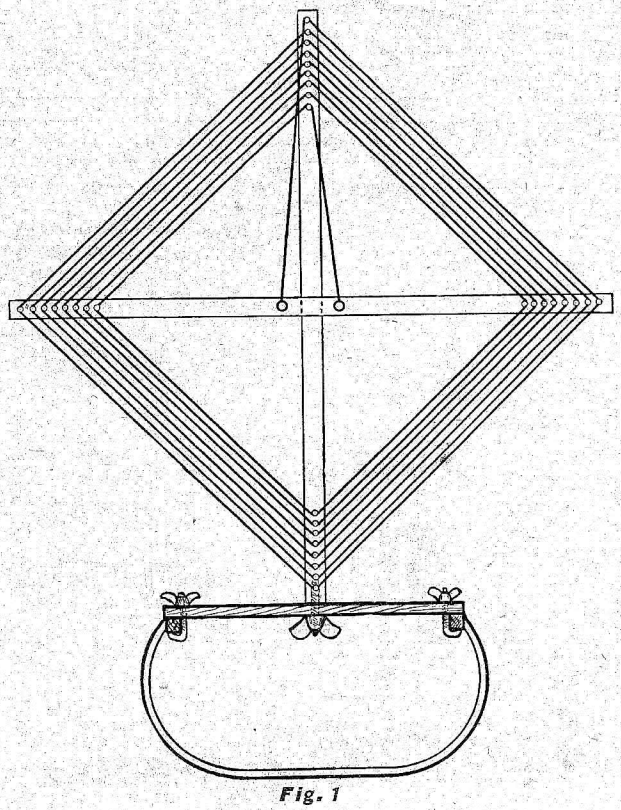


Fig. 1

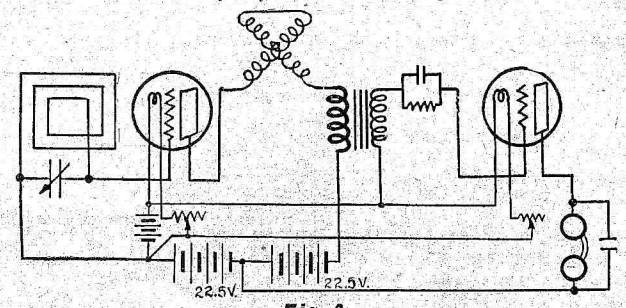


Fig. 2

Recording Coupling Measures

If it is desired to jot down notes on the position of the instruments while copying

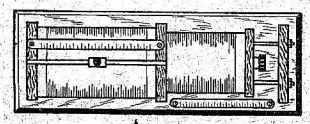


FIG. 1

A very effective way to measure the coupling of a loose coupler is to fasten a rule, preferably marked in centimeters, on the ends of the primary parallel to the slider, as shown in Figure 1. The rule may be screwed to the base of the coupler under the rods which support the sliding secondary, in such a position as to be easily seen. This will measure the coupling.

The honeycomb type coil presents a more difficult problem. The old method of measuring with a ruler the distance between their extreme ends is slow and inaccurate. A much easier and quicker method is to place a protractor where the coils separate, at the mounting or panel and then the coupling can be recorded in degrees. The illustration, Figure 2, shows how this may be accomplished. With

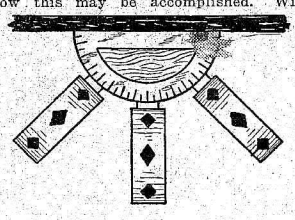


FIG. 2

these simple additions any amateur can

Battery Cap Makes Crystal Cup

If you have an old style dry cell of battery which has a metal cap over the center carbon stick, this cap can be of service in your crystal receiving set. Remove the metal cap, drill a hole in the side and tap the hole for a machine screw. When assembled it makes an admirable crystal cup. It can be used for either table or panel mounting by means of the bolt already attached.—James M. Hale.

Winding All Coils Even Makes Them Look Well

In winding coils, both for transformers and receiving sets some trouble is encountered in keeping the turns against one another for the whole circumference of the coil. I have wound quite a number of coils and until I wound my continuous wave transformer I had a hard time of it. My method for winding coils is as follows:

The first thing to do is to fasten the spool of wire to be used on a rod of some kind and hang it as near the ceiling as possible so that the wire will be out of the way as the winding proceeds. The next thing to do is to fasten the wire to the tube you wish to wind the coil on, starting the winding at the left end of the tube.

Roll the tube across a flat surface, such as a table top with the right hand and guide the wire with the left. When the center of the coil is reached the position of the hands must be changed as follows: Roll the tube with the left hand and guide the wire with the right.

If this plan is followed out it will be found to give very satisfactory results. I wound a secondary coil of 2,800 turns in three evenings and did the work easily.—John H. Boos, Jr.

Holding Detector Adjustment

To keep a crystal detector in adjustment first find its most sensitive spot by a buzzer test. When the point of the "cat whisker" is adjusted, drop some hot bees wax or paraffin around the point. In practice this has kept the whisker in the right place for months. It eliminates the necessity of seeking the desired sensitive spot every time the set is to be used.

STATION KDN FAMOUS IN WEST

Fairmont Hotel Plant Passes Two Year Mark with Many Laurels

Permits No Advertising

Well-Known Broadcaster Helps San Francisco Police Dept. Catch Criminals

By Earl Ennis

(Special to RADIO DIGEST)

The Radio history of the Pacific Coast, like much of the development record of the West, is a chapter of primitive pioneering—of advancement in the face of difficulty, of belief in a fundamental destiny, and of valiant adherence to the minutiae of achievement. In this chapter of hard won success, no one element stands forth more conspicuously than the now-famous Fairmont Hotel Radiophone station in San Francisco—known familiarly to 50,000 nightly listeners as "KDN" in the cabalism of government designation.

The Fairmont Hotel made its initial bow, as a Radiophone broadcasting headquarters more than two years ago. At that time, broadcasting was considered a romance of the east coast, more fanciful and experimental than of practical commercial and entertainment value. To Leo J. Meyberg, head of a San Francisco electrical concern, and Sheldon Peterson, his chief engineer, belong the credit of prophetic vision which led them to plunge where others feared to tread. Out of this vision was born San Francisco's first systematized Radio headquarters.

Open Station with Surprise

The original installation was a 5-watt equipment, using the well-known Heising modulation circuit. The instruments were installed under the personal direction of Peterson. There were, at that time, approximately 10,000 amateurs in the San Francisco bay district comprising nearly a score of cities and towns, and probably 25,000 amateurs in all, scattered along the immediate coast. To the ears of these, one summer night was brought, over busy air lanes, for the first time, the Fairmont's opening Radio program.

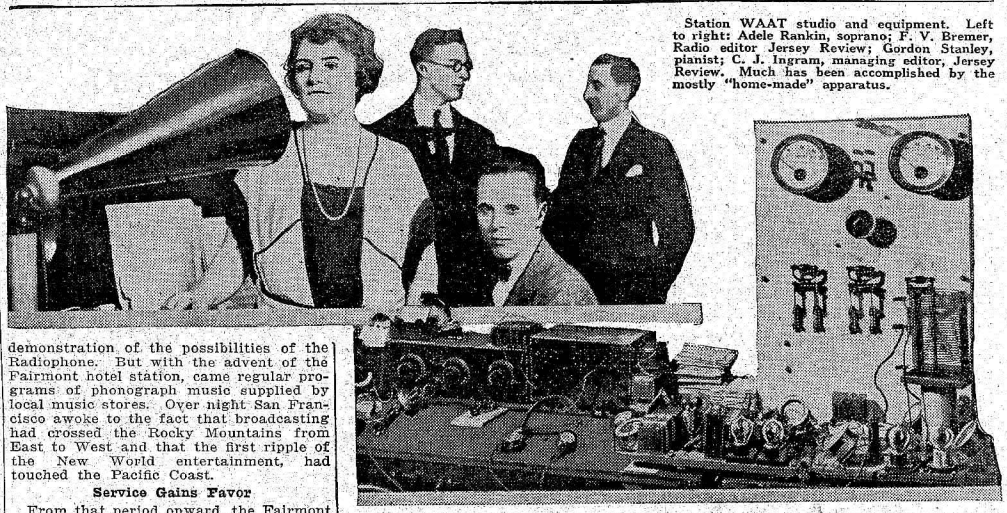
There had been other experimental Radio work done on the coast prior to that date—work that had resulted in various installations, and a partially successful demonstration of the possibilities of the Radiophone. But with the advent of the Fairmont hotel station, came regular programs of phonograph music supplied by local music stores. Over night San Francisco awoke to the fact that broadcasting had crossed the Rocky Mountains from East to West and that the first ripple of the New World entertainment, had touched the Pacific Coast.

Service Gains Favor

From that period onward, the Fairmont Hotel won fame for its nightly offerings. From the swaddling clothes period, it advanced into broader fields. From the valleys of the Sacramento and San Joaquin rivers—from rural communities, from farmers in distant points, who read in the newspapers of the Fairmont Hotel programs, came requests for stock and market quotations. This was answered by the Meyberg company with a regularly established stock market and United States Government Weather Bureau service.

Standard quotations were flashed from the antenna of the Fairmont hotel station for more than 1,000 miles inland. Growers and agriculturists grew to depend upon the butter and egg quotations received by Radio from San Francisco, as a valuable asset to their shipping operations. The latest figures, over the stock exchange wires, altered the price conditions in the local markets in the San Francisco bay districts and commission houses found the producer intelligently informed on prices of which he had previously been ignorant. The circumstance went down in Radio history as another milestone of achievement.

(Continued on page 9)



Station WAAT studio and equipment. Left to right: Adele Rankin, soprano; F. V. Bremer, Radio editor Jersey Review; Gordon Stanley, pianist; C. J. Ingram, managing editor, Jersey Review. Much has been accomplished by the mostly "home-made" apparatus.

WAAT, Jersey Review Claims Pioneer Honor

Began Broadcasts Before Amateur Stations Were Barred

By Frank V. Bremer

(Special to RADIO DIGEST)

Radiophone station WAAT operated by the Jersey Review, Jersey City, N. J., was one of the first stations in the United States to operate on a regular scheduled program. The station formerly known as 2IA was licensed as an amateur station and used for the first time on January 11, 1922 for Radiophone work. Previously, except during the war period, Station 2IA had been a spark transmitter.

On January 11, 1922, a regular schedule of Radiophone broadcasting was commenced by the Jersey Review. At that time the ban had not been placed upon amateur broadcasting and the station operated on a wave length of 200 meters. Regular programs ever since that time have been broadcast on Wednesday and Sunday evenings, commencing at 6:57 p. m. with a phonograph record for a tuning test, and continuing for about an hour or a little more.

Heard Over Wide Area

When the government placed a ban on amateur broadcasting, stations 2IA was changed to WAAT and commenced operating on 360 meters.

Low power is used at WAAT and modulation rather than distance is sought. The programs have been reported by over 1,100 stations, having been heard by operators in the first, second, third, fourth, fifth, eighth, and ninth districts. This is remarkable when it is considered that Station WAAT uses but 2 five-watt tubes for oscillators, 2 five-watt tubes for modulators, and one five-watt tube as speech amplifier. The greatest distance at which WAAT has been heard is Memphis, Tenn., where Station 5EK managed to tune in. Programs from WAAT are regularly tuned in at points 150 miles away and all report exceptionally fine modulation.

Broadcast Concerts Mainly

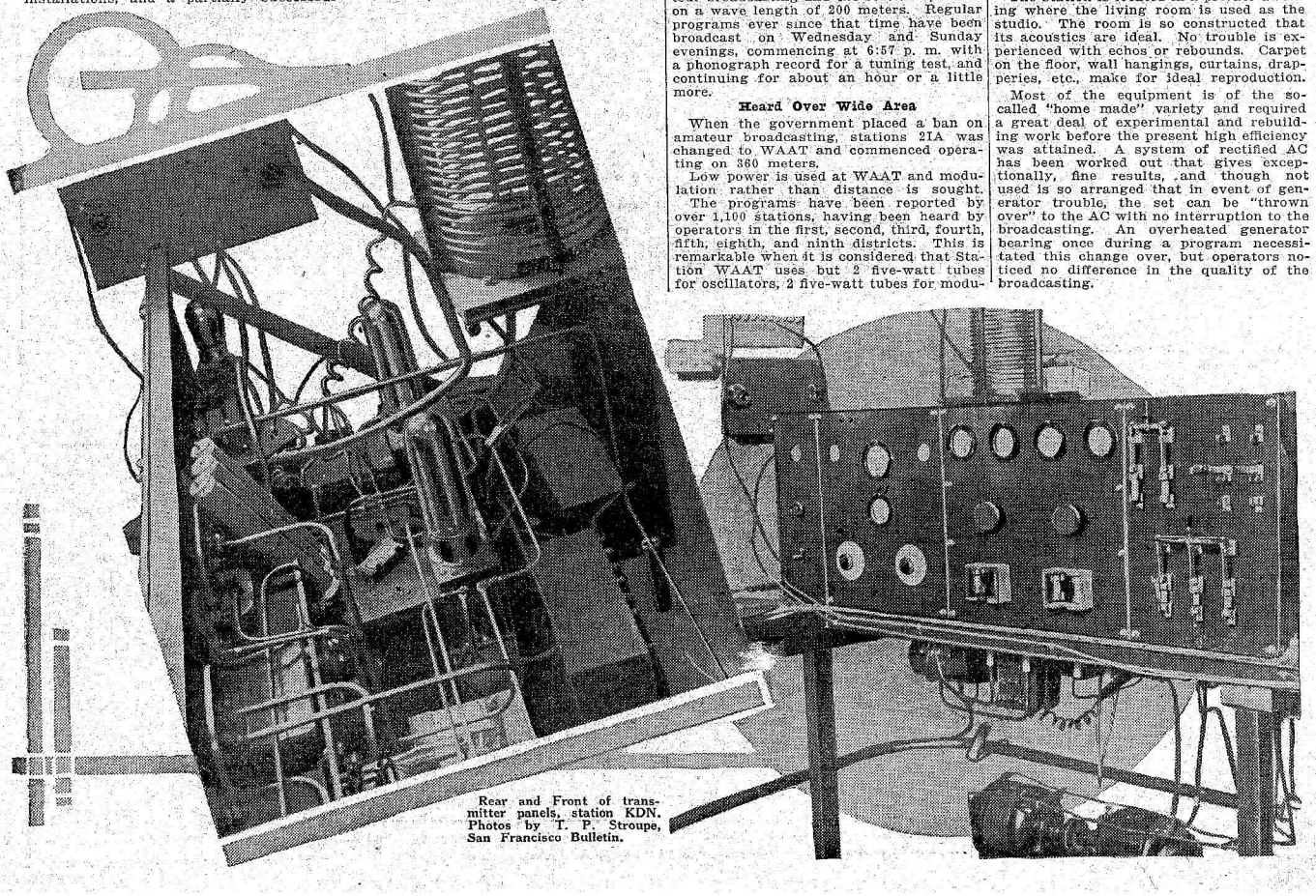
Programs broadcasted by the Jersey Review are principally of the concert or operatic type, though an occasional evening of dance music and 'Radio party' is broadcasted. That the offerings are appreciated is attested by the enthusiastic phone reports that are received at the station during a program.

On Wednesdays the program is usually a fifteen minute address by a prominent judge, or leader in some profession, and followed by a concert given by well known vocal and instrumental artists. On Sunday evening a half hour Radio chapel Vesper service is broadcast from 7 to 7:30 p. m. following which a musicale is given.

Experiment With Acoustics

The station is located in a private dwelling where the living room is used as the studio. The room is so constructed that its acoustics are ideal. No trouble is experienced with echos or rebounds. Carpet on the floor, wall hangings, curtains, draperies, etc., make for ideal reproduction.

Most of the equipment is of the so-called "home made" variety and required a great deal of experimental and rebuilding work before the present high efficiency was attained. A system of rectified AC has been worked out that gives exceptionally, fine results, and though not used is so arranged that in event of generator trouble, the set can be "thrown over" to the AC with no interruption to the broadcasting. An overheated generator bearing once during a program necessitated this change over, but operators noticed no difference in the quality of the broadcasting.



Rear and Front of transmitter panels, station KDN. Photos by T. P. Stroupe, San Francisco Bulletin.

DESCRIBES TRESCO UNIT NUMBER SU-3

SECTIONAL SET PERMITS ADDITIONAL PARTS

Is Licensed Under Armstrong Patent—Provided with Battery Panel and Ammeter

(See Diagram, Page 7)

The set shown in this number is the Tresco Sectional Universal Radio Receiving set No. SU-3, manufactured by the Tresco Radio Company of Davenport, Iowa. The circuit is the Armstrong Regenerative, licensed under patent 1113149.

This Sectional Receiving set consists of 3 separate units sold either jointly or separately as desired. Unit No. 1 shown on the left in the front view is the tuner and detector, a complete Radio Receiver in itself when the vacuum tube, "A" and "B" batteries and phones are added. Unit No. 2, the center one shown in the diagram, is a storage battery cabinet that offers a little relief from the monotonous similarity of the average standard receiving sets. The "A" storage battery is hidden away, eliminating the usual unsightly wires. An ammeter indicates the flow of current to the filaments when the battery is discharging. Binding posts in the rear offer a means of connections for recharging battery as desired. The ammeter under these conditions indicates the actual charging current. Unit 3 shown on the right of the section is a 2 stage amplifier. A top and base furnished with the three units permitting them to set into the base and top without the addition of screws or bolts.

Inter-Unit Connections

When the three units are set in the base, the four binding posts on the right hand side of unit No. 1 line up with the four on the left hand side of unit No. 2. Likewise the four on the right hand side of unit No. 2 are in line with the four on the left hand side of unit No. 3. These binding posts are connected in pairs, lining up with each other as indicated in the diagram. The two binding posts on the right hand side of unit No. 3 are for the connection of the phone receivers or loud speaker.

Battery Connections

Looking at the set from the rear, we find that the center or battery cabinet provides ample space for the storage battery. The negative terminal of the "A" battery connects to the one terminal on the ammeter wire. The positive terminal of the battery connects to the binding post, next to the second lowest binding post on the right hand side (rear view). In diagram the battery is shown outside of the cabinet, merely to avoid the obstruction of the interior view.

The battery can be installed inside of the detector unit with ample room to spare.

The two binding posts on the base of the center unit (rear view) are the terminals for connections, when charging the storage battery, or can also be used for the battery connections to the loud speaker when desired. The right hand unit in the rear view, is the tuner and detector, the "B" or plate battery of this unit, should be of the 22½ volt type. The positive side is connected to the wire running from the vacuum tube socket, the connection for the negative side is for the lower wire running from the interior. The two binding posts on the base of the detector unit, are for the aerial and ground connection, the one to the right for the antenna lead, and the one to the left running to the ground.

The amplifier unit requires three 22½ volt "B" batteries, conected in series. The positive terminal running to the wire on the left hand side (rear view) and the negative terminal with the wire on the right hand side. Likewise these batteries can be inserted in the amplifier panel. These panels are furnished with doors in rear, keeping the batteries dustproof, and eliminating the necessity of unsightly battery boxes in the neighborhood of an otherwise very decorative receiving unit.

Tuning Control

The dial in the upper left hand corner of the detector unit, operates a variable condenser in series with the tickler coil, thus controlling the finer adjustment of the plate or feed back circuit.

The other dial in the detector unit operates the variable condenser, shunted across the secondary coil, thus controlling the finer tuning adjustment to proper wave length of the secondary circuit.

The knob of the tapped switch directly under the nameplate, controls the tapped winding of the primary coil. Therefore, this knob is the means of tuning the primary or antenna circuit to the proper wave length.

The knob of the tapped switch on the left hand side, controls the adjustment of the tapped winding on the secondary coil thus permitting the adjustment for tuning of the secondary circuit by means of the variation in the inductance of that coil. The lower tapped switch controls the adjustment of the tapped winding of the tickler coil, in this way permitting an increase or decrease in the inductive effect in the plate or feed back circuit.

The knob in the lower right hand corner of the detector unit operates the filament rheostat, and therefore, controls the voltage of the filament current in the detector vacuum tubes. The two similar knobs in the amplifier unit likewise control the voltage of the current to the filament of the amplifier tubes.

The ammeter in the battery panel, as stated before, indicates the charge and discharge of the "A" battery.

Tuning

The tuning of this set is very similar to that of any other standard set of the same type. The filament rheostats should be adjusted for the proper point of incondescanse of the tube filaments.

The primary knob is set for the proper wave length, then the secondary is adjusted in conjunction with the tickler knob. Finer control of adjustments is accomplished by means of the two dials on top. The taps are not so numerous in number that tuning would be difficult, in fact the adjustments are so limited that the number of combinations require very little waste of time in tuning, and thereby causing loss of part of the broadcasting.

The actual wave length range of this set runs from 160 to 600 meters.

Involute Coils

The Involute Coil, used by the Tresco people, is a type which they have been successfully using for a considerable length of time. They are of the Spider Web Type, and the three coils are wound in a compact unit. The theory is very similar to the average spider web coil and requires no special explanation.

Detroit Radio Firm Expands

DETROIT, MICH.—Expecting an unprecedented demand for Radio parts in the fall and winter months, the Fisher Tool & Supply Company of this city has announced a large expansion. The firm as a result of the expansion is in a position to supply whatever is needed in Radio manufacture. The company of which Roy R. Fisher is president, is sole distributor in the middle west for the Bakelite Company and Frost Radio materials.

Predicts Television By Radio in Near Future

Nikola Tesla Says No Limit to Distance

Nikola Tesla recently predicted that television, a method of seeing by Radio, soon will be in as common use as the telephone. There will be no limit to the distance of such transmission, predicts Mr. Tesla, so that we may be able to talk to and see at the same time any person in any part of the world. Mr. Tesla will be remembered for his research in power transmission by Radio.

Radio Receiving Sets

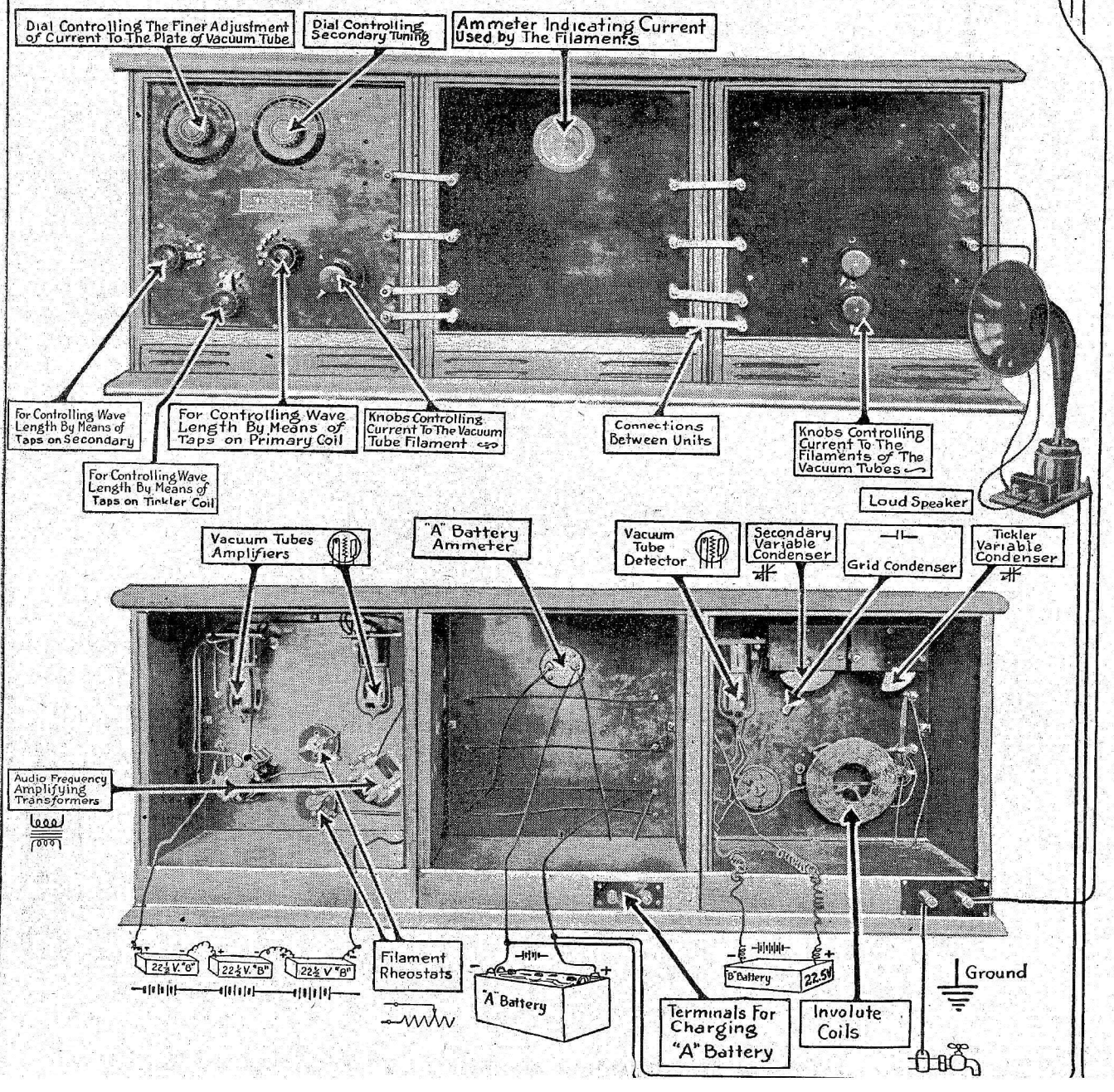
Tresco Sectional Universal Unit SU-3

Antenna

Pursuant to the policy of RADIO DIGEST to contain material of interest and help to beginners, the ninth of the series of standard receiving sets is given herewith.

The set shown below is known as the Tresco Sectional Universal Radio Receiving Set No. SU-3, and is manufactured by the Tresco Radio Company, Davenport, Iowa.

The front and back views of the unit show clearly what the various parts are and how they function. Although the novice may not possess a set of this manufacture, careful study of the photo diagram will aid in the understanding of the operation of his own apparatus. Complete instructions on the unit and details of its working will be found on page six, column one, this issue.



Radiophone Broadcasting Stations

Corrected Every Week.

CONTENTS AND HOW BEST TO USE

A CHANGE in the broadcasting station directory has been made in order to give RADIO DIGEST readers maximum information about each station in the most useful form for the user. The directory, now listing 389 broadcasting station in the United States, Canada and Hawaii, is, as it always has been, the most complete and authoritative directory of its kind. At much expense and trouble, this feature is revised and brought up-to-the-minute every week.

The station schedules, given below, are listed alphabetically by call letters. Following the call is given the city and state, the wave length (PROVIDING a wave length other than 360 meters is used), the miles range of the station, the owner of the station, the schedule of operating hours, and the kind of time used.

The state, city and call list given following the station schedule list is merely an index. One wishing to find the calls of the stations in his vicinity, will find this index useful. All licensed broadcasting stations in operation are given in the index, while only those which have made special reports to RADIO DIGEST, are given in the station schedule list.

Station Schedules

AGI, Presidio of San Francisco, Cal. 1,450 also. 50 mi. Signal Corps, U. S. A. Sun, 7-9 pm, instruction. Pacific.

CFCB, Vancouver, Canada. 440 only. 500 mi. Daily Province. Daily ex Sun, 8:30-9:30 pm, news, weather, concert. Pacific.

CFCF, Montreal, Can. 440 only. 200 mi. Marconi Co. Daily, 1-1:30 pm, concert. Mon, Thurs; 8-9 pm, concert. Eastern. Daylight saving.

CHCB, Toronto, Canada. 440 only. 500 mi. Marconi Co. Tues. 8-10 pm, concert. Eastern.

CHVC, Toronto, Canada. 410 only. 200 mi. Metropolitan Motors Co. Daily ex Sat and Sun, 5-5:30 pm, news, concert. Eastern.

CJCD, Toronto, Canada. 410 only. 200 mi. T. Eaton Co. Daily ex Sat and Sun, 4-4:30 pm, concert. Sat 11-12:30 pm, concert. Eastern.

CJNC, Winnipeg, Canada. 420 only. 500 mi. Tribune Newspaper Company. Daily ex Sun, 12-2 pm, markets, news; 7-10:30, concert, baseball. Sat, 2-3 pm or 3-5 "ladies' hour." Sun, 3-4 pm or 4-5, sacred concert; 8-10:30, concert. Central.

CKCE, Toronto, Canada. 450 only. 200 mi. Can. Indep. Tel. Co. (Toronto Star.) Daily ex Sun, 7-7:30 pm, baseball, stocks, concert, Tues, Fri, 8:30-9:30 pm, concert, address. Eastern.

DDI, Denver, Colo. 340 only. 1,500 mi. Fitzsimmons General Hospital. Daily ex Sun, 8:15 pm, weather, news, concert. Thurs, 8:15-9:30 pm, special concert, speech. Mountain.

KDKA, Pittsburgh, Pa. 1,000 mi. Westinghouse Elec. Mfg. Co. Daily ex Sun, 10-10:15 am, 12:30-1 pm, 2-2:20, 4-4:20, music; 7:30, bedtime story; 7:45, news; 8:30-9:30, music, news. Sat, 3-4 pm, concert. Sun, 10:45 am, 8 pm and 7:30, church service. Eastern.

KCN, San Francisco, Cal. 485 also. 250 mi. Geo. J. Meyberg Co. Daily ex Sun, 11-12 am, 1-2 pm, 4:30-5:30, concert; 7-7:15, weather; 8:30-9, concert. Sat, nothing after 5:30 pm. Sun, 10-11 am, sacred concert. Pacific.

KDPT, San Diego, Calif. 250 mi. Southern Elec. Co. Daily 7:30-9 pm, news, weather, concerts, lecture. Pacific.

KDYS, Great Falls, Mont. 200 mi. Tribune. Wed, 8-10 pm, bedtime story, concert. Sun, 4 pm, church service. Mountain.

KDZE, Seattle, Wash. 300 mi. The Rhodes Co. Daily ex Sun, 3:30-4:15 pm. Mon, Wed, Fri, 7:15-8:15 pm. Pacific.

KFC, Seattle, Wash. 700 mi. Northern Radio & Electric Co. Daily, eight hours, miscellaneous. Pacific.

KFI, Los Angeles, Calif. 200 mi. Earle C. Anthony, Inc. Daily, 1:15-2:30 pm; music, news; 4:30-5, news. Sun, 10:45-11:30 am, 4-5 pm. Pacific.

KFU, Gridley, Cal. 500 mi. Precision Shop. Mon, Thurs, Sun, 8-9 pm, concert. Sun, 3-4 pm, concert. Pacific.

KFZ, Spokane, Wash. 300 mi. Doerr Mitchell Elec. Co. Daily ex Sun, 7:30-8:30 pm, concerts and voice. Pacific.

KGB, Tacoma, Wash. 200 mi. Wm. A. Mullins Elec. Co. (Tacoma Ledger.) Daily, 4-5 pm, 7:30-9:30. Pacific.

KGC, Hollywood, Cal. 300 mi. Elec. Lighting Supply Co. Tues, Thurs, Sat, 7:30-8 pm, concert. Pacific.

KGF, Pomona, Cal. 150 mi. Pomona Fixture & Wiring Co. Thurs, 7:30-8:15 pm, news, markets, concert. Mountain.

KGG, Portland, Ore. 500 mi. Hallock & Watson Radio Service. Daily ex Sun, 4:30-6 and 7-7:30 pm, baseball scores, markets, news. Sat, 9:10 pm, instruction. Sun, 4:30-6 pm. Pacific.

KGN, Portland, Ore. 500 mi. Northwestern Radio Mfg. Co. Daily, 12-1 pm, concert, lecture; 2:30-3:30, miscellaneous. Mon, Fri, Sun, 9-10 pm, health bulletin, concert. Tues, 7-7:30 pm, miscellaneous; 8-9, concert. Wed, Thurs, Fri, Sat, 7-7:30 pm, miscellaneous. Pacific.

KGO, Altadena, Calif. 300 mi. Altadena Radio Lab. Daily, 1-2 pm, 6-7. Pacific.

KGW, Portland, Ore. 200 mi. Ship Owners Radio Service Inc. (Daily Oregonian.) Daily, 3:30-4:30 pm, news etc. Mon, 7:30-8:30 pm, concert. Wed, 8-10 pm, concert. Fri, 8-9 pm, concert. Sun, 7-8 pm, church service. Pacific.

KGY, Lacey, Wash. 100 mi. St. Martins College. Tues, Fri, Sun, 8:30-9:30 pm, concert, news, Pacific.

KHD, Colorado Springs, Colo. 200; 485 meters only. 100 mi. Aldrich Marble & Granite Co. Daily except Sun, 8:15 am, weather, forestry bulletins, etc. Mountain.

KHJ, Los Angeles, Calif. 50 mi. C. R. Kieruiff & Co. (Los Angeles Times.) Daily ex Sat and Sun, 1-1:45 pm, 7:15-8, concert, lecture, news. Pacific.

KJC, Los Angeles, Calif. 100 mi. Standard Radio Co. Daily ex Sun, 11:30-12 noon, Mon, 10-11 am. Wed, 9-10 am. Sun, 1-2 pm. Pacific.

KJJ, Sunnyvale, Cal. 200 mi. The Radio Shop. Tues, 8:15-9 pm, concert. Fri, 7:30-8:15 pm, concert. Pacific.

KJR, Seattle, Wash. 200 mi. Northwest Radio Service Co. Daily ex Sun, 8-9 pm, miscellaneous. Pacific.

KLB, Pasadena, Cal. 300 mi. J. J. Dunn Co. Mon and Fri, 7:30-8:15 pm, concert. Sun, 3-4 pm and 8-9, concert. Pacific.

KLN, Monterey, Cal. 150 mi. Noggle Electric Works. Daily, 12-1 pm, weather, markets, news; 7-8 pm, concert. Pacific.

KLP, Los Altos, Cal. 1,500 mi. Colin B. Kennedy Co. Mon, 7:30-8:30 pm, industrial news, concert. Thurs, 8:30-9 pm, concert. Sun, 4-5 pm, concert. Pacific.

KLS, Oakland, Cal. 150 mi. Warner Bros. Daily, 12-1 pm, concert. Sat, 7:30-8:15 pm, concert. Pacific.

KLZ, Denver, Colo. 485 also. 1,000 mi. Reynolds Radio Co. Daily ex Sun, 7:30 pm on, news, markets, bedtime story, concert. Sun, 8-9 pm, church service. Mountain.

KMC, Reedley, Calif. 100 mi. Lindsay-Weatherill & Co. Mon, Wed, Fri, 8:30-9 pm, concert. Pacific.

KMO, Tacoma, Wash. 200 mi. Tacoma Times. ("Love Electric Co.) Daily ex Sun, 11-1 pm, 6-7, 9:15-10, concert, news, lecture. Pacific.

KNJ, Roswell, N. M. 300 mi. Roswell Public Service Co. Daily, 7:30-8:30 pm, weather, financial, markets, news. Sun; 7-9 pm, church service. Mountain.

KNN, Los Angeles, Calif. 100 mi. Bullock's. Tues, Thurs, Fri, 10-11 am. Pacific.

KNT, Aberdeen, Wash. 400 mi. Grays Harbor Radio Co. Daily, 5-5:30 pm, 7:30-8:15, news, concert. Pacific.

KOA, Denver, Colo. 485 only. 100 mi. W. H. Smith (Y. M. C. A.). Daily, 9:55-10:25 pm, time, weather reports. (Telegraph only.) Mountain.

KOC, Los Angeles, Calif. 300 mi. Western Radio Elec. Co. Daily, 12:15-12:30 pm, markets; 5-5:30, news. Tues, Wed, Fri, 8:15-9 pm, concert. Pacific.

KON, Los Angeles, Calif. 300 mi. Holzwasser Inc. Daily ex Sun, 4-5 pm and 8:15-9, concert, news. Sun, 10-11 am, 4-5 pm and 8:15-9, church service. Pacific.

KOP, Hood River, Ore. 100 mi. Blue Diamond Elec. Co. Daily ex Sun, 7-7:30 pm, news. Mon, Wed, Fri, 8:30-9:15 pm, concert. Pacific.

KOV, Pittsburgh, Pa. 100 mi. Doubleday-Hill Elec. Co. Daily ex Sat and Sun, 12-12:30 pm, 2:30-3 pm, Mon, Wed, Fri, 10-11 pm. Sat, 12-12:30 pm. Sun, 4-5 pm. Eastern, daylight saving.

KQY, Portland, Ore. 100 mi. Stubbs Elec. Co. Daily, 1-2 pm, 6-7, miscellaneous. Pacific.

KQW, San Jose, Cal. 200 mi. Chas. D. Herrold. Wed, 7:30-8:15 pm, concert. Sun, 5-6 pm, concert. Pacific.

KRE, Berkeley, Cal. 100 mi. Maxwell Elec. Co. Sun, 1-2 pm, 6-7 pm, concert. Pacific.

KSD, St. Louis, Mo. 1,000 mi. St. Louis Post-Dispatch. Daily ex Sun, 4 pm, markets, news, concert; 7:45 pm, concert, lecture. Central.

KSL, San Francisco, Cal. 50 mi. The Emporium. Daily ex Sun, 10-11 am, concert, news; 2-3 pm, concert, educational talk. Sun, 2-3 pm, concert and educational talk. Pacific.

KSS, Long Beach, Calif. 25 mi. Prest & Dean Radio Research Lab. Daily ex Sun, 3:30-4:30 pm, news, concert. Pacific.

KTW, Seattle, Wash. 360 mi. First Presbyterian Church. Sun, 11-1 pm, 7:30-10, church service. Pacific.

KUO, San Francisco, Cal. 1,500 mi. San Francisco Examiner. Daily ex Sat and Sun, 7-8 pm, concert, news, etc. Sun, 5-6 pm, news, etc. Pacific.

KVQ, Sacramento, Cal. 1,000 mi. J. C. Hobrecht (Sacramento Bee). Daily ex Sun, 5:30-6:30 pm, concert, news, markets, weather. Wed and Sat, 8-9 concert. Sun, 5-7 pm, concert. Pacific.

KWG, Stockton, Cal. 1,500 mi. Portable Wireless Telephone Co. Daily ex Sun, 5-6 pm, news, concert, markets. Tues and Fri, 8-9 pm, concert. Sun, 2-3 pm, concert. Pacific.

KWH, Los Angeles, Calif. 300 mi. Examiner. Daily ex Sat, 12:30 pm, music, news, crop reports. Daily, 5:30-6:30 pm, music, news. Sunday, 2-3 pm, sacred concert. Pacific.

KYG, Portland, Ore. 700 mi. W. P. Hawley, Jr. Tues, Thurs, 9-10 pm, concert. Sat, 8-9 pm, concert. Pacific.

KYJ, Los Angeles, Cal. 1,000 mi. Leo J. Meyberg Co. Daily ex Sun, 4-5 pm, concert, markets, weather, news. Mon, Thurs, Sat, 8-9 pm, same program. Pacific.

KYW, Chicago, Ill. 485 also. 1,000 mi. Westinghouse Elec. & Mfg. Co. Daily ex Sun, 9:35 am-1:20 pm, market quotations every half hr; 2:15, news, markets; 4 pm, storm warnings; 6:30-9:30, concert, agricultural. Sun, 8:30-9:30, church service.

KZC, Seattle, Wash. 50 mi. Public Market & Dept. Store Co. Daily ex Sun, 6:45-7:15 pm, prices of foodstuffs. Pacific.

KZC, Los Angeles, Cal. Western Radio Elec. Co. Daily ex Sun, 5-5:30 pm, news, concert. Pacific.

KZM, Oakland, Cal. 200 mi. Preston D. Allen. Daily ex Sun, 7:15-7:30 pm, news. Tues, 7:30-8:15 pm, concert. Fri, 8:15-9 pm, concert. Pacific.

KZY, Oakland, Cal. 1,500 mi. Atlantic Pacific Radio Supplies Co. Daily ex Sun, 6:45-7:15 pm, concert; 6:45-7 pm, news. Wed, 7:30-8:15 pm, concert. Sat, 8:15-9 pm, concert. Sun, 11-12:15 pm, church service; 3-4 pm, concert. Pacific.

WAAG, Shreveport, La. 50 mi. Bordreaux Co. Daily ex Sun, 7:30-9 pm, baseball, concert. Central.

WAAI, Boston, Mass. 50 mi. Eastern Radio Inst. Mon, Wed, Fri, 9-10 pm, concert. Eastern.

WAAQ, Greenwich, Conn. 600 mi. New England Motor Sales Co. Daily ex Sun, 9:30 am-5:30 pm, every half hr. Eastern, daylight saving.

WAAT, Jersey City, N. J. 70 mi. Jersey Review. Wed, 7-8 pm, concert, lecture. Sun, 7-8, church service, concert. Eastern.

WAAV, Athens, Ga. 500 mi. Athens Radio Co. Daily, 7-9 pm, miscellaneous. Central.

WAAZ, Emporia, Kan. 250 mi. Hollister-Miller Motor Co. Daily ex Sun, 9:45-10:15 am, market quotations every half hr; 7-8 pm, concert, weather. Sun, church service, 2 pm. Central.

WBAA, W. Lafayette, Ind. 100 mi. Purdue University. Fri, 8:15-8:30 pm, educational lecture. Other features irregular. Central.

WBAB, Syracuse, N. Y. 150 mi. Andrew J. Potter. Daily ex Sun, 6:30-7 pm, concert, baseball, weather, news, bedtime story. Sun, 6:30-7:30 pm, church service, etc. Eastern.

WBAD, Minneapolis, Minn. 100 mi. Journal. Mon, Fri, Sat, 9:30 am, markets; 7:50 pm, concert. Central.

WBAG, Bridgeport, Pa. 485 also. 300 mi. Diamond State Fibre Co. Daily ex Sun, 10:45-11:15 am, weather, markets. Eastern.

WBAI, Toledo, Ohio. 150 also. 100 mi. Marshall-Gerken Co. Tues, Thurs, Sat, 6-7:30 pm, news, bedtime story, 8:00 pm, concert. Eastern.

WBAM, New Orleans, La. 100 mi. J. B. Rennyson. Daily ex Sun, 11 am, real estate bulletins, lecture, concert. Central.

WBAN, Paterson, N. J. 100 mi. Wireless Phone Corp. Daily ex Sun, 10:30 am, on the hour to 9:30 pm, concert, baseball. Eastern.

WBAP, Fort Worth, Tex. 100 mi. Star Telegram. Daily ex Sun, 11-11:30 am, weather; 2-2:30 pm, road conditions; 3:30-4 pm, news, markets; 6:30-7, baseball; 8-8:30 pm, bedtime story, lecture; 10:30-11, concert. Sun, 2-2:30 pm, sermon, 3:30-4, concert. Central.

WBAV, Columbus, O. 200 mi. Ermer & Hopkins Co. Daily ex Sun, 5:30-7:30 pm. Central.

WBAQ, South Bend, Ind. 100 mi. Myron L. Harmon. Daily, 5:30-6 pm, news, concert; 9 pm, concert, news, police reports. Sun, 3:30 pm, church services, Central.

WBAZ, Richmond, Va. 300 mi. Times-Dispatch. Daily, 7-9 pm, news, concert, markets, etc. Eastern.

WBT, Charlotte, N. C. 485 also. 500 mi. Southern Radio Corp. Daily ex Sun, 11 am, weather; 9:30 pm, markets. Mon, Wed, Fri, 8:30-9:30 pm, concert. Sun, 11 am, 8 pm, church service. Eastern.

WBZ, Springfield, Mass. 500 mi. Westinghouse Elec. & Mfg. Co. Daily ex Sun, 7:30 pm, children's hour; 7:45, markets, weather, lecture; 8-9, concert. Sun, 3 and 8, church service. Eastern.

WCAB, Newburgh, N. Y. 100 mi. Newburgh Daily News. Daily ex Sun, on half hour 12:30-9:30 pm, news, sports, concert; 10:30-11 pm, concert, feature. Eastern, daylight saving.

WCAK, Houston, Tex. 280 mi. A. P. Daniel. Daily ex Sun, 7-7:15 pm, news etc. Wed, Sat, 8-9 pm, concert. Sun, 3-4 pm, concert. Central.

WCAO, Bellanco, O. 200 mi. Tri-State Radio Mfg. Co. Daily, 11:30-12:30 pm, 3, baseball; 6-6:30, baseball, concert; 8, special program. Central.

WCAW, Quincy, Ill. 200 mi. Quincy Elec. Sup. Co. (Quincy Herald.) Daily ex Sun, 8:45 am, markets; 11, markets; 1 pm, markets; 5, music, baseball. Tues, Wed, Thurs, Sat, 8:30-9:45 pm, concert. Sun, 6:30-7:30 pm, religious. Central.

WCK, St. Louis, Mo. 50 mi. Stix Baer & Fuller (Grand Leader). Mon, Wed, Fri, 6:45-8 pm, concert, lecture, bedtime story. Central.

WCN, Worcester, Mass. 485 also. 100 mi. Clark Univ. Daily, 11:15 am, 5:15 pm, weather. Evening program irregular. Eastern.

WDAB, Portsmouth, O. 100 mi. H. C. Summers & Son. Mon, Wed, Sat, 2-2:45 pm, 8:30-9:30 pm, concert. Sun, 2-2:45 pm, church service. Central.

WDAF, Kansas City, Mo. 500 mi. Kansas City Star. Daily ex Sat and Sun, 3 pm and quarter hours after baseball. Mon, Wed, Fri, 7:30, news, concert. Central.

WDAJ, College Park, Ga. 300 mi. A. & W. P. R. R. Co. Daily, 9-10 pm, concert etc. Central.

WDAL, Jacksonville, Fla. 485 also. Times-Union. Daily ex Sun, 3-3:15 pm, 4-4:15, 5-5:15, 6-6:15, baseball, markets, weather; 8-9:50, general. Eastern.

WDAP, Chicago, Ill. 485 also. 1,000 mi. Midwest Radio Central Inc. Daily ex Sat and Sun, 9:45 am, 10:45, 11:45, 1:45 pm, 3:15, foreign exchange; 3:17, closing Chicago stocks. Sat, 9:45 am, 10:15, 11:45, 12:45 pm, foreign exchange; 12:17, closing Chicago stocks. Sun, 8:30-10:30, concert. Central, daylight saving.

WDAU, New Bedford, Mass. 50 mi. Slocum & Killburn. Mon, Wed, 7-9 pm, concert etc. Eastern, daylight saving.

WDAX, Centerville, Ia. 250 mi. First Nti. Bank. Daily ex Sun, 11:30 am, 2:30 pm, markets, news. Mon, Thurs, 7:30 pm-9:30, concert. Central.

WDM, Washington, D. C. 50 mi. Church of the Covenant. Sun, 10:30 am, church service; 3 pm, lecture; 7:30, church service. Eastern.

WDZ, Tuscola, Ill. 70 mi. James L. Bush. Daily ex Sun, every half hr, 8:30 am-12:15, Chicago Board of Trade quotations. Tues, Fri, 7-8 pm, concert, entertainment. Central.

WEW, St. Louis, Mo. 485 only. 100 mi. St. Louis University. Daily ex Sun, 10 am, weather, morning grain and live stock markets; 2 pm, closing of markets. Sat, 2 pm program at 1 pm. Central.

WEY, Wichita, Kan. 485 also. 900 mi. Mayradio Co. (Wichita Beacon.) Daily ex Sun, hourly, 8:40 am-12:40 pm, stock markets. Daily, 10:15 am and 4:30 pm, weather; 8-10 pm, baseball, concert, lecture; 10:45 weather. Sun, 8:10 pm, church service, concert. Central.

WFI, Philadelphia, Penn. 350 mi. Strawbridge & Clothier. Daily ex Sun, 1:16 pm, news; 5:30-6:30, concert; 5:30-6, baseball. Mon, Fri, 6:30-7 pm, Radio talk. Wed, Fri, Sat, 7:30-8:30 pm, concert. Fri, Sat, (alternate weeks) 7:30 pm, concert at 8:30 pm. Sun, 4 pm, church service. Eastern, daylight saving.

WFO, Dayton, O. 485 also. 300 mi. Rike-Kumler Co. Daily ex Sun, 9-9:30 am, concert, news; 11-12 and 4-5 pm, concert, news, markets. Tues, Wed, Thurs, Fri, 7-8 pm, concert, lecture. Sun, 11-12 am, church service. Central.

WGH, Montgomery, Ala. 1,000 mi. Montgomery Light & Water Power Co. Tues, Thurs, Sat, 11 am, weather; 4 pm, storm warnings; 8:30-9:30, concert, agricultural. Sun, 8:30-9:30, church service.

WGI, Medford Hillside, Mass. 500 mi. Am. Radio & Research Corp. Daily ex Sun, 2:55 pm, music; 5, news; 7:30, baseball, news; 7:45 pm, lecture. Sun, On Tues and Thurs, 7:30 and 7:45 pm programs at 7:45 and 7:55 pm, respectively. Sun, 8 am, church service; 8:45 am, sacred concert. Special features week nights, 7:30-9 pm. Eastern.

WGL, Philadelphia, Pa. 2,000 mi. Thos. F. J. Howlett. Tues, Thurs, Sat, 7:45-11:30 pm, concert. Eastern.

WGR, Buffalo, N. Y. 485 also. 200 mi. Federal Telep. & Telegr. Co. Daily, 12m, 5:30 pm, markets, weather; 8, baseball news, bedtime story; 8:15, concert. Eastern.

WGY, Schenectady, N. Y. 1,000 mi. General Electric Co. Daily ex Sat and Sun, 7 pm, markets. Tues, Thurs, Fri, 7:45-9 pm, concert, address. Eastern.

WHA, Madison, Wis. 485 also. 600 mi. Univ. of Wis. Daily ex Sun, 12-1 pm, weather, markets. Tues, Thurs, Fri, Sat, 12-1 pm, weather, markets. Mon, Tues, 8-9 pm, concert. Fri, 8-9:15 pm, news, concert. Sat, 1-1:20 pm, instruction. Central.

WHD, Morgantown, W. Va. 100 mi. W. Va. University. Daily, 4-6, 7-7:30, news etc. Eastern.

WHK, Cleveland, O. 100 mi. Warren R. Cox (The Radiovox Co.). Daily, 1:30-2 pm, 3-3:4, miscellaneous. Tues, Thurs, Sun, 8-9:30 pm, concert. Eastern.

WHQ, Rochester, N. Y. 485 also. 50 mi. Times-Union, Inc. Daily ex Sun, 12-12:15 pm, news, concert; 7:30-8, markets, bedtime story, lecture; 8-8:30, concert. Sun, 3 and 7:30 pm, church service. Eastern.

WHW, East Lansing, Mich. 485 only. 150 mi. Stuart Wm. Seely. Daily ex Sun, 11:30 am and 12:30 pm, weather and markets. Eastern.

WIK, McKeesport, Pa. 500 mi. K. & L. Elec. Co. Daily ex Sun, 6:30-7 pm. Tues, Thurs, 9:30-10:30 pm. Sun, 1:30-2:30 pm and 6:30-7 pm. Eastern.

WID, Granville, O. 100 mi. Dennison University. Daily, 1:05 pm, concert, lecture. Central.

WJH, Washington, D. C. 200 mi. White & Boyer Co. Tues, 7:30-10 pm, concert, address, lecture. Eastern.

WJK, Toledo, O. 300 mi. Service Radio Equipment Co. Daily ex Sun, 3-4 pm, concert. Wed, Fri, 7:30-9 pm, concert, lecture, etc. Sun, 7:30-9 pm, church service, concert. Eastern.

WJT, Erie, Penna. 1,000 mi. Elec. Equipment Co. Daily ex Sun, 7:30 pm, baseball, markets, weather, police reports. Mon, Wed, Fri, 8, bedtime stories; 8:15, concert, lecture. Sun, 7:45 pm, church service. Eastern, daylight saving.

WJZ, Newark, N. J. 1,500 mi. Westinghouse Elec. & Mfg. Co. Daily ex Sun, 15 minutes hourly from 9 am to 6 pm; 12-12:30 pm; 7-10:15 pm. Miscellaneous program of highly varied nature. Sun, 3-10:15 pm, misc. Eastern, daylight saving.

WKC, Baltimore, Md. 500 mi. Jos. M. Zamoiski Co. Tues, Thurs, Sat, 7:30-9:30 pm. Eastern, daylight saving.

WKY, Oklahoma City, Okla. 485 also. 500 mi. Oklahoma Radio Shop. (Daily Oklahoman.) Daily, 12 m, weather; 7-7:30 pm, baseball, specials; 8:30-9:30, concert; 9, weather, news. Sun, 3:30-4:30 pm, concert. Central.

WLK, Indianapolis, Ind. 360 mi. F. F. Hamilton. (Indianapolis News.) Daily ex Sun, 11-11:30 am, music, weather; 12-12:30 pm, music; 2-2:30, music; 3-3:30, music; 5, baseball; 10, weather. Tues, Thurs, Sun, 8:30-10 pm, Special, Sun, 2-4 pm, church services; 10, weather. Central.

WLW, Cincinnati, O. 1,200 mi. Crosley Mfg. Co. Tues, Thurs, Fri, 8 pm, concert, lecture, news. Sun, 8 pm, church service. Central.

WMA, Anderson, Ind. 25 mi. Arrow Radio Lab. Mon, Wed, Fri, 7:30-8:30 pm, concert, news etc. Central.

WMC, Youngstown, O. 500 mi. Columbia Radio Co. Mon, Wed, Fri, Sat, 8:30-9:45 pm, concert, address etc. Eastern.

WMH, Cincinnati, O. 485 also. 1,000 mi. Precision Equipment Co. Daily ex Sun, 11 am and 4 pm, weather, markets. Mon, Wed, Sat, 8:15-10, concert, lecture, vaudeville, news. Central.

WMU, Washington, D. C. 100 mi. Doubleday-Hill Elec. Co. Daily, 4:30-5:30 pm, concert, baseball. Thurs, 8-9 pm, concert. Eastern.

WNJ, Albany, N. Y. 60 mi. Shotton Radio Mfg. Co. Mon, Wed, Sat, 8-9:30 pm, music, entertainment. Eastern, daylight saving.

WOC, Davenport, Ia. 485 also. 150 mi. Palmer School of Chiropractic. Daily ex Sun, 12-12:15 pm, markets, weather, concert; 3:30-4, lecture; 5:45-6 and 7-8, concert. Sat, 8-8:15, business review. Sun, 9-10 am and 5:30-6 pm, sacred concert. Central.

WOE, Akron, O. 50 mi. Buckeye Radio Service Co. Mon, Wed, Fri, 7-8:15 pm, concert, news, lecture. Sun, 10-12 am, church service. Eastern.

WOH, Indianapolis, Ind. 700 mi. Hatfield Elec. Co. Daily ex Sat and Sun, 10-11 am and 4-5 pm, financial, concert. Mon, Wed, 8:30-9:30 pm, concert. Sat, 10-11 am and 1-2 pm, financial, music. Sun, 10-11 am, concert. Central.

WOK, Pine Bluff, Ark. 1,000 mi. Arkansas Light and Power Co. Daily, 7:30 pm, baseball, markets, weather, news. Tues, Fri, 8-9:30 pm, concert. Sun, 11 am and 7:45 pm, church service. Central.

WOQ, Kansas City, Mo. 485 also. 300 mi. Western Radio Co. Daily ex Sun, every half hour 9:30-1:15 pm, markets; 11:30 am, 2 pm, 7:30, markets, weather, road conditions; 7:45-9, concert, vaudeville. Sun, 7 pm, church service. Central.

WOR, Newark, N. J. 150 mi. L. Bamberger & Co. Daily ex Sun, on minutes on half hour from 10:30 am to 6:30 pm, miscellaneous. Eastern, daylight saving.

WOZ, Richmond, Ind. 485 only. 300 mi. Richmond Palladium. Daily ex Sun, 12-12:15 pm, markets; 4-5, concert, news, markets; 6:30 pm, concert, news, weather, lecture. Central.

WRA, Fort Worth, Tex. 485 also. 500 mi. Fort Worth Record. Daily, 11:30 am, weather; 7:30 pm, baseball, concert; 9:30, news; 9:50, weather. Central.

WRE, Kansas City, Mo. 300 mi. Central Radio Co. Mon, Fri, Sun, 7:45 pm, concert. Sun, 8:15 pm, sermonette. Daily, afternoon, baseball scores. Central.

WRF, Philadelphia, Pa. 30 mi. St. Joseph's College. Daily ex Sun, 2:30 pm, 8:30, sports, news. Sun, 10:45-12 noon, 7:45-8:30 pm, church service. Eastern.

WRM, Washington, D. C. 200 mi. Thos. J. Williams, Inc. (Washington Daily News.) Daily ex Sun, 12:30 pm, news. Mon, 8 pm, concert. Eastern.

WPG, Memphis, Tenn. 200 mi. United Equipment Co. (News-Scimitar.) Daily, 7-9 pm, concert, news. Central.

WRK, Hamilton, O. 1,000 mi. Doron Bros. Elec. Co. Mon, Wed, Sat, 8:30-10:30 pm, concert, news. Fri, 7:30-9:30, concert. Sun, 10:45 am and 7:30 pm, church service. Central.

WRL, Schenectady, N. Y. 800 mi. Union College. Sun, 7:30 pm, sacred concert, speeches, etc. Irregular miscellaneous weekday program. Eastern.

WRM, Urbana, Ill. 410 also. 200 mi. Univ. of Ill. Thurs, 8:30-8:55 pm, 9:30 pm, news, concert, lecture. Special concerts irregular. Central.

WRP, Camden, N. J. 200 mi. Federal Inst. of Radio Telg. Daily ex Sat and Sun, 10-10:45 pm, instruction. Eastern, daylight saving.

WRR, Dallas, Tex. 485 also. 200 mi. City of Dallas. Daily, 7 pm, police news, sports, weather; 8:30-9:30, concert. Sun, 11 am and 7:30 pm, church service. Central.

WRW, Tarrytown, N. Y. 1,500 mi. Tarrytown Radio Research Lab. Tues, Thurs, Sat, 9:05 pm. Sun, 10:30 am, 2 pm, 10:05. Eastern, daylight saving.

WSB, Atlanta, Ga. 1,000 mi. Atlanta Journal. Daily ex Sun, 12 m, weather, markets; 2:30 pm, markets; 5, baseball, news, bedtime story; 7-8, concert. Sun, 11 am and 5 pm, church service. Central.

WSN, Norfolk, Va. 100 mi. Shipowners Radio Service Inc. Mon, Wed, Sat, 8:15-9:30 pm, concert. Eastern.

WSC, Erie, Pa. 75 mi. Erie Radio Co. Tues, Thurs, Sat, 10-10:55 pm, news, concert, lecture. Sun, 12:15-1:30 pm, sermon. Eastern, daylight saving.

WSY, Birmingham, Ala. 150 mi. Alabama Power Co. Daily ex Sun, 8:30-9:30 pm, concert, addresses etc. Central.

WTG, Manhattan, Kan. 485 only. 75 mi. Kan. State Agri. College. Daily ex Sun, 9:55 am, weather (code). Central.

WTK, Paris, Tex. 300 mi. Paris Radio Elec. Co. Daily ex Sun, 10 am to 5 pm, 7-11 pm, miscellaneous. Sun, 11 am to 8 pm. Central.

WTP, Bay City, Mich. 75 mi. Ra-Do Corp. Daily ex Sun, 1-2 pm, 6:30-7:30, 10-12, concert, baseball, markets. Sun, 1-2 pm, 6:30-7:30, 9-10, concert, weather.

WWI, Dearborn, Mich. 300 mi. Ford Motor Co. Wed, 8-11 pm. Eastern.

WWJ, Detroit, Mich. 485 also. 1,000 mi. Detroit News. Daily ex Sun, 9:30-10:30 am, hints to housewives, concert, weather; 10:55, time signals; 12:05-12:45 pm, concert; 3:30-4:15, markets, weather; 5-8, news, baseball. Week of May 28 and every other week 4, 7-8 pm, concert, lecture. Fill in weeks, 8:40-11 pm, concert, lecture. Sun, May 27 wk etc., 9:30 am-2:30 pm, church services and special; 4-6 pm, special. Sun, fill in wk, 2-4 pm, special; 6-10, church services and special. Eastern.

WWO, Washington, D. C. 1,160 only. 600 mi. Post Office Dept. Daily ex Sun, 10 am, weather; 10:30, markets; 5 pm, 7:30, 8, markets; 9:50, weather. Eastern.

WWZ, New York, N. Y. 200 mi. John Wanamaker. Daily ex Sun, 1:40-2 pm, 2:40-3, 3:40-4, 4:40-5, 10:30-12 midnight, concert. Eastern.

3YN, Washington, D. C. 100 mi. Nat'l Radio Inst. Daily, 6:30-7:30 pm, instruction. Eastern.

9ARU, Louisville, Ky. 200 only. 200 mi. Darrell A. Downard. Mon, Wed, 8 pm, police news, concert. Central.

9WD, Denver, Colo. 235 only. W. D. Pyle. Sat, 8-9:30 pm, concert. Sun, 5:30-7:00, concert. Mountain.

9YY, Lincoln, Nebr. 375 only. 300 mi. Univ. of Nebr. Daily ex Sun, 10:10 am, stock and grain markets, weather; 7:30 pm (irregular), concert. Central.

State, City, Call	State, City, Call	State, City, Call	State, City, Call	State, City, Call	State, City, Call
Alabama:	**California:**	Los Angeles, KNX	Los Angeles, KHJ	Redwood City, KDYN	San Jose, KQW
Birmingham, WSY	Altadena, KGO	Los Angeles, KJC	Los Angeles, KNN	Sacramento, KVQ	San Jose, KSC
Mobile, WEAP	Bakersfield, KYI	Los Angeles, KNR	Los Angeles, KDZD	San Diego, KDYM	Stockton, KJQ
Montgomery, WGH	Bakersfield, KDZB	Los Angeles, KNV	Los Angeles, KDZF	San Diego, KDYO	Stockton, KWG
Arizona:	Berkeley, KRE	Los Angeles, KON	Modesto, KOQ	San Diego, KDPT	Sunnyvale, KJJ
Phoenix, KDYW	Berkeley, KQI	Los Angeles, KUS	Modesto, KXD	San Diego, KYF	
Tucson, KDZA	El Monte, KUY	Los Angeles, KWH	Monterey, KLN	San Francisco, AG1	**Colorado:**
Arkansas:	Eureka, KNI	Los Angeles, KXS	Oakland, KLX	San Francisco, KDN	Colorado Springs, KHD
Fort Smith, WCAC	Fresno, KMJ	Los Angeles, KZI	Oakland, KLS	San Francisco, KGB	Denver, KDYY
Little Rock, WCAV	Fresno, KDZH	Los Angeles, KJS	Oakland, KZM	San Francisco, KSL	Denver, 9WD
Little Rock, WSV	Gridley, KFU	Los Angeles, KOG	Oakland, KZY	San Francisco, KPO	Denver, DD-5
Little Rock, WEAX	Hollywood, KGC	Los Angeles, KQL	Pasadena, KDYR	San Francisco, KUO	Denver, KLZ
Pine Bluff, WOK	Long Beach, KSS	Los Angeles, KYJ	Pasadena, KLB	San Francisco, KDZG	Denver, KOA
	Los Altos, KLP	Los Angeles, KZC	Pomona, KGF	San Franciscoo, KDZW	Denver, KDZU
	Los Angeles, KDZP	Los Angeles, KFI	Reedley, KMC	San Francisco, KDZX	

State, City, Call

Connecticut:
Greenwich, WAAQ
Hartford, WDAK
New Haven, WCJ

District of Columbia:
Washington, WMU
Washington, WDM
Washington, WDW
Washington, WJH
Washington, WWX
Washington, 3YN
Washington, WPM
Washington, WIL
Washington, WEAS

Florida:
Jacksonville, WCAN
Jacksonville, WDAL
Tampa, WDAE
Tampa, WEAT

Georgia:
Atlanta, WGM
Atlanta, WSB
Atlanta, 4CD
Atlanta, WAAS
Atlanta, WDAW
College Park, WDAJ

Illinois:
Chicago, WGU
Chicago, KYW
Chicago, WBU
Chicago, WAAF
Chicago, WDAP
Decatur, WCAP
Decatur, WBAO
Peoria, WBAE
Quincy, WCAW
Quincy, WCAZ
Springfield, WDAC
Tuscola, WDZ
Urbana, WRM

Indiana:
Anderson, WMA
Indianapolis, WLK
Indianapolis, WOH
Richmond, WOZ
South Bend, WBAQ
Terre Haute, WEAC
West Lafayette, WBAA

Iowa:
Ames, WOI
Centerville, WDAX
Davenport, WOC
Des Moines, WGF
Fort Dodge, WEAB
Iowa City, 9YA
Sioux City, WEAU
Waterloo, WEAZ

Kansas:
Anthony, WBL
Atwood, WEAD
Eldorado, WAH
Emporia, WAAZ
Lindsborn, WDAD
Manhattan, WTG
Salina, WFAD
Wichita, WEY
Wichita, WAAP
Wichita, WEAH

Kentucky:
Louisville, 9ARU

Louisiana:
New Orleans, WCAG
New Orleans, WWL
New Orleans, WGV
New Orleans, WBAM
New Orleans, WAAC
New Orleans, WAAB
Shreveport, WAAG
Shreveport, WDAN

Maine:
Auburn, WMB

Maryland:
Baltimore, WCAO
Baltimore, WKC
Baltimore, WEAR

Massachusetts:
Boston, WAAJ
Medford Hillside, WGI
New Bedford, WDAU
Springfield, WBZ
Worcester, WCN
Worcester, WDAT
Worcester, WDAS

Michigan:
Bay City, WTP
Dearborn, WWI
Detroit, WWJ
Detroit, KPO
Detroit, WCX
East Lansing, WHW
Flint, WEAA
Superior, WFAC

Minnesota:
Minneapolis, WCAS
Minneapolis, WAAL
Minneapolis, WLB
Minneapolis, WBAH
Minneapolis WBAD
Minneapolis, WCE
Redfield, WCAL
St. Paul, WAAH

Missouri:
Columbia, WAAN
Jefferson City, WOS
Kansas City, WDAF

State, City, Call

Kansas City, WHB
Kansas City, WOQ
Kansas City, WPE
St. Joseph, WEAK
St. Louis, KSD
St. Louis, WAAE
St. Louis, WCK
St. Louis, WEB
St. Louis, WEW

Montana:
Great Falls, KDYS

Nebraska:
Lincoln, WCAJ
Lincoln, 9YY
Omaha, WOU
Omaha, WOV
Omaha, WAAW
Rushville, WEAV

Nevada:
Reno, KDZK
Reno, KOJ

New Hampshire:
Berlin, WEAQ

New Jersey:
Camden, WRP
Deal Beach, 2XJ
Jersey City, WAAT
Moorestown, WBAF
Newark, WAAM
Newark, WJX
Newark, 2XAI
Newark, WOR
Newark, WJZ
Newark, WBS
N. Plainfield, WEAM
Paterson, WBAN

New Mexico:
Roswell, KNJ
State College, KOB

New York:
Albany, WNJ
Buffalo, WGR
Buffalo, WWT
Canton, WCAD
Ithaca, WEAI
Newburgh, WCAB
New York, WBAY
New York, KDOW
New York, WVP
New York, WWZ
New York, WDT
New York, WDAM
Poughkeepsie, WFAF
Rochester, WHQ
Ridgewood, WHN
Schenectady, WGY
Schenectady, WRL
Syracuse, WDAI
Syracuse, WBAB
Syracuse, WFAB
Tarrytown, WRW
Utica, WSL

North Carolina:
Charlotte, WBT

North Dakota:
Fargo, WDAY

Ohio:
Akron, WOE
Athens, WAAV
Canton, WWB
Cincinnati, WAAD
Cincinnati, WLW
Cincinnati, WMH
Cincinnati, WIZ
Cleveland, WHK
Columbus, WBAW
Columbus, WEAO
Dayton, WFO
Dayton, WA-1
Defiance, WCAQ
Fairfield, WL-2
Granville, WJD
Hamilton, WBAU
Hamilton, WRK
Lebanon, WPG
Marietta, WBAW
Portsmouth, WDAB
Toledo, WHU
Toledo, WJK
Toledo, WBAJ
Youngstown, WMC
Youngstown, WAAY
Zanesville, WPL

Oklahoma:
Muskogee, WDAV
Oklahoma City, WKY
Oklahoma City, 5XT
Tulsa, WEH

Oregon:
Eugene, KDZJ
Hood River, KQP
Klamath Falls, KDYU
Portland, KDYQ
Portland, KQY
Portland, KYG
Portland, KGW
Portland, KGG
Portland, KGN

Pennsylvania:
Bridgeport, WBAG
Brownsville, WDAQ
Clearfield, WPI
Erie, WSX
Erie, WJT
Harrisburg, WBAK

State, City, Call

McKeesport, WIK
Philadelphia, WCAU
Philadelphia, WFI
Philadelphia, WIP
Philadelphia, WGL
Philadelphia, WOO
Philadelphia, WPJ
Philadelphia, WDAR
Pittsburgh, WCAE
Pittsburgh, KDKA
Pittsburgh, KQV
Pittsburgh, WAAX
Pittsburgh, WPB
Villanova, WCAM
Wilkes-Barre, WBAX

Rhode Island:
Edgewood, WEAG
Pawtucket, 1OJ
Pawtucket, 1XAD
Providence, WEAN

South Dakota:
Rapid City, WCAT

Tennessee:
Memphis, WKN
Memphis, WPG
Nashville, WDAA

Texas:
Amarillo, WDAG
Austin, WCM
Dallas, WRR
Dallas, WDAO
Dallas, WFAA
El Paso, WDAK
Fort Worth, WBAP
Fort Worth, WPA
Houston, WCAK
Houston, WEV
Houston, WEAY
Paris, WTK
San Antonio, WCAR

Utah:
Ogden, KDZL
Salt Lake City, KDZV
Salt Lake City, KZN
Salt Lake City, KDYL

Vermont:
Burlington, WCAX

Virginia:
Norfolk, WSN
Richmond, WBAZ

Washington:
Aberdeen, KNT
Bellingham, KDZR
Centralia, KDZM
Lacey, KGY
Seattle, KFC
Seattle, KHQ
Seattle, KJR
Seattle, KTW
Seattle, KZC
Seattle, KDZE
Spokane, KFZ
Spokane, KOE
Tacoma, KGB
Tacoma, KMO
Wenatchee, KZV
Wenatchee, KDZI
Yakima, KPY
Yakima, KQT

West Virginia:
Charleston, WAAO
Huntington, WAAR
Morgantown, WHD

Wisconsin:
Milwaukee, WCAY
Milwaukee, WAAK
Madison, 9VHA

Hawaii:
Honolulu, KGU
Honolulu, KDYX

Canada:
Calgary, CHBC
Calgary, CHCQ
Calgary, CFAC
Edmonton, CJCA
Fort Frances, CFPC
Halifax, CFCE
Hamilton, CKOC
London, CJGC
Montreal, CKAC
Montreal, CFCF
Montreal, CHYC
Montreal, CJBC
Ottawa, CHXC
Regina, CKCK
St. John, CJCI
Toronto, CHVC
Toronto, CJCN
Toronto, CFCA
Toronto, CHCB
Toronto, CHCZ
Toronto, CJCD
Toronto, CJSC
Toronto, CKCE
Vancouver, WEI
Vancouver, CFCB
Vancouver, CFYC
Vancouver, CHCA
Vancouver, CJCE
Vancouver, CKCD
Winnipeg, CHCF
Winnipeg, CJCG
Winnipeg, CJNC
Winnipeg, CKZC

RECEIVING RECORDS

(Continued from page 2)

KHQ—2,400—C. M. Rice Jr., Worcester, Mass.
KLP—1,300—H. Wantuck, Fayetteville, Ark.
KLZ—1,575—C. M. Rice Jr., Worcester, Mass.
KNJ—1,150—N. M. Holmes, Chippewa Lake, O.
KOB—1,550—C. M. Rice Jr., Worcester, Mass.
KQW—1,725—W. E. Long, Sterling, Ill.
KUO—3,000—C. M. Rice Jr., Worcester, Mass.
KVQ—520—T. E. Buchholz, La Grande, Ore.
KWG—670—E. Thornton, Walla Walla, Wash.
KYG—200—E. Thornton, Walla Walla, Wash.
KYJ—1,300—H. Wantuck, Fayetteville, Ark.
KYW—1,000—Wm. Holland, Brookline, Mass.
KZM—570—T. E. Buchholz, La Grande, Ore.
KZN—1,875—C. M. Rice Jr., Worcester, Mass.
KZY—2,600—A. Galloway Jr., Grand Rapids, Mich.
WAAB—450—R. M. Sanford, Atlanta, Ga.
WAAK—900—C. M. Rice Jr., Worcester, Mass.
WAAZ—325—F. W. Steffen, Hartley, Ia.
WAH—175—D. Keigley, Miami, Okla.
WBAH—400—C. C. Dancer, Chicago, Ill.
WBAK—750—H. Walrath, Cedar Rapids, Ia.
WBAX—800—C. C. Dancer, Chicago, Ill.
WBU—800—W. A. Knight, Hudson, Mass.
WBZ—1,175—R. O. Wise, Villisca, Ia.
WCAC—550—N. G. Garlock, Galena, Ill.
WCM—1,500—C. M. Rice Jr., Worcester, Mass.
WCN—1,000—W. Lerne, Elkhart, Ind.
WCX—500—E. G. Waste, Spooner, Wis.
WDAC—350—F. W. Steffen, Hartley, Ia.
WDAF—750—H. A. Tuttle, Diamond, O.
WDY—1,000—F. D. Weeks, Milwaukee, Wis.
WEH—130—D. Keigley, Miami, Okla.
WEI—2,000—Wm. Hayes, E. Liverpool, O.
WEY—450—H. Walrath, Cedar Rapids, Ia.
WFO—425—H. Walrath, Cedar Rapids, Ia.
WGF—635—C. D. Mason, Cleveland, O.
WGI—1,000—H. Walrath, Cedar Rapids, Ia.
WGY—1,500—R. L. Bayerle, Spring Valley, Minn.
WHA—900—J. B. Dusak, Worcester, Mass.
WHB—200—D. Keigley, Miami, Okla.
WHQ—725—H. Walrath, Cedar Rapids, Ia.
WJH—1,000—R. O. Wise, Villisca, Ia.
WJX—650—R. M. Sanford, Atlanta, Ga.
WJZ—1,200—N. H. Schensted, Brooten, Minn.
WKN—750—A. N. Hopkins, Ashtabula, O.
WKY—400—R. O. Wise, Villisca, Ia.
WLB—700—R. M. Sanford, Atlanta, Ga.
WLK—500—W. P. Liller, Keyser, W. Va.
WLW—500—Wm. Holland, Brookline, Mass.
WMH—725—W. A. Knight, Hudson, Mass.
WOH—970—M. Simmons, Shreveport, La.
WOI—500—A. E. Strong, Flagler, Colo.
WOK—700—F. D. Weeks, Milwaukee, Wis.
WOQ—1,100—G. W. Perkins, Thomson, N. Y.
WOU—475—A. Galloway, Grand Rapids, Mich.
WRK—600—R. O. Wise, Villisca, Ia.
WRR—700—H. Walrath, Cedar Rapids, Ia.
WSB—1,800—S. S. "Betty B," Canal Zone.
WSY—570—M. Simmons, Shreveport, La.
WWJ—2,200—F. W. Hill, Cristobal, C. Z.
2XJ—900—H. Walrath, Cedar Rapids, Ia.

STATION KDN FAMOUS

(Continued from page 5)

Helps Make Police Efficient

In addition to the allotted hours, station KDN has been appointed the official broadcasting station for the San Francisco police department. Criminal broadcasts containing license numbers of stolen automobiles, missing persons, warnings of a public safety nature and other police matters are sent out at stated hours. All amateur co-operate and transmit this information to the nearest peace office in their district. The result has been the establishment of an unusual web of efficient police assistance that is one of the important factors in Pacific Coast crime suppression.

Fast passenger boats plying between San Francisco and coast points, have installed Radio equipments for the use of their passengers, and it is a daily thing to see dancers aboard these ships, made possible by orchestras playing from Station KDN. Similar use is made of the station's broadcasting activities by incoming steamers from the Orient, through loud speakers installed in the main salons of the vessels.

Bars All Advertising

KDN station is unique in one particular—it has clamped down the lid for all time on advertising and propaganda. Nothing is sent out from this station but news, stock market reports, weather, police bulletins, financial quotations and entertainment. No speeches, unless of a public character are permitted, no projection of wearying "ad" literature, and no political talks. Under The Bulletin management, it is held that the public which nightly listens to Radio concerts, is not concerned or interested in personalities, and every effort is put forth to provide clean, wholesome, intelligent and instructive entertainment and information.

The Fairmont Hotel station is rated as a $5,000 equipment with a standard conservative range of 1,000 miles and a record range of 3,300 miles overland and 4,100 miles over water.

Radio Digest Illustrated

TRADE-MARK

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

New York Office - - - - 2126 Broadway
Detroit Office - - - - 28 Rowland Building

58
PUBLISHED WEEKLY

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

Entered as second-class matter April 27, 1922, at the post office at Chicago, Illinois, under the 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 these 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, June 24, 1922 No. 11

Radio and Church Collections

Remember Those Who Cannot Go to Church

THERE are many invalids who cannot possibly attend church, and for their benefit Radio church services are the finest thing in the world. But for good able bodied men and women it hardly makes a substitute for worship in person. While the person who relies on his receiving instruments alone for inspiration in his spiritual life is missing much, he can help materially by inviting in his neighbors not so fortunate physically or financially.

It should be remembered by those who attend church or who listen in without cost that the making of contributions aids in continuing the exercises, thus enabling those who cannot attend the services to receive much from the music and sermons.

Small Town Best Field for Radio

Better Chance for Radio to be Found in Rural Districts

THE logical field for the Radiophone is in the small country town. The department of commerce tells of a community broadcasting set which has a low wave length and which is practically free from interference. With a set of this type installed in the village, important news, concerts and public lectures can be broadcasted and every citizen in the township surrounding can get the program with his receiving set. Where other means of communication are more difficult to maintain the Radiophone can bridge the gap with ease.

The Airphone, like motion pictures and interurbans, means more to the small town and the farmers than to the city dwellers. Persons residing in large centers are ordinarily jammed with multitudinous distractions. The people in the small towns can best appreciate the utilitarian and entertaining advantages of Radiophony.

Radio Broadcast Advertisements

Airphone Advertising Will Kill Fan Interest

YOU will remember the days when you paid your money to see a motion picture show and between "acts" you were compelled to read over, or sit with your eyes closed to prevent reading over, a whole lot of local still picture advertisements. Then along came the "bright idea" fellow and put across a movie film with the same sort of "kill time on your money" advertisements. Do you recall how bitterly you were opposed to such a thing? It really hurt a number of movie theaters, and the owners wondered what was the trouble.

The same propaganda now confronts the Radiophone broadcasts. Do you wish to tune up your receiving set and sit back to take in a good concert or listen to something interesting and instructive and get for your trouble, "You can save dollars if you trade at Wanacoopers."

Suppose a delightful soprano voice has just sung your favorite song—"Kiss Me Again," "Little Gray Home in the West," or whatever it may be—and you are just drawing a deep breath, sorry it's over, and you are saying to yourself, "Gosh that was a dandy! Made me think of someone I used to know who sang that song." And then, all of a sudden, a voice says, "Good morning! Have you used Hare's Soap? Be sure to buy Goodberry's Facial Cream. Save the surface and you will keep that schoolgirl complexion!"

Do you like the idea? Something must be done about it—government regulation perhaps. Maybe you have found an answer to the question of who will eventually pay for broadcasting when the saturation point in sales of instruments is reached and if advertising is prohibited. The right place to stop anything dangerous is just before it starts. The broadcasting of advertising matter comes in the "dangerous" class and it must be nipped in the bud.

Radio Digest Comment

Views of Central and Western Editors

WHEN your set refuses to work what will you do? Heretofore everybody who had a small manufacturing establishment started in to make receiving sets, but there will be a time when aid will be required to keep these sets in working order. A service man will be needed. The Jobber's Salesman (Chicago) has an editorial on maintenance service as follows:

"When Radio settles down to a steady business a new responsibility will be placed upon the manufacturers and distributors of sets, it is said in some quarters. The users of the Radiophones will demand service in much the same way that the automobile owners or the telephone subscribers demand that their equipment be kept in operation.

"Some manufacturers are already taking steps to establish service departments, where the bewildered Radio fan may summon aid when the set refuses to work. A few dealers today in selling sets quote prices for installing and two or three months' service.

"This tendency, experts assert, can be expected to increase until the owners of a particular kind of receiving apparatus will have their sets inspected at regular intervals, renewal of parts made when needed and the instrument kept in first class order at all times."

Radio has covered quite a number of years' time for its arrival at the present stage. It has been quite a few years since the first inventions for transmitting messages were brought out. The Denver Post reviews the history of Radio as follows:

"Radio today is the one thing we hear about, dream about, write about, yet we venture to say that there are few who can trace, at least in part, its development from the beginning. The following is a short and concise outline of Radio development since its beginning.

"The first name mentioned in connection with telegraphy of any kind is that of Savery, in 1827. His experiments eventually led up to the invention of the line telegraph by Morse in 1837. Even at those early dates Radio was talked about, but the conception at that time was far different from our present day ideas.

"The scientists of this time searched diligently for some means of employing the earth or waterways as means of conducting electric currents, but were much disappointed with the cost and impracticability of the project.

"In 1867 James Clark Maxwell predicted the coming of the propagation of electric energy through space, but it remained for Heinrich Rudolph Hertz, in 1887, to produce and measure the magnitude and length of electrical energy now known as Hertzian waves. This is really the birth of Radio.

"The efforts of other scientists, such as Trowbridge and Branly, served to add impetus to the general theory, and in 1896 the world awoke to find itself the possessor of the first real Radio patent taken out by Marconi, generally conceded the title of the "Father of Wireless."

We all know that Radio has fallen upon us almost instantly. There are many things yet to be learned, and before another year passes receiving sets will have attained a high degree of efficiency through the efforts of the many manufacturers and interested amateurs. We all know the demand for outfits at the present time and manufacturers are beginning to meet the needs. The editor of the Spokesman-Review (Spokane, Wash.) writes:

"The manufacture of apparatus for the transmission and reception of Radio waves has grown over night into a sizeable industry, and even at that it is just beginning to grow. If the prophets are true prophets, and if America is destined some day to have as many Radio outfits as it has telephones, it is easy to see that the thing for the discerning young man to do is to start a Radio factory on a small scale, and let the wave of electrical progress carry him to fame and affluence.

"Trade reports say that the demand for Radio outfits is a long way ahead of the supply, and that manufacturers cannot turn this sort of apparatus out fast enough. A good many of the contraptions being sold are only playthings, and will not be in demand after the first wave of curiosity has subsided, but the making of really serviceable sending and receiving sets rests on a solid basis, and has a great future. The scheme of Radio telephony is passing through its first stage, which is one of excitement and confusion. Not until later shall we be able to know its permanent value to society."

There is no doubt but what the airphone is much needed in places where news is retarded, either by location or inability to be reached by daily mail or telephone and telegraph lines. The editor of the Chronicle (Ketchican, Alaska) makes this statement in his editorial:

"The day of extreme isolation is rapidly disappearing in the remote corners of the earth. Radio telephony is responsible, according to T. Wood, chief clerk of the lighthouse service, who reports that even the most isolated lighthouse stations now are getting in touch with the news of the day.

"At one station where the keeper of the lighthouse received but one mail in a year, he is now equipped so that he may talk with other stations, or listen in for the concerts or information sent out broadcast. Also, he is able to get in touch with any ships that may come his way. Thereby, his life and health and that of his assistant is better protected."

RADIO INDI-GEST

Radio All Over the Globe

The radio craze continues to spread. Soon it will be around the world. Then look out.

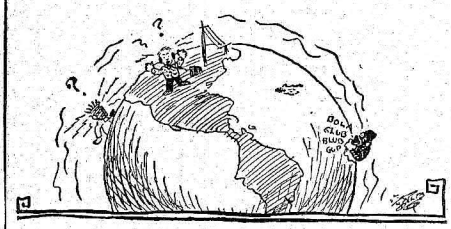
For when China, Poland and Zululand start to broadcast someone is going to need an interpreter with about ninety-three languages, dialects and jargons ready for action.

Imagine sitting in with a parlor Radio outfit.

"Bo-la, glub, blup, bub." Gasps as the grand opera selection is interrupted. Follows the interpreter.

"It's only a kaffir making love to his dusky sweetheart." So much for that and the opera selection is resumed.

"Chee klick il se," comes over the Radio and



once again the interpreter comes to the rescue.

"It's only the missing link somewhere in darkest Africa calling to its mate." That's that.

On with the concert, only to be interrupted again. This time it's different.

"Dearie, can I have $37.48 for a new hat—I should say not, whaddye think I am, a millionaire?"

Just a husband and wife accidentally broadcasting a little family opera.—Transcript, Peoria, Ill.

The Song of the Nut

One day I thought that I would get
An inexpensive Radio set;
I thought its entertaining tone
Would save me many a hard-earned bone,
Heigho! Heigho! For Radio!

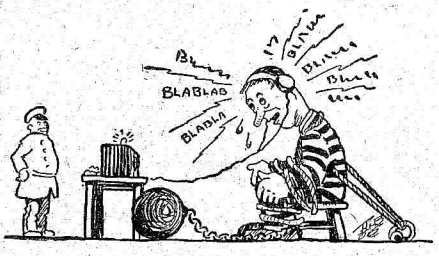
The things 'twould do, the things 'twould say
(All Radio fans start out this way)
Would furnish entertainment cheap
And at the home the children keep,
Heigho! Heigho! For Radio!

But soon I got the Radio craze
And spent much cash in many ways,
The latest wrinkles soon I bought,
The whole darn family's now distraught,
Heigho! Heigho; For Radio!

For sets and jimcracks I'm in deep,
But everlastingly I keep
A buying Radio this and that
It's great, but oh! I'm busted flat,
I owe, I owe, for Radio.—Chicago Daily News.

Broadcast That Calls for Help

Sunrise, a. m.—Brennan's scheme eliminates electric chair and hanging. Condemned get national capital punishment by being chained to receiver tuned to Congress and talked to death.



An Answer for Mr. Henpeck

Dear Editor.—In answer to "Henpeck's" question under Radio Indi-Gest in the June 3d copy of RADIO DIGEST, I suggest that he try another hook-up.—Fred W. Oliver.

Inhale, One, Two, WOP!

The Radiophone is a great invention, but it is fraught with dangerous possibilities. When we go to the door or window for fresh air we breathe in Radio songs, market reports, political speeches and jazz.—Messenger, Grapeland, Texas.

Paul Would Need a License

If the Radiophone had been in existence in Paul Revere's time that wild ride on a horse would have not been necessary at all. He would have bawled his message into the broadcaster, then the rest of us would have jumped into our autos and airplanes and given 'em fits.—Messenger, Grapeland, Texas.

Characteristics of Vacuum Tube Amplifiers

By Benjamin F. Miessner

IT has been shown in the preceding article that vacuum tube rectifiers may cause considerable distortion in the audio frequency wave form, with a resultant loss in exactness of sound reproduction. The reason underlying this distortion was shown to reside in the curvature of the characteristic curve for the rectifying tube.

It may be remarked here that some other types of rectifying devices, while perhaps not so sensitive as the tube rectifier, may function with very much reduced distortion. The sensitivity, it will be remembered, depends largely on the sharpness of the rectifying bend and on the steepness of the curve beyond it, while low distortion depends on the sharpness of the bend and the **lack of curvature** of the curve beyond the bend.

Crystals Give Less Distortion

These characteristics are shown in Fig. 24. A represents an insensitive and badly distorting rectifier; B shows sensitivity but still bad distortion; C shows insensitivity but no distortion; and D indicates high sensitivity and absence of distortion.

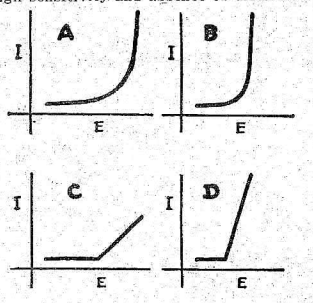


FIG. 24

Obviously a characteristic such as D is the most desirable for Radiophone reception. Some types of crystal and electrolytic rectifiers possess characteristics approaching that shown in C, and actual tests have shown that receiving apparatus with crystal rectifiers reproduces with less distortion than the usual vacuum tube rectifiers. Certain special types of rectifying tubes have been constructed, however, which possess both high sensitivity and low distortion.

Purpose of Previous Articles

The preceding installments of this series, while dwelling at considerable length on rectifying tubes and characteristics, has now fulfilled its most important mission, that is, to provide a thorough understanding of the principles underlying the operation of all types of vacuum tube devices based on pure electronic discharge phenomena. At the same time, they have served to acquaint us fully with such a device as used for one important function in Radio reception.

The discussions relative to vacuum tube amplifiers which will now follow will, for this reason, be comparatively easy to understand without the necessity for a painstaking attention to fundamentals in the treatment.

Vacuum Tube Amplifiers

The ability of a vacuum tube to amplify alternating currents resides in the control of the electron stream between filament and plate, provided by the grid electrode. This electrode, merely by the nature and amount of its electrostatic charge, has the power to control, with practically no expenditure of energy, the flow of current through the tube. Like the catalytic agent in chemical reactions, it possesses a great power of control without being itself controlled.

Since the current in the plate circuit depends from moment to moment on the potential of the grid with respect to the filament, it will be seen that the greatest change in plate current is produced by the greatest change in grid potential. It is a fundamental principle then, when desiring the highest possible amplification of changing currents, to impress the highest possible potentials between the grid and filament, and corresponding in form to the currents or voltages to be amplified.

Types of Amplifiers

In Radiophone reception the function of amplifiers is to increase the energy of currents, themselves too weak for proper reception, to a point where they are sufficiently powerful to actuate the final sound producing device in the desired manner. Such amplifiers are not confined to Radio but find important use in other fields, including long distance wire telephony and many kinds of laboratory research.

There are two general types of amplifiers used in Radio reception. One is the audio frequency type, used to amplify the received currents **after** rectification; the other is the Radio frequency type, used for amplifying the received current **before** rectification.

Nearly all amplifiers now used in Radiophone reception employ the audio frequency system, and this type will therefore be given first consideration.

Point of Best Amplification

In Fig. 25 is reproduced one of our earlier characteristic curves (Fif. 13), showing the variations of plate current with grid potential for several values of

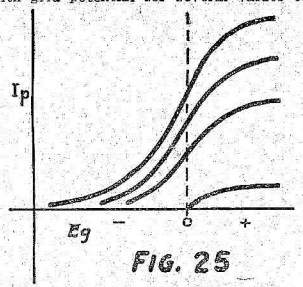


FIG. 25

plate voltage. This represents roughly the characteristic of small tubes of the receiving types now in general use. It will be observed that the region of greatest steepness and consequently highest amplification exists at a grid potential of zero volts. This means that if the grid be connected through its input circuit to the negative terminal of the "A" battery, its potential will be zero and maximum amplification will be obtained. This is not always the case, however, as sometimes the filament rheostat may be in the negative leg of the battery circuit to the filament, in which case the grid voltage may be one or two volts negative.

Tubes also vary as to the best grid voltage for maximum amplification, so that if the very best results are desired a grid potentiometer should be provided for accurate adjustment.

High Voltage and Ionization

Obviously the greatest amplification will also be produced, using a tube of such characteristics, when the highest permissible plate voltage is applied, inasmuch as the curve steepens with that voltage. There is a limit to that voltage, however, which is determined usually by the perfection of the vacuum, known commonly as the "hardness" of the tube. With practically all tubes there is some point at which either the residual gas is ionized, or a small amount is driven from the metallic parts, such as the plate, and ionized.

In any event the resultant ionization effects completely alter the performance

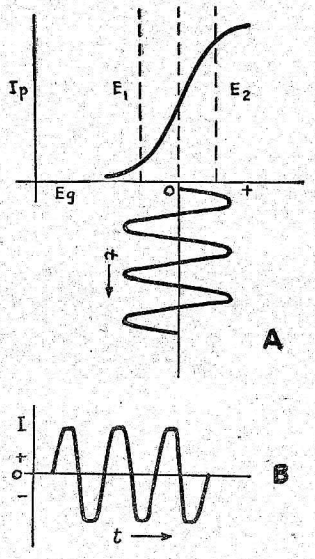


FIG. 26

of the tube. Ionization occurs when the electrons attain a sufficient velocity to break up, by collision, the gas molecules which they strike, forming two or more parts carrying positive and negative charges. On this account the ionization greatly complicates the action of the tube.

Tube Distortion

Irrespective of the kind of amplification used, there exists certain fundamental causes for distortion in amplifying tubes themselves which must be guarded against. Chief among these is the curvature of the characteristic at the ends of the comparatively straight central portion. If the impressed voltage extends beyond this central portion, the peaks of amplified wave forms will tend to be flattened as shown in Fig. 26 B.

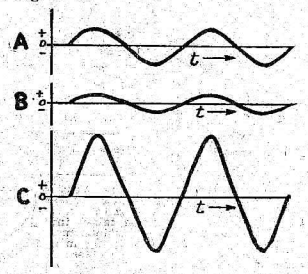


FIG. 27

It is seen in Fig. 26 A that the operating range of grid potential extends at most from E 1 to E 2, indicated by the dotted lines. With these limits, the greatest output will be obtained without serious distortion. Less distortion, however, may be obtained at a decreased output by restricting the limits so that the operating part of the curve is more nearly rectilinear.

Peak Flattening Effect

Graph A of Fig. 26 shows that the impressed voltage to be applied extends beyond this low distortion part of the tube characteristic, so that the current limiting or "cut-off" action of the tube comes into play. Graph B shows that the output wave form, instead of being an exact but magnified counterpart of the original input wave form, has its peak portions cut off or flattened out as a result of the flattening of the tube characteristic at its two extremities.

It should be noted here that in the magnified wave form, only the ordinates are increased by amplification. The abscissae, of course, remain constant, as they represent time intervals which are the same in the two graphs. This causes an apparent change in the wave form as viewed by the eye, but the actual time rate of variation is maintained in correct ratio.

This effect is shown in Fig. 27, where A, B, and C, all represent the same wave form, the curve of sines, of identical frequency but of different amplitudes. A sound represented by these wave forms would be weak in B, louder in A, and loudest in C, but the quality of the sound would be the same in all.

Editor's Note—The next installment of Mr. Miessner's instructive series of articles will appear in the July 8 issue of RADIO DIGEST.

The Plain English of Ether and Ether Waves

By Letson Balliet

AIR waves and ether waves are different. We know that both light and heat waves come from the sun. We know that there must be something to conduct these waves, for they could not come through a vacuum. We know that whatever it is that fills the space between here and the sun is not air, because the air film that surrounds the earth is only 40 miles deep, while the sun is 93,000,000 miles away. There is no air in space. In fact, the space between the stars comes as near being pure nothing as we can imagine, but there is something that conducts the heat vibrations or waves more rapidly than air will conduct them. We will call it "ether."

Use Spectroscope

If we undertake to analyze the heat and light waves we use the spectroscope, which separates the waves by their wavelength, giving us the seven colors of the rainbow, or the colors of the prism. Light and heat waves come together. As we commonly see the light of the sun, of the fire and the electric light we know that they have both heat and light. The raindrops, the prisms and the spectroscope reflect all of the visible light waves. A green light differs from the red light only in the length of the ether waves. Yellow, violet and blue differ only in wave length.

Violet Waves Shortest

The violet waves are very short. The blue waves are a little longer, green waves are still longer and red waves still longer, though they come several million to the inch. To the unaided eye these waves come mixed and we see a blended color of light; in some lights we have one wave predominating over the others.

But the light waves are not all the waves coming through the ether. There are still other longer waves, which are invisible and are called the "infrared," or heat waves. Thus the only difference between the visible light waves and the heat waves is that the heat waves are the longer. The common electric light has a greater number of long heat waves than it has visible light waves. In other words, there is more heat energy in an electric light than there is light energy.

Wave Lengths Discussed

And now, if we advance still farther, we pass into wave lengths that are longer than the heat waves. These are the Hertzian waves, or wireless waves, and may range anywhere from one-fifth of an inch to several miles in length. These are the waves that we must make to send a wireless message and these are the waves we must catch and amplify into sound waves in order to hear them.

Now, we know that a dog can hear a fainter sound than a human ear can detect, and that a dog howls with pain at the ringing of a bell, which is due to the height of the waves, not to the length of the waves. The dog's ear drum is "tuned" more sensitively to catch shallow or faint waves than the human ear, hence a deep or loud wave continuously vibrating makes the dog howl with pain and anguish.

In order that the human ear may be able to detect the vibrations that are as faint or even more faint than those that are detected by the dog's ear, the vibrations must be amplified by some means. In other words, their pressure or strength must be increased. As a comparison, a pipe line carrying water or oil a long distance might have a booster pump installed somewhere along the line to increase the pressure, or an electric current generated at, say, 2,200 volts pressure could be passed through a transformer and brought out at a pressure of 100,000 volts for transmission to great distance. If it was passed the other way through a series of transformers it could be stepped down to two or three volts, or even to a fraction of a volt, which would be so low that its detection would be impossble. It is on this principle that the amplifier works. It increases the pressure or size of the vibrations until they are of sufficient size or strength to operate on the human ear drum. These vibrations can be amplified still greater by a series of amplifiers until concerts can be given in great auditoriums or speakers heard for blocks away from the amplifying apparatus.

All of this seems very simple, but it would result in nothing but discord and a jumble of sound waves if it were not possible to tune out all the vibrations except those wanted.

Tune for Waves

Figuratively speaking, the electricians have been able to "tune" electric vibrations so that they can obtain light waves, or from the same circuit obtain magnetic waves to turn a motor, and again, from the same circuit they can obtain heat waves to cook your food. The electric vibrations travel with the same speed as the ether waves that bring our light; hence electricity is used for sending or creating the wireless waves. Whether there are etheral waves in electricity as generated, or whether they are capable of transmitting their vibrations to the ether I do not know, but we do know that electric actuated waves come through the ether to the receiving station, just as we know that heat waves and light waves come through the ether from the sun.

Must Meet Resistance

We also know that the further away we go from the earth the colder it gets, aviators and temperatures on high mountains have proven that, and it will surprise many of us to know that the space between the earth's atmosphere and the sun is absolutely dark, and the temperature is down to absolute zero. In other words, traveling heat and light waves through the ether give neither heat nor light till they meet resistance or interruption in the earth's atmosphere. Neither will electric vibrations give off heat or light till they meet resistance. While it is impossible to make electric transmission lines at absolute zero, it is a common sight to see ice and snow upon electric wires carrying thousands of horsepower which may lead to electric furnaces where 8,000 or 10,000 degrees are in use.

Editor's Note—The third of Mr. Balliet's everyday language explanations of the wonders of Radio will appear in the July 1 issue of RADIO DIGEST.

Radio Telephony for Amateurs and Beginners

Part VI—Section I: Crystal Detectors

By Peter J. M. Clute

To Explain—

The following article by Peter J. M. Clute is a continuation of his series. Articles to come are:

VI. Detectors: Crystal and Vacuum Tube, Section II Vacuum Tube.
VII. The Batteries.
VIII. Receivers and Loud Speakers.
IX. Crystal Detector Receiving Sets.
X. Vacuum Tube Receiving Sets.
XI. Amplifiers.
XII. Useful Information.

The process of tuning the receiving circuit to the incoming Radio-frequency waves had been described in the previous part. These high-frequency currents are then converted, through the medium of the detector, into direct current, so that with the aid of the telephone receivers the incoming signals are rendered audible to the ear. This device, therefore, performs the function of converting the Radio-frequency oscillations of the antenna circuit into uni-directional pulsating currents.

High frequency oscillations are far in excess of the limiting frequency of vibration to which the ear will respond. Under normal conditions, vibrations whose frequencies are above 10,000 cycles per second are inaudible. The diaphragm of the telephone receiver vibrates at frequencies between 500 and 1,000 cycles per second.

Of the various kinds of detectors only two are commonly used, namely, the crystal detector and the vacuum tube detector.

The Crystal Detector

The crystal detector (Figure 1) consists essentially of a piece of mineral, such as listed below, upon which rests with light pressure a sharp metal point,

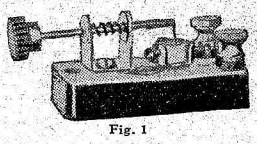


Fig. 1

or a piece of some other mineral. The crystal is generally mounted in a metal cup, which forms one terminal of the detector. The pointed contact is adjustable so as to be moved over the surface of the crystal, until a point is found where signals are clearly received. Figure 2 shows a weatherproof and dustproof galena crystal detector. Some of the minerals which possess the valuable property of rectification are: Galena, carborundum, silicon, tellurium, zincite. Some crystals are more sensitive than others because they are better rectifiers. All crystal combinations act as rectifiers, that is, current can only pass through the detector in one direction. Alternating current is changed to direct current by the detector. Naturally, this direct current is a pulsating one, inasmuch as there is no current flowing during the time that the alternating current is applied in the negative direction. The high-frequency currents received in the tuning circuit vary the same as the transmitted electro-magnetic waves vary with the speech or sound vibrations. The pulsating direct current thus passing through the detector and telephone receivers varies in strength in the same proportions, thereby causing the receiver diaphragms to be vibrated by the magnetic variations in their windings and so give off audible waves.

While it not as yet definitely known how or why a crystal detector acts as it does, it is quite evident that it works, in effect, as a rectifier. The sensitivity of a crystal is a measure of the degree of its usefulness as a rectifier of high-frequency currents. In order to get as much contact with them as possible, crystals will work much better and more efficiently, if mounted in a soft metal alloy. An alloy, known as Wood's metal, is commonly used for this purpose. When the crystal is held by set-screws, or in a fuse clip, there is added, in effect, another metal point, working in opposition to the one already provided. Under these adverse circumstances, the current can not flow through the crystal detector in either direction.

Sensitiveness of the Crystal

The value of a crystal detector lies in its sensitiveness to the incoming oscillations, in addition to its stability of adjustment. Some crystals will give good signals on currents which give no sound at all on other crystals. Furthermore, crystals of the same material differ greatly in sensitiveness, and some of them have only a few sensitive spots on the surface.

Many crystals, such as carborundum, operate better with a low-voltage battery connected across them. The small current supplied by this battery must flow

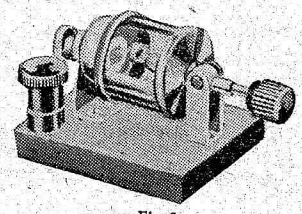


Fig. 2

in a certain direction through the crystal, the amount of current being adjusted by means of a potentiometer. Carborundum requires a firm pressure of the contact point to obtain audible signals. It is one of the most stable detectors but it not very sensitive, unless a battery is connected across it as explained above. A connection of this sort is shown in Figure 3.

Galena, with a fine phosphor bronze or steel wire point resting lightly upon it, is the most sensitive detector. However, it has to be readjusted frequently, because strong signals or slight vibrations easily put it out of adjustment. Figure 4 shows a galena detector that is easily adjusted and clamped in position.

A crystal detector consisting of silicon with a brass contact point combines a fair share of both stability and sensitiveness.

Use of a Test Buzzer

If the crystal detector receiving set is being used beyond the usual range, it may be necessary to use a test buzzer, such as is shown in Figure 5, to make sure that the detector is adjusted to the utmost

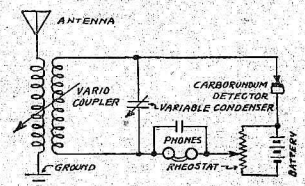


FIG. 3: CIRCUIT FOR CARBORUNDUM DETECTOR WITH BATTERY.
Fig. 3

sensitiveness. The buzzer test serves as a positive indication of the sensitivity of the crystal detector. The buzzer is connected in series with a dry cell and a single-pole switch, or push-button, a wire from one side of the buzzer interrupter being lead to the ground lead of the receiving set, as shown in Figure 6. When the switch is closed the electro-magnetic waves given off by the buzzer interrupter are impressed on the receiving circuit. The detector can then be adjusted for sensitivity as though tuning for a Radio-frequency transmitter. Adjust the detector until the sound of the buzzer is audible in the head-phones—the spot that brings the buzzer signals in loudest is the most sensitive. The buzzer circuit can then be opened, and by proper tuning anything in the range of the receiving set can be heard.

Figures 7 and 8 show other methods of using a buzzer for this purpose, by depending upon induced currents. The advantages are slight but users of this system claim that sensitive spots so found on crystals are not apt to be lost or burnt and that more sensitive spots are generally found. In Figure 7, several turns

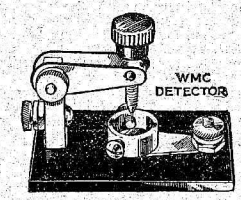


Fig. 4

of wire are wound around the aerial "lead-in" wire, before connecting to the buzzer. In Figure 8, a coil of wire, in the buzzer circuit, is placed near the loose coupler or tuner, so as to react upon it.

Figure 9 shows a single-circuit receiving connection, in which the detector element is connected directly to the terminals of the tuning coil. Oftentimes better and more satisfactory results may be obtained by connecting the detector across part (one-third to one-half) of the coil, instead of across all of it.

An indirect method of connecting the detector to the antenna circuit is shown in Figure 10, where the antenna tuning

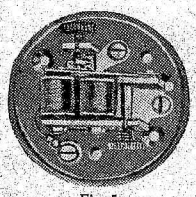


Fig. 5

coil is the primary of a loose coupler or variometer. The crystal detector is connected across the secondary of the coupler. The currents induced in the secondary coil by the high-frequency currents flowing in the primary or antenna circuit are rectified by the detector, as previously explained. In the two-circuit receiver, two circuits must be tuned to the incoming waves and the degree of coupling between the primary and secondary

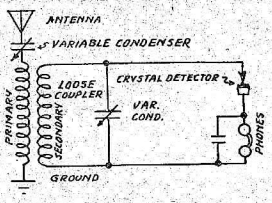


FIG. 10: TWO CIRCUIT RECEIVER.

coils of the coupler must be carefully adjusted for best results. The secondary is usually movable with reference to the primary, so that the induced effect of the primary on it can be regulated gradually. The two-circuit is more selective than the single-circuit receiver, and, hence, it eliminates interference from signals which are not desired to be heard.

The distance at which a crystal detector set can receive is dependent, in a small measure, upon the power of the transmitting station. The present commercial Radiophone broadcasting stations can be heard with a crystal detector at a distance not over thirty to forty miles. For long distance reception a detector having more sensitive and stable characteristics than the crystal type is quite desirable and very essential. These characteristics are embodied in detectors of the vacuum tube type.

The vacuum tube detector has the advantage over the crystal detector in the matter of increased range, louder signals and more stable adjustment. With a vacuum tube as a detector, signals may be received at distances up to eighty or ninety miles.

NOTE:—The second installment for Part VI of this series will appear in the next issue and will deal with vacuum tube detectors, giving the theory, construction and operation of the same.

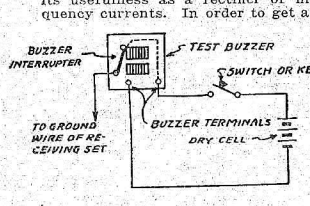


FIG. 6. CONNECTIONS FOR BUZZER FOR TESTING CRYSTAL DETECTOR.

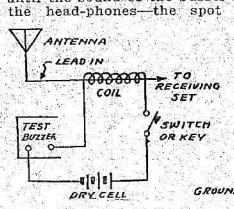


FIG. 7: MODIFIED CONNECTIONS FOR TEST BUZZER.

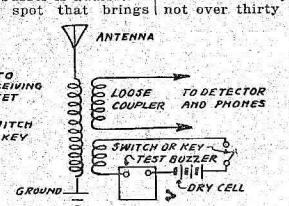


FIG. 8: MODIFIED CONNECTIONS FOR BUZZER FOR TESTING CRYSTAL DETECTOR.

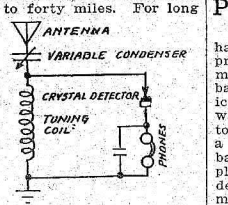
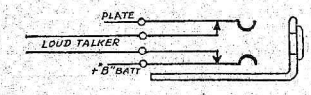


FIG. 9: SINGLE CIRCUIT RECEIVER.

Connection for a Loud Speaker

Those of you who have a two circuit jack for your last stage of amplification can save time and also one plug by connecting a pair of binding posts to your idle



terminals and connecting your loud talker to the binding posts permanently. Removing the phone plug thus automatically connects your loud speaker.

Do Not Use Any Paint on Sets

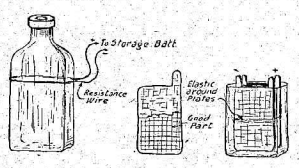
In finishing your Radio apparatus do not use any kind of paint on them. This is because most paints contain metal oxides and are poor insulators. Use nothing but a good grade of water or oil stain and either shellac or a good insulating varnish. Do not apply the shellac or insulating varnish too thickly over coil windings because this lessens their efficiency. A very thin coat will do just as well.

To Make "B" Battery Cell

It is easy to make a B-battery if you can procure a suitable glass bottle that has an almost square body. The bottle must be cut to the proper height. There are several ways to do this. One is to wind one turn of resistance wire around the bottle at the desired height and short the wire across a storage battery. When the wire becomes hot tap the top of the bottle smartly and the glass will break off smooth.

Procure some old unsulphated plates, 2 by 3 inches, at a battery supply station, and cut them to the right size to fit in the bottle. Use two positive and two negative plates in each jar made from the bottles. Be sure to have proper insulation between the plates.

When placing the plates in the jar remember to put first positive and then the negative, then positive and negative again. Make sure that both negative plate leads will come on the same side of the jar and the positive leads on the other side of the jar. Two volts per cell will be obtained. Ten cells will be enough for an audion detector.



Make inquiry of your battery service dealer in regard to how much acid and water to use and how low to charge each cell. Do not put the acid in the cells until ready to charge and use.—Marius Salisbury.

Panels Made of Battery Boxes

Material for a panel is not always at hand and in some localities is hard to procure. I am using hard rubber plates made from material cut out of storage battery jars procured from a battery service station. Fill the battery jar with hot water and cut the one side with the bottom attached in one piece. This gives you a panel about 8 by 12 inches in size with a base to mount it on. A number of these plates can be used as units with a tuner, detector and amplifiers, and they will make a very attractive set. By placing these panels in hot water they work up very easy and a person can cut or drill them without fear of breaking the piece. —R. C. Barrie.

Simple Instructions for the Beginner

By Harry J. Marx

Radio Formulae

before he can thoroughly understand the theory and operation of Radio telephony. It is to his advantage to study the operation of his set and to understand just how each piece of apparatus can be used to the best advantage. To do this the proper instrument must be used in each place in the circuit. This means that the capacity, inductance, resistance or any other characteristics must be found and located in the proper place in the circuit. The following general formulas are given and where necessary an explanation is added. No explanation of the derivation is given.

Ohms law is given, but the amateur must remember it does not apply to alternating current.

$$\text{Amperes} = \frac{\text{Volts}}{\text{Ohms}} \quad (1)$$

$$\text{Watts} = \text{Volts} \times \text{Amperes} \quad (2)$$

$$\text{Frequency} = \frac{\text{velocity}}{\text{wavelength}} \quad (3)$$

$$\text{Wavelength} = 1885 \sqrt{C \times L} \quad (4)$$

where

C = capacity in microfarads

L = inductance in microhenries

Resistance in series

$$R = R_1 + R_2 + R_3 \quad (5)$$

Resistance in parallel

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \quad (6)$$

Capacity of a condenser in micro-microfarads

$$C = .0885 \frac{KS}{t} \quad (7)$$

where

t = thickness of dielectric

S = Surface area in square centimeters

K = dielectric constant

Table for "K"

Substances	Values of dielectric constant
Air	1.0
Glass	4 to 10
Mica	4 to 8
Hard rubber	2 to 4
Paraffin	2 to 3
Paper, dry	1.5 to 3.0
Paper (treated as used in cables	2.5 to 4.0
Porcelain, unglazed	5 to 7
Sulphur	3.0 to 4.3
Marble	9 to 12
Shellac	3.0 to 3.7
Beeswax	3.2
Silk	4.6
Celluloid	7 to 10
Wood, maple, dry	3.0 to 4.5
Wood, oak, dry	3.0 to 6.0
Molded insulating material, shellac base	4 to 7
Molded insulating material, phenolic base ("bakelite")	5.0 to 7.5
Vulcanized fibre	5 to 8
Castor oil	4.7
Transformer oil	2.5
Water, distilled	81.0
Cottonseed oil	3.1

Series & Parallel

Capacity of condensers in parallel

$$C = C_1 + C_2 + C_3 \quad (8)$$

Capacity of condensers in series

$$C = \frac{1}{\frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}} \quad (9)$$

Voltages in a transformer

$$\frac{Ep}{Es} = \frac{Tp}{Ts} \quad (10)$$

where

Ep = voltage in primary

Es = voltage in secondary

Tp = turns in primary

Ts = turns in secondary.

Antenna Formulae

Watt energy radiated in transmitting

$$\frac{WE = 1578\ H^2\ I^2}{Wa^2} \quad (11)$$

where

H = Height of aerial in meters

I = Current at base of aerial in amperes

Wa = Wavelength of aerial in meters

Capacitance of antenna in microfarads

$$C = \frac{Wa^2 - Wá^2 \times C'}{Wá^2} \quad (12)$$

where

Wa = natural wavelength of aerial in meters

Wá = wavelength with condenser in series

C' = capacity of condenser in series with aerial

Inductance of an aerial in centimeters

$$L = \frac{Wa^2}{Wá^2 - Wa^2} \times L' \quad (13)$$

where

Wa = natural wavelength of aerial in meters

Wá = wavelength with inductance in series

L' = Inductance of coil in series with aerial

Wavelengths Corresponding to Various Frequencies

Wavelengths in meters	Frequency in cycles per second
200	1,500,000
300	1,000,000
450	666,666
600	500,000
1,000	300,000
2,000	150,000
3,000	100,000
6,000	50,000
8,000	37,500
10,000	30,000

Coil Formulae

The amateur occasionally finds that the natural wavelength of his aerial is too high for broadcasting. To reduce the natural wavelength of the antenna a condenser is connected in series in the antenna circuit.

The following formula gives the approximate capacity in microfarads required to reduce the wavelength of the aerial to the desired meters:

$$C = \frac{W^2 \times Ca}{3552\ LaCa - W^2} \quad (14)$$

where

W = desired wavelength in meters

La = inductance of the aerial in centimeters

Ca = Capacity of the aerial in microfarads

The inductance of the primary coil in an antenna circuit for a desired wavelength is calculated from the following formula:

$$L = \frac{W^2}{3552\ Ca} - \frac{La}{3} \quad (15)$$

where

W = desired wavelength in meters

Ca = capacity of the aerial in microfarads

La = inductance of the aerial in centimeters

If the circuit is to be used for longer wavelengths than that of the antenna with the primary coil, loading coils are inserted in series. The following formula gives the required inductance in centimeters of the loading coils.

$$L = \frac{W^2}{3552\ Ca} - \left(\frac{La}{3} + Lp\right) \quad (16)$$

where

W = desired wavelength in meters

Ca = capacity of the antenna in microfarads

La = inductance of the antenna in centimeters

Lp = inductance of the primary coil in centimeters

The inductance in centimeters of the secondary coil is calculated as follows:

$$L = \frac{W^2}{3552\ C} \quad (17)$$

where

W = desired wavelength in meters

C = capacity of the condenser shunted across secondary coil

The inductance in centimeters of any single layer coil where the details of the winding are given can be figured from the formula:

$$L = \frac{39.47\ Kr^2 n^2}{J} \quad (18)$$

r = radius of coil in centimeters

n = number of turns

J = equivalent length of winding in centimeters

K = variable factor depending on the value of $\frac{2r}{l}$

Here is table showing the length and turns for different coils, all wound with No. 28 single silk covered wire. The inductance values will be accurate within 5 per cent:

Coils 3 Ins. in Diameter

L cms.	Total No. of turns	Length of coil in ins.
50,000	18	0.28
100,000	27	0.42
200,000	42	0.64
300,000	53	0.82
400,000	64	0.98
500,000	73	1.13
600,000	83	1.27
700,000	92	1.42
800,000	101	1.55
900,000	110	1.70
1,000,000	119	1.83

Coils 5 Ins. in Diameter

500,000	47	0.73
1,000,000	72	1.10
1,500,000	94	1.44
2,000,000	113	1.74
2,500,000	120	2.00
3,000,000	147	2.26
3,500,000	164	2.52
4,000,000	180	2.76
4,500,000	195	3.00
5,000,000	210	3.24

TABLE V. WAVE LENGTH VALUES

Inductance Milhenries	CAPACITY IN MICROFARADS								
	.00025	.00030	.00040	.00050	.00060	.00070	.00080	.00090	.00100
0.02	133	146	169	188	206	223	238	253	267
0.025	149	163	188	211	231	249	267	283	298
0.03	163	179	206	231	253	273	292	310	326
0.04	188	206	238	267	292	315	337	358	377
0.05	211	231	267	298	326	353	377	400	421
0.06	231	253	292	326	358	386	413	438	462
0.07	249	273	315	353	386	417	446	473	499
0.08	267	292	337	377	413	446	477	506	533
0.09	283	310	358	400	438	473	506	536	565
0.10	298	326	377	421	462	499	533	565	596
0.12	326	358	413	462	506	546	584	619	653
0.14	353	386	446	499	546	590	631	669	705
0.16	377	413	477	533	584	631	674	715	754
0.18	400	438	506	565	619	669	715	759	800
0.20	421	462	533	596	653	705	754	800	843
0.25	471	516	596	666	730	789	843	894	942
0.30	516	566	653	730	800	864	923	979	1,032
0.40	596	653	754	843	923	997	1,066	1,131	1,192
0.50	666	730	843	942	1,032	1,115	1,192	1,264	1,333
0.60	730	800	923	1,032	1,131	1,221	1,306	1,385	1,460
0.70	789	864	997	1,115	1,221	1,320	1,410	1,496	1,577
0.80	843	923	1,066	1,192	1,306	1,410	1,509	1,599	1,686
0.90	894	979	1,131	1,264	1,385	1,496	1,599	1,696	1,788
1.00	942	1,032	1,192	1,333	1,460	1,577	1,686	1,788	1,885
1.20	1,032	1,131	1,306	1,460	1,599	1,727	1,846	1,959	2,065
1.40	1,115	1,221	1,410	1,577	1,727	1,866	1,995	2,116	2,230
1.60	1,192	1,306	1,509	1,686	1,846	1,995	2,133	2,262	2,384
1.80	1,264	1,385	1,599	1,788	1,959	2,116	2,262	2,399	2,529
2.00	1,333	1,460	1,696	1,885	2,065	2,230	2,384	2,529	2,665
2.50	1,490	1,632	1,885	2,108	2,308	2,493	2,665	2,827	2,980
3.00	1,632	1,788	2,065	2,380	2,529	2,732	2,920	3,097	3,264
4.00	1,885	2,065	2,384	2,665	2,920	3,154	3,372	3,576	3,770
5.00	2,108	2,308	2,665	2,980	3,264	3,526	3,770	4,000	4,214
6.00	2,308	2,529	2,920	3,264	3,578	3,863	4,129	4,379	4,617
7.00	2,493	2,732	3,154	3,526	3,863	4,172	4,460	4,731	4,987
8.00	2,665	2,920	3,372	3,770	4,129	4,460	4,768	5,057	5,321
9.00	2,827	3,097	3,576	3,998	4,379	4,731	5,057	5,364	5,654
10.00	2,980	3,264	3,770	4,214	4,617	4,987	5,331	5,654	5,960
12.00	3,264	3,576	4,129	4,617	5,057	5,462	5,840	6,192	6,529
14.00	3,526	3,863	4,460	4,987	5,462	5,900	6,306	6,693	7,052
16.00	3,770	4,129	4,768	5,331	5,840	6,306	6,741	7,152	7,539
18.00	3,998	4,379	5,057	5,654	6,192	6,693	7,152	7,587	7,996
20.00	4,214	4,617	5,331	5,960	6,529	7,052	7,539	7,996	8,429
25.00	4,713	5,161	5,960	6,663	7,299	7,885	8,429	8,940	9,423
30.00	5,161	5,659	6,529	7,299	7,996	8,637	9,233	9,794	10,320
40.00	5,960	6,529	7,539	8,429	9,233	9,973	10,660	11,310	11,920
50.00	6,663	7,299	8,429	9,423	10,320	11,150	11,920	12,640	13,330
60.00	7,299	7,996	9,233	10,320	11,310	12,210	13,060	13,850	14,600
70.00	7,885	8,637	9,973	11,150	12,210	13,200	14,100	14,960	15,770
80.00	8,429	9,233	10,660	11,920	13,060	14,100	15,090	15,990	16,860
90.00	8,940	9,794	11,310	12,640	13,850	14,960	15,990	16,960	17,880
100.00	9,423	10,320	11,920	13,330	14,600	15,770	16,860	17,880	18,850
120.00	10,320	11,310	13,060	14,600	15,990	17,270	18,460	19,590	20,650
140.00	11,150	12,210	14,100	15,770	17,270	18,660	19,950	21,160	22,300
160.00	11,920	13,060	15,090	16,860	18,460	19,950	21,330	22,620	23,840
180.00	12,640	13,850	15,990	17,880	19,590	21,160	22,620	23,990	25,290
200.00	13,330	14,600	16,860	18,850	20,650	22,300	23,840	25,290	26,650

The table shown above is given as an aid to the amateurs who are interested in the calculations that were described in the two-part article on "Tuning Apparatus Design." It gives the wave length in the meters, when the capacity and inductance are known. In the same sense, the table can really be used to get any one of the three values when the other two are known. This will help in eliminating a number of the tiresome calculations necessary in solving the wave length formula.

Correct Regenerative Tuning

By William R. Tanner

A regenerative receiving set is not hard to tune, once the operator gets used to the complicated controls. Probably not more than 2 or 3 percent of the Radio fans realize the importance of tuning the primary circuit to the exact frequency of the secondary. When this is done, a surprising amount of amplification is obtained, and signals are much sharper, in fact, stations not wanted, can usually be tuned out. The procedure is as follows: Set the coupling at about 35 or 40 degrees. Start the tube oscillating by increasing the inductance of the plate variometer or tickler, whichever is used. Start tuning the secondary condenser (as grid variometer) from zero to maximum, at the same time tuning the primary condenser and inductance until the click is heard in the phones. If no click is heard, use more taps on the primary. With close coupling two clicks will be heard a few degrees apart. The looser the coupling, the closer will be the clicks. On either side of the clicks, continuous wave signals can be received. For phone signals, the operator should decrease the plate variometer until voice or music is clear. Spark signals may be received at the point between the two clicks. The primary condenser should preferably be shunted across the primary coil as this gives louder signals and the series connection. This method is applicable to both short and long receivers. The back of the panels should always be coated with tin foil or other metal to eliminate body capacity effects. The foil should, of course, be grounded. If a secondary condenser is used, capacity effects of the hand may sometimes be eliminated by grounding the stationary plate. The connection from the rotary plate should go to the grid side of the coil.

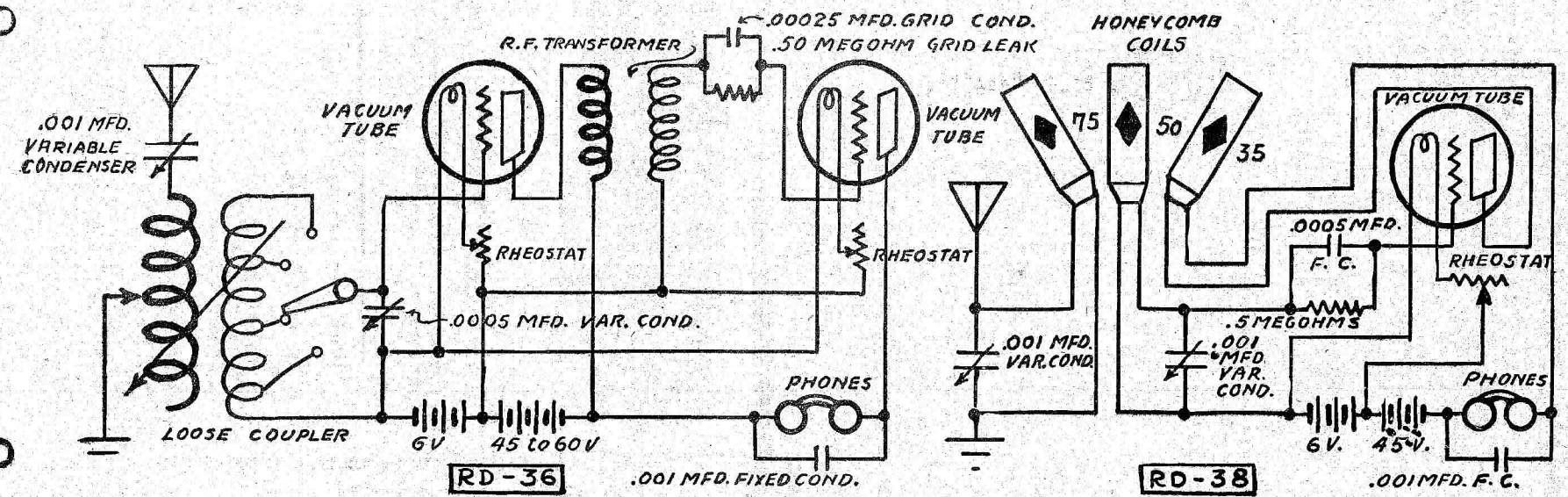
Dodging Body Capacity Effects

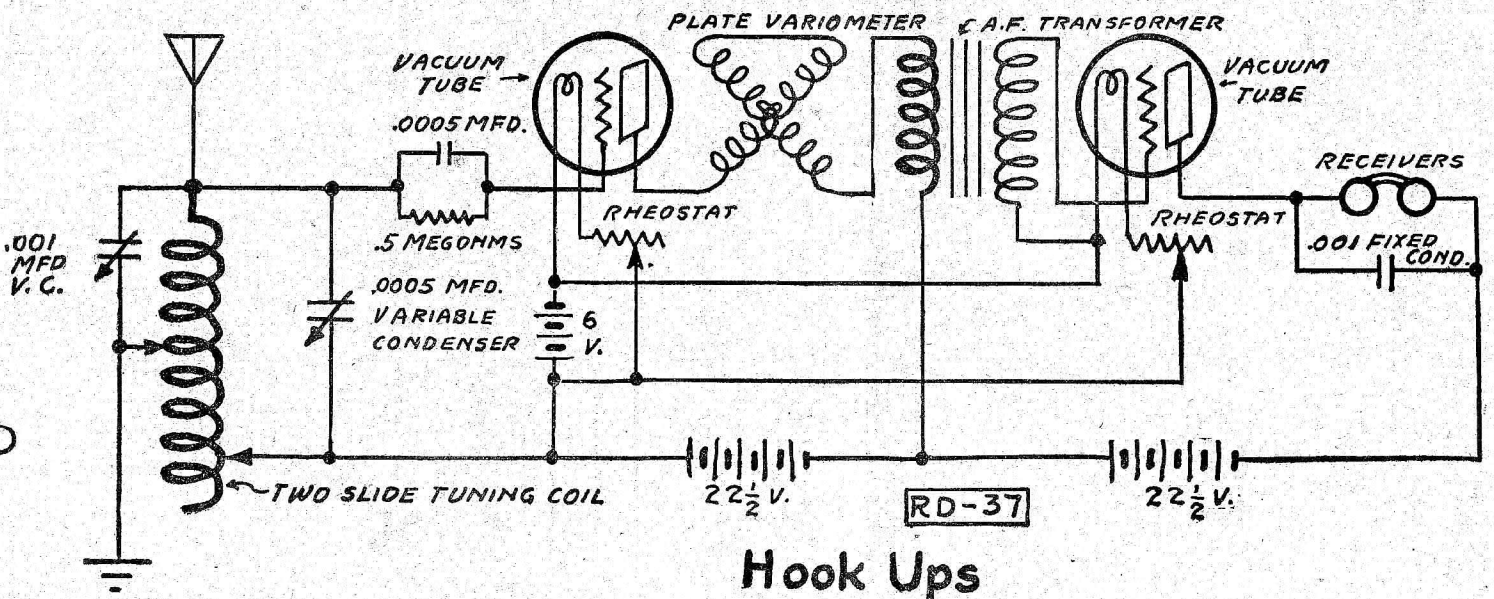
Many sensitive regenerative receivers are troubled by body capacity effects. To eliminate these, the panels may be lined with grounded tinfoil, but this is bothersome to do with so much wiring in the way. A so-called "magic wand" has been conceived but lacks friction for fine adjustments and I have found that a twelve-inch length of rubber tubing or hose will remove the effects and has friction enough for very fine adjustments, which are necessary for sharp tuning. By pressing an end against the dial and turning it as desired, it will perform very well.—Lewis A. Spalding.

Radio Digest Illustrated

No 11

By: Harry J. Marx





Hook Ups

J.T.

Questions and Answers

Audio Frequency

(631) EW

I am a reader of RADIO DIGEST. Inclosed find a drawing of Hook-up for 1 Variocoupler and 1 Variometer. How can I connect 2 steps of Amplification to this circuit. This Hook-up will be found in Vol. 1, No. 3, April 29.

A—Hook-up Q & A 631 is given on this page.

Potentiometer as Rheostat

(232) EHB

I am submitting herewith attached a diagram of a hook-up system which I would appreciate if you would look over and give me a little advice as to its receiving qualities. The following questions have me plexed to quite a degree.

1. Is an amplifier necessary with this hook-up system.
2. How far will this receiving set receive telephone messages and also code messages.
3. Is it a good policy to use an auxiliary coil and also a variable condenser in series with the antenna.
4. Will a potentiometer of 200 ohms 0.2 Amps. work as a Rheostat and to what degree if any.
5. Is the vacuum tube detector and amplifier contained in one tube or can you get them separate.

A.—1. How far do you want to receive? Better put a .001 mfd. condenser across your phones.

2. How high is your aerial? Are there any obstructions, building, trees, etc.? On an average, 100 miles.
3. No.
4. No. This resistance is too high.
5. The detector is one style of tube, the amplifier another.

Diagram Hook-up

(340) MCW

In your magazine Vol 1, No. 3, April 29th, 1922, on page five you illustrate a receiving set. I am just a new Radio fan and know very little about same, but I like the looks of the set shown and would like to know how great a range a set similar to the set shown can receive. I would like also to know if I could get further information as to type of parts shown and a more thorough diagram of the wiring and connections.

The nearest sending station is 300 to 500 miles. As I cannot buy such an outfit already set up, I would like to buy it a part at a time and assemble it myself.

Thanking you for information you can give me, I am

A.—The distance of reception with a set of this type depends upon the surrounding conditions, location of aerial etc.,

We cannot take a manufacturer's set and divulge the complete details of construction. If you want to assemble a set yourself I would suggest that you use the hook-up shown on page 13 of the 6th number of RADIO DIGEST, May 20th, 1922. This will give you the receiving range in miles that you need.

Honeycomb Coils vs. Vario Coupler and Variometers

(354) SA

Please send me an answer to the enclosed three questions by mail if possible.

1. With the enclosed hook-up, could I receive clearly from the stations in Cincinnati, about 100 miles, Louisville, 98 miles, Dayton and Toledo?
2. Can the toy transformers for electric trains be used as "A" battery in audion tube receiving set, giving 6 volts?
3. Are honeycomb coil sets, as shown in enclosed diagram better than a set containing a vario coupler and two variometers?

P. S. Please answer by enclosed self-addressed envelope as I buy RADIO DIGEST at the news stand and occasionally

1. What should be the diameter of the primary winding so as to obtain maximum results?
2. Is the range dependent upon the miss an issue. I think your magazine is the best published, at any price.

A.—1. No. See R. D., 11 issue, No. 4, RADIO DIGEST, May 6th, 1922.

2. Yes.
3. Matter of choice.

"Wave-length"

(275) MGM

I am enclosing the wiring diagram of a regenerative receiver, with a one step amplifier, that I am thinking of constructing.

Using standard parts, and having a one wire aerial forty-five feet high on one end and about fifteen on the other, and about ninety to one hundred feet long, what would be the range of such a set? Would I be able to hear the Radiophone broadcasts from Minneapolis, Minn., which is about two hundred and fifty miles from here?

A.—The natural wave-length of your aerial is about 175 meters.

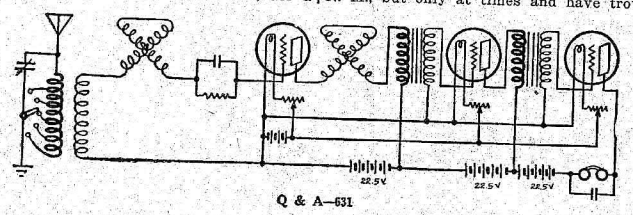
You ought to pick them up O. K.

Loose Coupler and Vario Coupler

(330) JGK

Having read your articles on the loose coupler and vario coupler, I decided to ask a few questions.

1. Please send me data for construction of a good loose coupler and a good vario coupler, in enclosed envelope.
2. May the ground of a lightning switch be connected with a drain pipe in the cellar of an apartment block or has it got to be driven in the ground outside?
3. Send list of parts necessary to build a fairly good bulb set.
4. Would 200 feet of seven strand copper covered antenna wire, about 60 feet high at one end and 50 feet at the end where the lead-in is, a 25 foot lead-in, and a wire about 20 feet long, going to a water pipe on the fourth floor, for a ground, would this make a good antenna?
5. With the antenna mentioned, a loose coupler of your design (or a vario coupler). A crystal detector, a .005 Microfarad phone condenser and a pair of 3,000 ohm Manhattan Radio telephone head set. What would be my approximate range? What could I add to better this set?



Q & A—631

A.—1. See issue No. 4 and 8 of the RADIO DIGEST.

2. The lightning ground must be outside.
3. Look up our hook-up sheets especially in No. 8.
4. Your aerial should not exceed 150 feet including lead-in and ground wire. Preferably not more than two strands for receiving.
5. About 30 miles. Use a vacuum tube.

"Radio Frequency"

(332) LH

Would you kindly answer the following questions:

1. Is it possible to connect a Radio frequency amplifier in the enclosed circuit (Grebe C. R. 8)? If so will you mark the changes in the diagram and return to me?
2. What kind of Radio frequency amplifying transformers and tubes would you advise me to get?
3. Will an aerial erect over a tin roof be effected by it? The aerial will be about thirty feet above the roof.
4. The national guard is thinking of putting in a station which will be quite near me (about 200 feet). Will they interfere while they are sending? Should my aerial be at right angles or parallel to theirs?

A.—1. No, not without taking it apart.

2. Any of the popular makes.
3. No.
4. To a limited extent depending on power, output, etc., parallel.

Indoor Aerial

(276) RCD

It is impossible for me to have an outdoor aerial. My aerial would be in a room about ten (10) by tewelve (12) feet, would you advise me to lay one wire around the molding, and then string three or four wires across the ceiling? The house is elevated about fifteen feet from the front sidewalk, and the elevation is about one hundred twenty-five (125) feet long. What instruments would I need to receive broadcasting from Chicago and about how much would they cost? Could I make any of the parts myself?

A.—Wind your aerial around the room four times spaced about 1 inch apart.

You will have to use a short wave regenerative receiver consisting of two variometers, one variocoupler, a vacuum tube detector and two stages of amplification.

You can make the variocoupler and variometers yourself.

Electric Bell Wire

(659) DJ

Would you please answer these questions in your RADIO DIGEST in the next issue:

1. Could I use wire off of a coil from an electric bell for the aerial?
2. Salina is twenty-five miles from where I live. Could I hear the concerts with a crystal set?

A.—1. I would not suggest using that wire as the gauge is rather small.

2. Yes, but not very clearly.

Loading Coil

(266) CT

Please answer these questions and oblige:

1. Please give data for making a 1,500 meter loading inductance and name the parts necessary to go with it for a crystal set.
2. Would a loose coupler wound with number 26 wire for both primary and secondary, be all right?

A.—See issues Nos. 9 and 10 of RADIO DIGEST. Also see loose leaf sheets for hook-ups.

2. Yes.

Loud Speaker

(277) CFH

We have the following Radio equipment hooked up as per the attached diagram variocoupler, two variometers, detector and two stages of amplification. We have an L type antenna about 35 feet high and 62 feet long.

We have at times gotten G. E. Co. WGY at Schenectady, WWJ, Detroit News, Fitzsimmons Hospital at Denver, University of Wisconsin at Madison, Wis., Roswell, N. M., but only at times and have trouble getting them very clearly at times. We are unable to get any of the closer stations although there are several within a 200 mile range.

Will you please criticize the diagram and give us any suggestions you may have? We also have a Magnavox but have not had any success with it. Can this be made to work on a Cunningham 301 amplifying tube or will we be compelled to use power tubes and a higher voltage? In this case would it be all right to use a mercury arc rectifier, connecting directly to the amplifier or power tube? Do you know of anyone having had satisfactory results using a Baldwin phone on a Victrola?

A.—For one thing your aerial ought to be longer. Another point, shunt a .001 mfd variable condenser across your primary and one .0005 mfd variable condenser across your secondary. This will help your tuning which I believe is the main cause of your trouble. Magnavox should work on two stages of amplification. Yes, a Baldwin phone can be connected to the Victrola. I believe there is a concern putting an attachment for the phone and Victrola on the market.

(227) GDD

I am taking this opportunity to accept your invitation of asking questions. I have several call books but none of them list the stations which sign off as I am listing and I will appreciate it very much if you will write the name of the station and where located after each of them, of course you understand it is telegraphy I am getting and not Radiophone.

Just write the station and location after these calls or as many as possible and return same to me.

A.—5 AN—H. W. Phillips, McAlester, Okla.

5 BF—C. R. Taylor, Waurika, Okla.
WXY—Washington, D. C. (Govt.)
WHY— ?
Z-WD—H. L. Demuth, N. Y. C.
WYB— ?
3 BC—C. A. Roberts, Phila., Pa.,
WVP—Fort Drum, Phillippine Islands.

Panel With Fittings.

Many an amateur can easily make a panel with fittings from some parts of his "meccano" or similar set and a cigar box. A tuning coil for this purpose can be made by winding wire (about No. 22 insulated) around a pasteboard box in which salt or rolled oats are sold, taking as many taps out as desired from the coil. The taps are connected as shown in the illustration, using the nuts and bolts for the switch points. The illustration is self explanatory. The panel may be stained dark or enameled black to improve the appearance.

A home-made variocoupler may be mounted in the same way as the tuning coil, except that it has two knobs with switch points instead of one.—Joseph M. Manenium.

Reducing Static.

One way to reduce static is to make a loop lead to the aerial. Construct the aerial in the usual manner then make connections to each wire in the aerial and run them down as shown in the illustration. Keep the wires separate with rings of insulating material to hold them in a circular form. I have found this to reduce much of the static to be encountered during the warm weather.—Clifford Kenyon.

MANAGUA, NICARAGUA—The establishment of a commercial Radio station at Managua, and also stations at Bluefields, San Juan del Norte, and Cabo Gracias de Dios in Nicaragua, have been authorized by concessions granted to John B. Wilson, Managua.

Radio Illustrated

The "most ingenious Radio fan" is Sterling G. Sears, who made the smallest vacuum tube set and won the first prize at the recent New York Radio show. The set was judged best for police work. The set's normal range is seventy-five miles.
© K. & H.

There are other things to do at Brighton Beach on Long Island, New York, besides bathing and luncheon. Then, too, who wants to stay in the water all the time when there is something interesting in Radioing? Miss Peggy Roy and Miss Florence Cronin enjoying the shade under a beach umbrella and listening in on grand opera.
© Int.

Another small receiving set which is placed into a safety razor box. It consists of a variable condenser, a tuning coil and a crystal detector. Signals can be heard for a distance of ten miles.
© K. & H.

The largest Radio horn ever made was placed in Idora Park, California. This horn will megaphone music over an area of twenty-eight square miles.
© Wide World