

Beginners Given Plain Directions This Issue

Radio Digest

Illustrated

THIS NUMBER **Illustrated** 50,000 COPIES

Vol. 1. No. 2

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E. C. Rayner

CHICAGO, ILL., SATURDAY, APRIL 22, 1922

PRICE TEN CENTS

RAIL LINES ADOPT RADIO

ARMY RADIO OUSTS WIRES, CUTS COST

WASHINGTON TO TALK TO POSTS BY AIR

Statistics Show Government Gains Sixteen Per Cent. on Capital of \$25,159,116 Since 1917

Washington, D. C.—Radiograms have displaced telegrams as a means of communication between headquarters and all posts in the United States army. This means a great saving to the army as the cost of operating a Radio transmitting set as compared with telegraphic rates is almost negligible. According to plans of Maj. Gen. Squier, chief signal officer, a corps of signal men will flash ordinary messages to post commandants via the ether instead of by wire.

It is stated that the government has taken in as earnings from the Radio transmission of messages \$1,853,270.95. The government has earned 16 per cent on an investment of \$25,159,116.15.

The amount received in 1921 was \$663,362.44; in 1920, it was \$641,584.90; in 1919, \$221,171.19; in 1918, \$291,903.08, and in 1917, the first year commercial and private messages were handled, it was \$32,249.34.

Schenectady-Frisco Radio Sets Record

Air Phone Standards Raised by Use of Short 360-Meter Wave, Three and One-Half Kilowatt Power

SAN FRANCISCO.—A new Radio telephone record was announced today. For four hours one night recently, a powerful sending station of the WGY, at Schenectady, New York, conversed and sent music to the Rock Bridge Radio receiving station of the Atlantic-Pacific Radio Supply company.

The record was all the more remarkable because of the fact that it was made on the short 360-meter wave length and with only three and one-half kilowatts of power used in transmission.

Unusually delicate amplifiers were used in the receiving sets making the test successful.

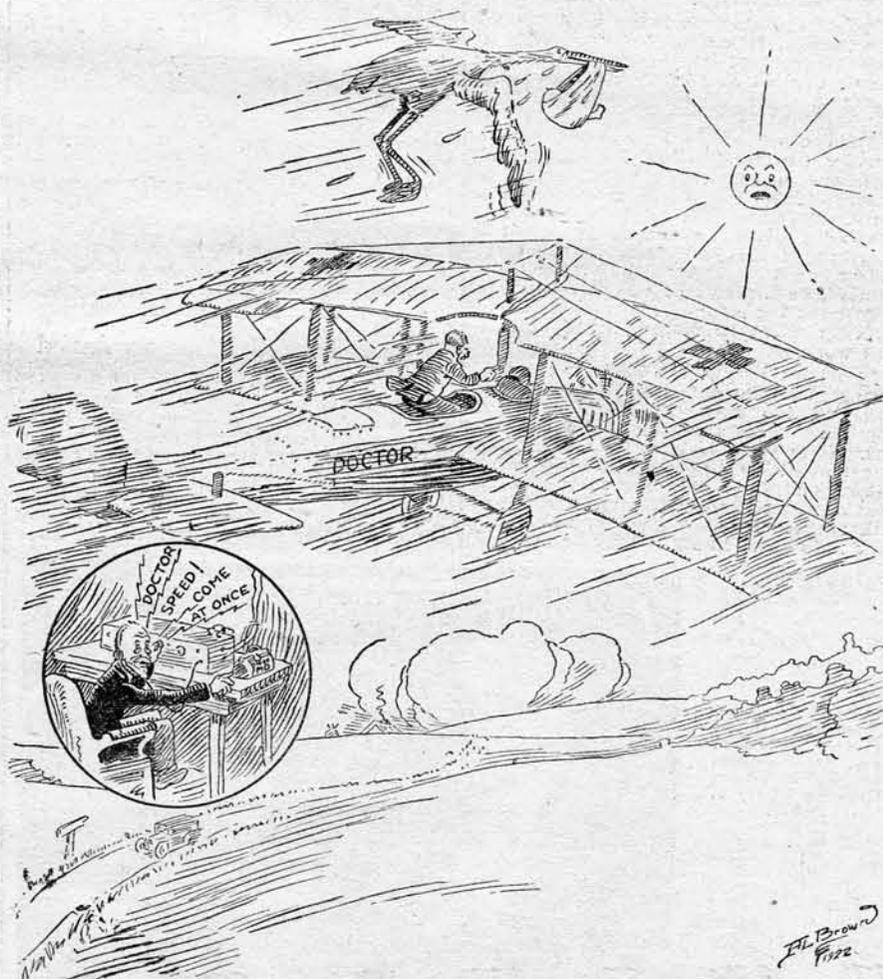
FIRST RADIO SUPPLY EXHIBIT IN DETROIT

Equipment Show in Michigan Metropolis Ends April 26

DETROIT.—The first Radiophone equipment show in the middle-west is being held in the Detroit armory, and will continue to April 26.

The show is in charge of W. W. Tanney, Detroit manager of the American Radio Exhibitors' Association, Inc. with offices at 1609 First National Bank Building. Mr. Tanney has announced 47 exhibits.

OL' DOC STORK FETCHES 'EM BY RADIO



Keyman, on Sunday, Uses Radio to Hear Preachment

HARRISBURG, PA.—Daniel Strine, a local telegrapher, goes to church by staying in bed, thanks to his trusty receiver. Last Sunday he was too tired and just tuned in on a Pittsburgh station just in time to get the minister's plea for a contribution.

SMALLEST RECEIVER QUARTER-INCH WIDE

Size of Wire Secret of Pittsburgh Instrument

Pittsburgh, Pa.—Matthew Bishop, a Radio fan, has produced what is claimed to be the smallest Radio set that will actually receive messages. The size of the instrument is five-eighths long and one-quarter inch wide. The coil is made of nine feet of black enamel wire wrapped about a piece of celluloid. The size of the wire is the secret, he says. It is tuned for KDKA only.

Weather Data Phoned by Air to Film Star

Larry Semon, in Hollywood, Becomes Ether Seaman

HOLLYWOOD, CAL.—Since the San Francisco Radio Station has inaugurated a service of storm warnings by Radiophone, to which any person may "listen in," Larry Semon, the comedy star, has installed a receiving set at his residence here primarily to get weather reports. Every morning his secretary "tunes" for the spoken "waves" and hands the report to Mr. Semon.

WIRES DEEMED PERILOUS

Borough President, Brooklyn, Asks Property Protection

BROOKLYN, N. Y.—The board of estimate has received a letter from borough president Connolly of Queens in which he urges that steps be taken to protect property from the careless stringing of wires across streets which makes a great fire hazard.

AIR PHONE SEEN VITAL TO TRAFFIC

Experiments Show Great Value in Sending Orders by Means of Ether

Use in Emergency Proved

Passenger Trade Is Gained by Installing Sets for News and Concerts

Radio and the great railroad systems of the country are being rapidly linked together. The latest form of communication, the Radiophone, and railway transportation will soon be inseparable if installation of Radio equipment on the trains continues at its present rate. Experiments have proved that of these two great arms of progress and civilization, Radio and railway transportation, the former is destined to enable passengers and train crews to maintain conversations perfectly with any fixed points or other moving trains they may desire while the trains are speeding from city to city.

Another use of Radio on trains which is booming its popularity is that of employing receiving instruments and loud speakers for the purpose of supplying the passengers with the broadcast programs in the air, be they concerts, news reports, stock and market quotations or any other one of the many varied entertainment features which Radiophone broadcasting stations are scheduling. In the realm of the experimental, it is reported that serious consideration is being given the practicability of using the Radiophone on railroads for emergency signal purposes following the tearing down of telegraph lines in wrecks or in storms, and for communication from one end of a long train to the other, as in the case of freight trains.

(Continued on page 2)

FORD TO RADIOPHONE REPAIRS TO DRIVERS

Detroit Plant Aids Car Owners by Air Advice

DETROIT.—When Henry Ford installs his large transmitting station at Dearborn, Michigan, it will be quite a boon to all owners of "flivvers." In the near future there will be a special receiving outfit to place in Ford cars. Equipped thus it will be an easy matter for the flivver owner to listen in on broadcasting talks on how to fix tires and to make repairs.

RADIO PLEASURES 'EM ON FAST TRAIN



Hearing KYW, Chicago, aboard C., M. & St. P. Fast Train; insert shows antenna on roof of coach

(Continued from page 1)

Adopt Radiophone for Passengers

The Chicago, Milwaukee and St. Paul Railroad claims the honor of having installed the first Radiophone equipment on trains for the use of passengers. On the 29th of March this road announced that it had equipped with Radiophone receiving apparatus, all of its Pioneer Limited trains running between Chicago, St. Paul and Minneapolis.

Before that time, the Rock Island Railroad had experimented successfully with a receiving station installed in the observation car of their Golden State Limited. The Rock Island was so satisfied with the results that plans are being made to make permanent installation on its Rocky Mountain Limited and Golden State Limited trains out of Chicago. The Rock Island plans to celebrate its seventieth anniversary in October by the installation of the apparatus.

Lackawanna Succeeds in Test

Only recently, the Lackawanna Railroad succeeded in receiving and dispatching Radiophone messages between two of its trains, from Scranton, Pa., to Hoboken, N. J., and from Hoboken to Scranton, and points along the route, including Scranton and Binghamton. The tests were the first made by the Lackawanna since 1914 and proved conclusively that Radiophones could be successfully employed for the safety and pleasure of the traveling public. The tests were repeated on April 5th and again proved practical. D. W. Richardson, G. D. Murray and Edgar Sisson, Jr., all Princeton University men, had charge of the experiments.

As a result the Lackawanna will install equipment on every train within a short time, so that all passengers may listen to the broadcast programs, and in order that conversations may be held with other stations if so desired.

Illinois Central Experimenting

For more than two months the Illinois Central Railroad has been experimenting with train Radiophone apparatus. When the tests have been completed and the type of apparatus to be used selected, the Panama Limited, a fast train running

between Chicago and New Orleans, and certain other fast trains of the Illinois Central will be equipped. Results of tests obtained so far have been announced as very satisfactory.

One of the stations being used for the experiments is operated by B. Weeks, superintendent of telegraph service of the Illinois Central at Memphis, Tennessee.

P. E. R. Gives Train Operation Tests

While other roads have been experimenting with and installing Radiophone apparatus on trains, the Pennsylvania Railroad has not been asleep. J. D. Jones, superintendent of telegraphs and signals of the Pennsylvania system and chairman of the Radio committee of the American Railway Association, announced, as a result of recent tests, that he believes the Radiophone will become of practical value in many phases of railroad work.

Experiments with the Radio were first conducted on Pennsylvania Railroad tugboats in the New York harbor some months ago with a certain amount of success. It is possible through this method to communicate information from shore to boat and from boat to boat under almost any conditions, Mr. Jones said, and with further improvements in the equipment it is quite likely it may be adopted.

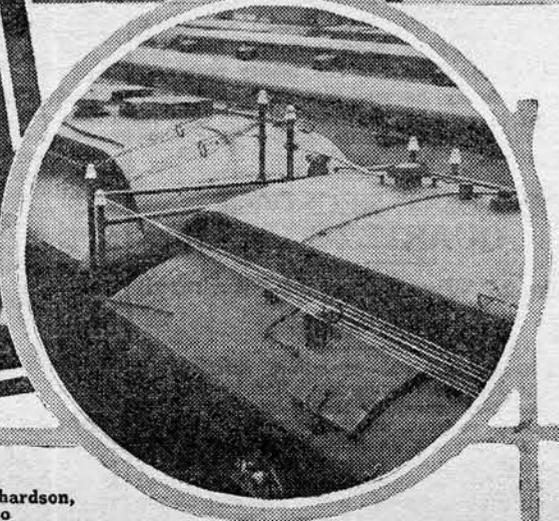
Talking to Fast Passenger Train from Scranton, Pa., to Hoboken, by Radio Shows Growing Utility of Device

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Left to Right—G. D. Murray and D. W. Richardson, Princeton Students Testing Train Radio

© INT.



Aerials Strung Along Car Roofs © INT.

Are Still Experimenting

The tugboat experiments are still being conducted and it is possible that some official action as to Radio use in that connection may be made in the near future.

"The greatest possible use of the Radio which I can see now," Mr. Jones said, "is in emergency service. In case of wrecks in inaccessible places or in event that wires have been torn down during a storm, it would be quite possible, I believe, to communicate between trains and stations by means of the Radio phone.

"We, of the American Railway Association committee, are also considering the advisability of the utilization of the phone in communication from the front to the rear end of trains especially freight trains. It might be possible through this system to obtain more efficient train operation."

Radio Succeeds on French R. R.

Experiments have also been carried out recently on the Nord Railway in France with regard to the employment of Radiophony between moving trains, and between a moving train and a fixed point. An antenna was erected on one of the railway coaches and in a compartment of the same coach was placed a transmitter and a receiver.

A Radio conversation was started as soon as the train left the Paris station and was continued until the train left Criel, 34 miles distant. The voice was clear at all times regardless of the speed of the train or the distance of the train from Paris. Other experiments are being tried between Paris and Calais.

Swiss Station to Talk on Land, Sea and Air

LAUSANNE, SWITZERLAND—A high-powered Radiophone station is being installed here, with which it is planned to hold daily communication with the Eiffel tower in Paris.

The apparatus will receive messages from London, Berlin and the United States.

It is also hoped to be in communication with Radiophone-equipped airplanes flying over western Europe.

Fire Escape Used as an Aerial

A Radio fan of New York City makes use of a steel fire escape for his aerial. This seems to be quite appropriate for the purpose. It is used in connection with a regenerative set. His advice is to scrape the paint off from one of the bars, attaching the aerial wires and grounding the other portion of the fire escape to a radiator or a water pipe.

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A column of humor.

Looking Ahead

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

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

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

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

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KITE ANTENNA HAILED AS SAVIOR OF FLYERS

Navy Tests May Prove Worth of Device Intended to Supplant Aerial Net

The adaptation of Radio to the aeroplane always arouses considerable interest. Radio and aeronautics are both still in the embryo of development, and many of the aviation students are hearty supporters of Radio. Imagination sometimes inspires the public to view the possibilities of the future when they will be sailing along in majestic airliners, traveling from one end of the continent to the other. From Europe to America, to Asia and Africa are the hops that can be visualized without undue stretch of imagination. But to this is promised the added convenience of keeping in touch with any part of the world that inclination demands. A throw of the switch, an adjustment of a few dials, the call for the station, and communication with any part of the country is accomplished.

The value of Radio on the aeroplane was appreciated by the American Government during the war, and constant development has since been going on. The question of the aerial and the ground has presented some difficulties, but in spite of apparent impossibilities, progress has been made. The aerial usually was a wire net trailing at the end of a wire that was reeled in and let out as required. But after the plane came back to its element, whether land or water the aerial could no longer be used.

This has now been overcome, by means of a kite antenna. An aeroplane will carry two kites, one for strong and the other for light winds.

Take for example, the case reported recently in the papers, where a flying boat was forced down off the coast of Florida and five lives were lost because the boat was unable to send out word of its distress. If the flying boat had been equipped with a kite antenna, after the forced descent, the kite could have been sent up, and an S. O. S. sent out. The steamships plying in the neighborhood would then have been able to rescue the survivors in ample time.

The device is being tested out by Chief Petty Officer Pete Ryan on the plane belonging to Secretary of the Navy Denby at the Naval Air Station near Washington. The idea solves the problem for flyers landing in remote places. Messages can be sent for great distances. The equipment is simple and requires little additional weight to be carried.

Checkers by Radio: Iowans' New Stunt

"It's Your Move," Airphone Player in Shenandoah to Opponent in Blockton

Shenandoah, Ia.—The moves of a checker game, made by players here and at Blockton, were recorded by Radiophone and code Radio here recently and the Shenandoah player won.

Adrian Dale was the Shenandoah player. His moves were reported to Blockton by Radio telegraph from the Radio station owned by E. E. Brown. Harry Cole, the Blockton player, had his moves reported by Radiophone to Shenandoah. Dale won the game.

GREENLAND OPPOSES GOVERNMENT RADIO

THERE is one place in the world that is immune from the bite of the radio bug. Dr. Morton Porsild, chief of the Danish arctic station at Disco Island, Greenland, said on his arrival in this country that public sentiment was against the erection of a large government station in Greenland. The station will nevertheless be in operation within six months and will be the farthest north station of the world.

RADIO MAY REVEAL MINERAL WEALTH

FRENCH SAVANT ATTUNES AIR TO RICH DEPOSITS

Doodlebug and Crooked Stick Recede as Scientists Test Two Kinds of Waves

There is no longer need of crooked stick witchery to locate water or other substances beneath the earth's surface. Use Radio. It now seems quite probable that a person may determine the presence of coal, oil or any other body, solid or liquid, or even gaseous by the use of Radio. This may be an astounding claim but an experiment made by a French scientist has brought out wonderful results. He employs a combination of Hertzian waves and cathodic waves and his apparatus consists of two parts, the transmitter of which is worked by an electric current of 110 volts.

The waves sent out, which for simplicity's sake may be called "investigating waves," already have been made to cover distances of several hundred miles. The receiver registers the results obtained.

The Hertzian waves and rays projected by the transmitting instrument are described as awakening from sleep the underlying masses of mineral prospected for, and releasing their own radioactive rays, which declare themselves at the receiver.

Recent improvements of the apparatus have enabled the inventor to localize the presence of oil over 300 miles, and he has since verified the accuracy of the find on the spot.

The tests made by the Frenchman have proved that the passage of Radio waves over the surface of substances such as marble, pitch, sandstone, sulphur, etc., affects the waves in a manner which can be measured and which is unique for each substance. It would seem probable that he is experimenting with waves of different lengths and noting the strength of the signals received over ground of various types at various distances from the transmitter and has discovered a practicable way of interpreting his results. Equipped with such knowledge he could then send out waves over unexplored areas and determine the material beneath.

Radio Immune to Cold Invented by Frenchman

Paris, France.—Jean Lecarne, a French engineer, connected with Vallot observatory, at the summit of Mont Blanc, in the Alps, has invented a Radio instrument which is not affected by low temperatures. He proposes the use of such sets by mountain climbers and other adventurers.

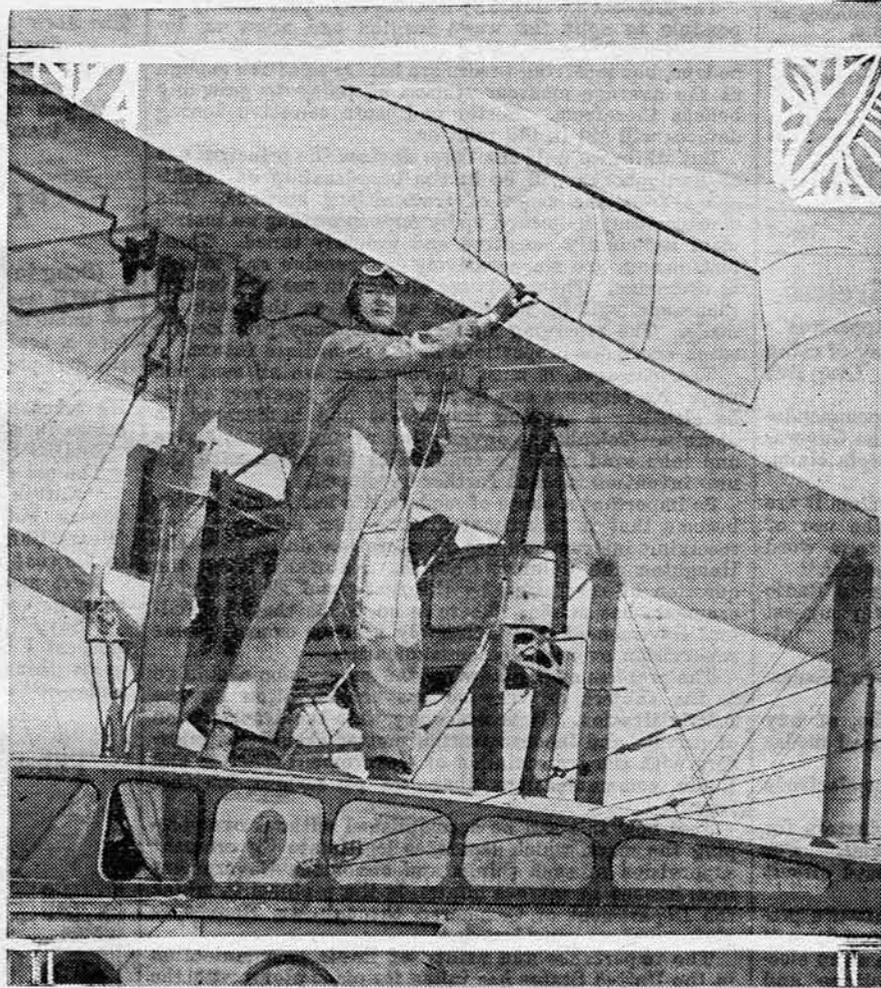
SONG PUBLISHER USES AIR AS PRESS AGENT

New York Firm to Interpret "Hits" by Radiophone

New York.—Milt Hagen, exploitation manager for S. C. Caine, Inc., has arranged to demonstrate via the Radiophone for the benefit of orchestras throughout the country, the correct method of interpreting his firm's rhythmic dance numbers.

Giorgio Passilia's orchestra, now at the Ambassador Hotel, which introduced the new hit, "Cairo Moon," a strikingly tricky melody, will demonstrate the Caine Company's songs. Many orchestras in the East, which have been informed by mail of the coming performance, will listen in.

SENDING FORTH THE KITE THAT TALKS AS AVIATORS IN DESPAIR DISCARD NET



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By Means of a Recent Invention Air Flyers Are Enabled to Use an Antenna Trailing from a Kite to Signal for Help

BAY STATE AID TO HOMES

Massachusetts Housewives Hear Market Advice by Air

MEDFORD HILLSIDE, MASS.—A series of Radiophone talks for the housewife have been instituted by Miss D. H. Goodwin of the Massachusetts Division of the Bureau of Markets. All these talks are broadcast from the Amrad broadcasting station here. Each talk is supplemented by weekly market reports furnished by the division. These reports are interesting local dealers handling perishable merchandise.

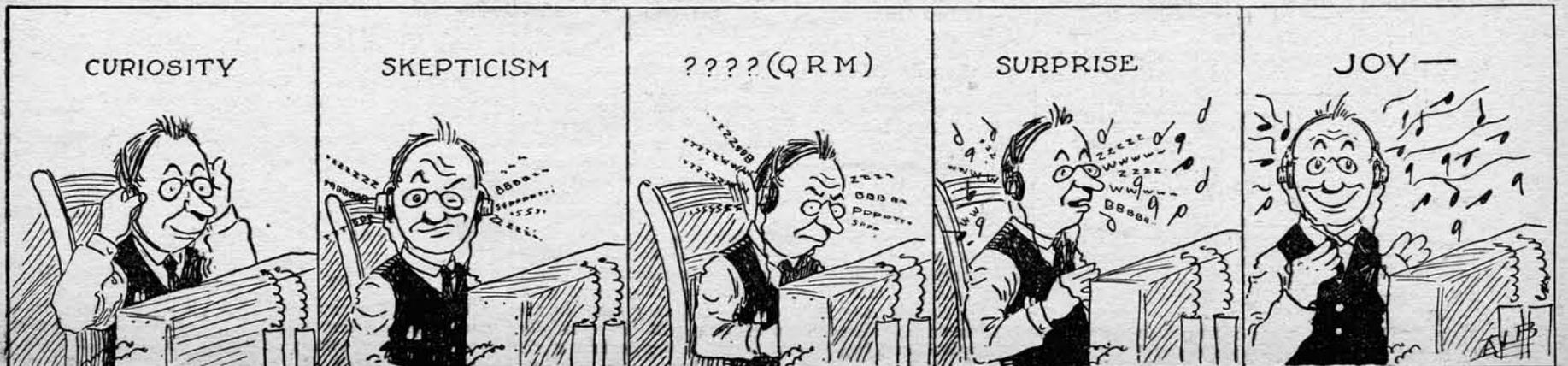
RADIO GUIDE RIVALS SUN

Canadian Astronomer Depends on Air Signals in Far North

TORONTO, CANADA.—It is just as easy to receive Radio messages in the far North as it is in the United States. Professor Bibby of the Toronto observatory has a Radio receiving set while he is conducting his investigations at Ft. Norman in the Canadian Far North. Time signals are received daily which are necessary for him to have in order to make a correct basis on which to make his observations.

A FIVE STEP AMPLIFIER

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Radio Digest Illustrated

TRADE-MARK

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

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

58
PUBLISHED WEEKLY

SUBSCRIPTION RATES

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

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

In a new scientific field where many writers are contributing articles there will arise some controversy over the expressions of opinions and statements made from time to time. Some of these controversies may be taken into the courts for settlement. The priority of inventions may be claimed as well as the merits of some part entering into the construction of the radio apparatus. The Radio Digest is an outlet for 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, April 22, 1922 No. 2

Radio Takes the Name of Wireless

Also New Names for Other Parts of the Apparatus

THE RADIO DIGEST has adopted the policy of using Radio exclusively. "Wireless" is dead. Long live "Radio."

"Wireless" will be killed officially if recommendations of the Committee on Nomenclature of the Government Radio Conference are carried out, experts claim, according to a Washington dispatch.

The word "Wireless" and names derived from it are obsolete, say experts. Instead they urge the use of "Radio." Thus official sanction is given to a word which even the late dictionaries mark "colloquial."

"Statics" or the shorter "X's" are common Radio terms which they ban instead of approve. They suggest the use of "atmospheric disturbances" or "atmospherics."

Other recommendations of the Committee on Nomenclature include:

For the generic title of the vacuum tube, of any number of electrodes, and any of its recognized modes of operation, use "electron tube."

For the specific title of the ordinary three-electrode tube, use "triode."

For the generic title for a system of conductors for radiating or absorbing Radio waves, use "aerial." For an open circuit use "antenna." For a closed circuit aerial use "coil."

For a receiving arrangement in which beats are produced by a separate local oscillator, use "heterodyne."

For a receiving arrangement in which the same electron tube is used for generating oscillations and detecting, use "self netro."

Radio Helps Agriculture

The County Agent Can Give Instruction by Radio

THE new country "school master" is the county agricultural agent, a teacher of modern methods of obtaining the greatest production from the soil with the maximum of efficiency. His mental equipment must be of the best and he must have a great deal of energy and interest in the work in order to qualify himself for the position. One of the best assistants he can have is the mechanical equipment to put his message of instruction over in the most comprehensive manner.

There is no question but what he can do this work better by visual methods of instruction than by any other way. Hundreds of young men graduates from the many agricultural colleges know what they need, but cannot always obtain the few mechanical devices because of the conservative tendencies of their employers. This conservatism hardly pays when it reacts against the agricultural teacher and leader in his attempt to get the best results from his efforts. Equipment is the one thing necessary for the county agent.

If he has access to a Radio station his instructions can be carried out in a most effective and expedient manner. The farmer equipped with a Radio receiving set is able to gather information he would otherwise overlook or neglect. Radiophony is bringing him closer to the instruction, helping him to get the most from his efforts, and doing much to keep him in touch with the outside world and the markets which mean so much to him.

Action on Radio Press Permit Slow

Time Limit to Be Set for Use of Navy Apparatus

IT IS of considerable importance to newspapers to have the extension of time for using the Radio facilities of the navy for the transmission of news. The rights now held expire in June.

Congressional resolutions for extension are in conference with the Senate and House conferees deadlocked on whether the extension shall be five years or merely one year. Publishers contend five years to be the shortest practicable time.

Those against the acceptance of the Senate proposition of a five-year extension are Representatives Green of Massachusetts and White of Maine. The President

may break the deadlock through a provision to end the use of the navy Radio facilities as soon as private facilities are secured in the Pacific. It was made plain by the President that he considered the exchange of news between the United States and the Orient of utmost desirability.

The Senate, led by Senator Poindexter, advocates the continued use of the navy apparatus, and this continued use to extend for five years.

Viewpoints of Others

Press Comment on Radiophony

A GREAT deal of nonsense is appearing in the newspapers and magazines concerning the wonders of the Radiophone. One of the best known national publications says that we are on the verge of the immediate and almost universal use of the new instrument. The impression is plainly given that anyone may expect to send as well as receive messages through the ether. But the fact that sending is an expensive and complicated matter, and that the number of stations is limited, not only by cost and license regulations, but by number of suitable wave lengths available.

The Lincoln (Nebraska) Journal says that it may be possible to split the wave lengths and allow an indefinite number of sending stations. Perhaps this may be true, but receiving tuners are hardly selective enough at the average amateur station of today to gain any benefit therefrom. Better and more selective tuning devices will aid in the solution.

But while we wait for these devices the principal use of Radiophones will be in the broadcasting of intelligence from the chain of transmitting stations. The messages may be picked up by anyone owning an instrument sufficiently sensitive and properly tuned. These instruments are comparatively inexpensive and simple in operation. Thousands are already in use and tens of thousands will be marketed as soon as they can be made. The receiving side of Radiophony promises to reach enormous proportions in the immediate future.

The messages, it must be observed, are all sent one way. No response can be made by the receiver, unless he also has a sending instrument and is licensed to operate. Telephone conversation of the ordinary give and take kind must be confined to the wires until the new invention is much further developed.

So important a phase of modern life has Radio service become that it is estimated more than half a million receiving instruments are in operation daily, says the Houghton and Calumet Gazette. Naturally, then, the question of regulation by the State and Federal governments has arisen. There is no doubt that the Federal Government will ultimately need to exercise some supervision over Radio communication.

The problem of just how far the supervision should go is the subject of very serious consideration by the Administration. It is necessary that the transmission of private and inconsequential matter should not interfere with the transmission of Government matters and Radio communications that are of serious business import.

Just how this can be accomplished without overstepping the mark which separates legitimate Government supervision of such things and obnoxious Government interference in private affairs, is the problem to which the Department of Commerce, through Mr. Hoover, is giving serious consideration.

The importance and utility of Radio communication in the United States has taken its place along with the telephone and telegraph as an instrumentality of general communication, says the St. Joseph Gazette. As such it is generating problems which, a year, or even six months ago, were not thought of. The number of instruments in use has been estimated from a few hundred thousand up to a million and the owners who listen in on messages sent out from the various Radio broadcasting stations throughout the country is now a vast army. All kinds of matter is transmitted—news bulletins, weather and market reports, concerts, sermons, lectures, vaudeville, advertisements and even common gossip.

This rapid development of Radio service raises the question of its regulation by State and Federal governments. There is no doubt that the Federal Government ultimately will be caused to exercise some supervision over Radio communication, and the problem of how far this control should go is therefore the subject of very serious consideration. It is necessary that the transaction of private and inconsequential matter should not interfere with the sending of Government matter and the weather forecasts, yet, at the same time, amateur and student experimenters must be protected. However, improvements in mechanism and circuits will probably solve this phase of the problem before many months pass.

The Grand Rapids Press says: "Drop a pebble into a pond of water and a uniform set of concentric waves are produced." But if you drop a handful of pebbles the circle or waves merge and they cannot be distinguished one from the other. A similar condition can exist in the ether with regard to Radio. It already exists to such an extent that control measures are required to prevent utter confusion of messages.

Inasmuch as the ether belongs to the whole people, it is considered that the right of way must be given to the types of service which will be of the greatest good to the greatest number. These are without question the Government and private sending services which broadcast news, education, entertainment and commercial reports of value.

The Bureau of Navigation, Department of Commerce, is already charged with regulating Radio traffic through the issuance of licenses to operators and stations and the assignment of wave lengths. The establishment of a zoning system may be necessary. Under such an arrangement sending the schedules will be carefully scrutinized and the time of transmitting certain kinds of information fixed.

RADIO INDI-GEST

And Then the Ship Sank!

IT WAS a dark and stormy night and the ship was sinking fast, The Captain wondered on the bridge, how long the ship would last; The S. O. S.'s were hurrying forth upon the midnight air—



The crew and all the passengers were stricken with despair, Then turning to the Radio guy, the Captain up and said:

"If you can get in touch with land, find out what team's ahead."

—"Chiquita."

"The Bigger They Are, the Harder, Etc."

(Sung to tune of "Twinkle, Twinkle, Little Star")

THE scene is a street car lurching in from the suburbs. A crusty old customer comes in, plumps into a seat and opens his newspaper. He looks over the first page and grunts. Another page, another grunt, finally a snort, and he dashes the paper to the floor. He turns to look out the window. His line of vision comes in contact with a flaring sign before a store—"RADIO SUPPLIES."

The old crust snorts again. "Nothin' but Radio, Radio, Radio. Nothin' in the papers but Radio. Stores sell nothin' but Radio. 'Pears like the whole state's gone crazy," he growls to his seat mate.

Next morning. Same scene on same car. Same old crust gets on, sits down besides the same man.

"Say," he begins, "'J'ever hear one of these Radios? I heard one at my neighbor's last night. 'Sa great thing. You can hear the music just as plain and—" so he goes on for the rest of the journey.

—Ham Op.

Take Your Pick, Barber or Radio Lingo!



The owners of a very busy barber shop on a downtown corner in Chicago are installing a Radiophone receiver for the entertainment of the customers. There will be considerable (QRM) competition from the "umteen" stage amplifier if the barber tries to talk on the same wave length to an occupant of the chair, eh?

Jazz 'Em to Starboard, Mate!

A movement is under way by the yachtsmen and jolly tars in the vicinity of Chicago to equip their boats (tubs, etc., also) with Radio, so that they will not by any chance miss out on the market reports, concerts, weather bulletins and the very latest news as broadcast by the powerful stations which cover the entire country.

Thus they can keep in touch with the land and at the same time rove the salty main (slang for Lake Michigan) within easy reach of the jazziest jazz or the silliest songs. You really ought to know (if you don't) that Radio music is wonderful to dance by.

Heard on a Busy Night

"This is Station —"
"The market closed bullish, but—"
"And then the brownies climbed on top of a toadstool while Dorothy—"

"The weather for—grr—grr."
"Our last number will be rendered—blah—blah—grr—at the piano. Will those listening please write us of their impression as to its—grr—grr—ooooo—fluh—fluh—Good night. Station—grr—grr—signing off."

"Just a second, old man, and I'll change the record." Then a terrible series of growls, whistles, whines, coughs, sneezes and wails, which lead one to believe that an elephant is being killed, shocks the ears, and the concert goes on, murdering the air until some "ham" with a two-kilowatt set starts up in the next block and blows it apart. We devoutly thank the "ham."

And How About the Spotlight?

A Washington scientist says he has perfected an invention for sending music by use of electric light wires. It should be especially effective, we assume, for transmitting light opera.

NEW MUSIC OF SPHERES, WISDOM OF THE AGES, FREE TO ALL BY AIR

High Educational Institutions All Over Land Apply Radio to Broadcasting Lectures on Economics, Sciences and Arts

At last a college education for everyone. Every man is now enrolled in the wonder night school of the world. The night air is heavy-laden with knowledge waves from the great educational institutions of the earth. The broadcast has come into its own with the announcement of the first Radio college by Tufts College, Medford Hillside, Mass.

Following immediately in the wake of the Tufts College adoption of university broadcasting courses comes announcements from schools and colleges all over the country that Radio has been harnessed to spread education free to all. Members of the faculties of America's leading universities have been drafted in the great drive to bring knowledge within the reach of every man, woman and child in the country.

Huge classes, comprising students from all walks of life, are being enrolled. Members from the crowded tenement districts of the cities, from the farms, the offices, are all matriculating into the Freshman class of the world's university without paying tuition.

Lecture courses in science, law, medicine, literature, art, music and history will be nightly occurrences on the broadcasts from not only Tufts College at Medford Hillside over WGI but from New York University, St. Lawrence University, University of Wisconsin and University of Michigan, and many other well known seats of learning. High schools and city schools also are arranging broadcasting schedules for the spreading of education.

To Dean Charles Ernest Fay, A. M. and L. D. Wade, professor of modern languages and the dean of the graduate school, belongs the credit for starting Radio courses at Tufts College. The first series of lectures consists of thirteen broadcasts comprising a concentrated course on pertinent subjects. The lectures are brief, not exceeding thirty minutes and are made simple enough so that no technical education is necessary to understand them. Some of the talks are given in the afternoon but most of them are broadcasted in the evening.

The courses include "The Story of Money" by Dr. Harvey A. Wooster, professor of political science and head of the department of economics; "The Story of Engineering, Dean Gardner Chace Anthony of the engineering school; Dr. A. I. Andrews, head of the department of history and public law, "Changes in Europe"; Dr. A. C. Lane, "Preparedness Among Animals"; Dr. William F. Wyatt, "Story of Architecture"; Professor C. E. Houston, head of the department of physical education, "Athletics"; Professor Edward H. Rockwell, head of the department of structural engineering, "The Story of the Bridge Builders"; Dr. H. V. Neal, "Conservation of Bird Life"; Dr. Albert H. Gilmer, "The Modern Drama"; Dean Lee S. McClester, dean of the Crane Theological School, "The Palace of the Minister in Modern Society." Professor Leo Rich Lewis will also give a lecture on college music which will be illustrated

by selections by the Tufts College Glee and Mandolin Clubs.

The University of Wisconsin, Madison, Wis., is not far behind the Eastern institution in taking advantage of this great opportunity to serve the public. Through its extension division ten minute talks on subjects of general interest will be delivered by the university professors over the college station WHA. These lectures will be supplemented every Tuesday evening by courses enlivened by musical selections. A special course is given on Friday evenings by Prof. E. B. Gordon of the extension division. E. A. Birge, president of the university, has named a committee representing all branches of university work to plan programs of instructions and entertainment.

Dr. James E. Lough, dean of extramural division of New York University, New York City, in commenting recently on the establishment of educational broadcasts said:

"We are trying to provide financially for the broadcasting courses by selling a syllabus to the Radio students, but all listening in can get an education free. No definite method of financing the new system has been worked out, but it is possible some one interested in the spread of education will come forward to assist."

The University of Michigan using Station W W J of the Detroit News is broadcasting a series of lectures every Friday. The first series of lectures is under the direct charge of Professor W. D. Henderson, director of the extension work of the university. The lectures deal with public health, public education, chemistry, biology, astronomy and like general subjects. Five lectures will be given on the "tryout." If successful the course will be broadened.

The Universities of California and Washington have inaugurated a series of

MUSICAL SMOKESTACK SCARES DIXIE NEGRO

GREENVILLE, ALA.—"Soap" Monroe, a colored man, climbed into a large steel smokestack to clean it out and while at work he heard the strains of "Dixie" from a band floating down from the top. "Soap" is somewhat superstitious, and the strains of the band caused him to climb out quickly with much precipitation.

There was no band in the vicinity, but the music was plainly heard by two other persons helping "Soap." It is believed that the large metal stack had the same natural period of vibration, or wave length, as the transmitting Radiophone station was using, so that the strains of the concert were picked up without the complicated apparatus necessary at the usual station. The case is analogous to organ pipes, with their natural periods, resulting from the length of the column of air employed. But everyone can't own a smokestack.

educational courses by broadcasts in addition to the transmission of college news for the dailies.

The St. Lawrence University, Canton, N. Y., has just recently installed a complete sending and receiving set and plans to offer courses to the public by Radio.

High schools and grade schools all over the country are joining in the "Radio in the Schools" movement for the dissemination of knowledge by broadcasts. It was recently said by a Radio authority that every little red school house in the country had potential possibilities for becoming a college. Boys and girls from the rural districts may be taught mathematics, science, literature, history and art by authorities in the universities. They may then take examinations and receive diplomas for good work.

A grade teacher in one of the Philadelphia elementary schools said that she did not believe radiophoning as used in teaching would be practicable for the elementary grades. The children like to see the teacher as well as listen to her voice and it is because of liking for her and her personality that the little students absorb the lesson. She asserted that it might be a novelty but after the newness had worn off, there would have to be a reversion to old and present methods of teaching.

In a Rockford, Illinois, grade school the pupils have become so interested in broadcasts that they have bought stock to the extent of fifty cents a share for the installation of a receiving set.

TEST SHOWS FUSSING WITH DIALS FUTILE

AKRON FIRM EXEMPLIFIES UTILITY OF BATTERY

Frequent Adjustments to Catch Sounds Not Necessary, Experiment With WHK Proves

AKRON, OHIO.—No doubt the beginner in trying to receive a message over his new Radiophone thinks that it is necessary to be continually fussing with the dials in order to keep the radiophone music coming into the receivers. To show his friends that the above is not true the manager of the Radioart Supply Company, here, turned on the set in the concert room and immediately heard the announcement from the Cleveland station, WHK, that the next selection would be a violin solo.

The Cleveland station's musical program and the boy scout lecture were heard very distinctly. In the background was heard an announcement of church services at a church in Pittsburg from station KDKA. The pipe organ and choir music at Pittsburg could be heard much louder than the music at the home city. After a time the church services became so loud and distinct that the Cleveland station was scarcely audible.

The words of the pastor came in so loud that an echo was plainly heard. Near the end of the services a woman's voice broke in from station WHK, but not loud enough to interfere with the church services.

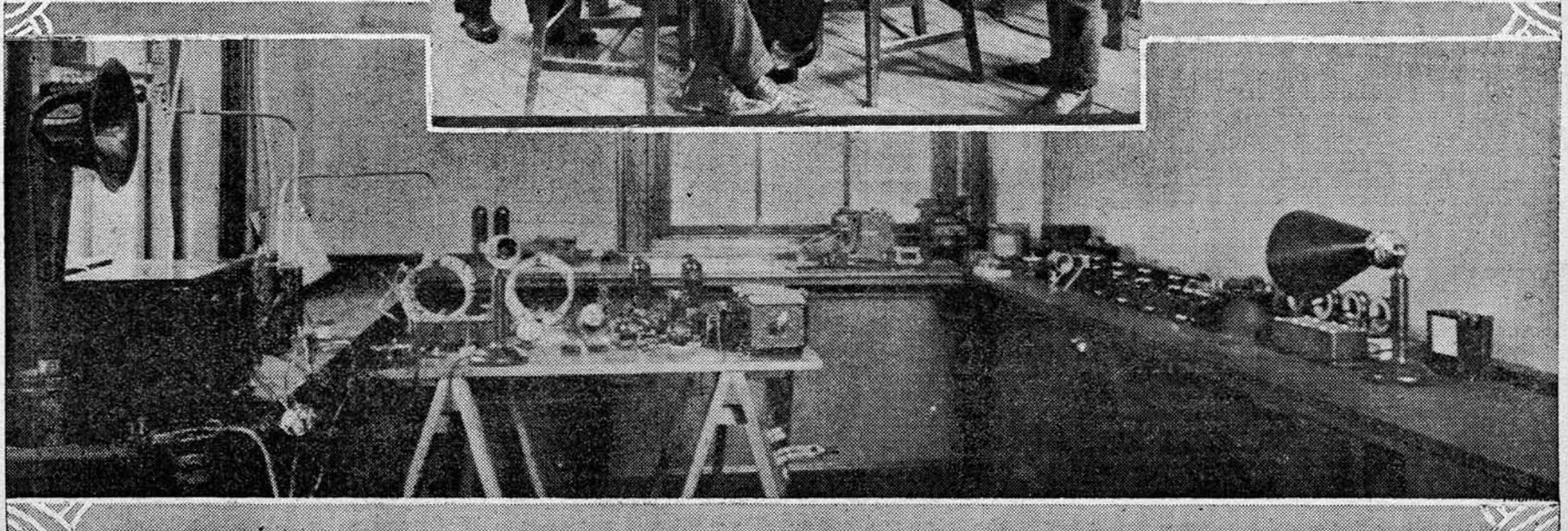
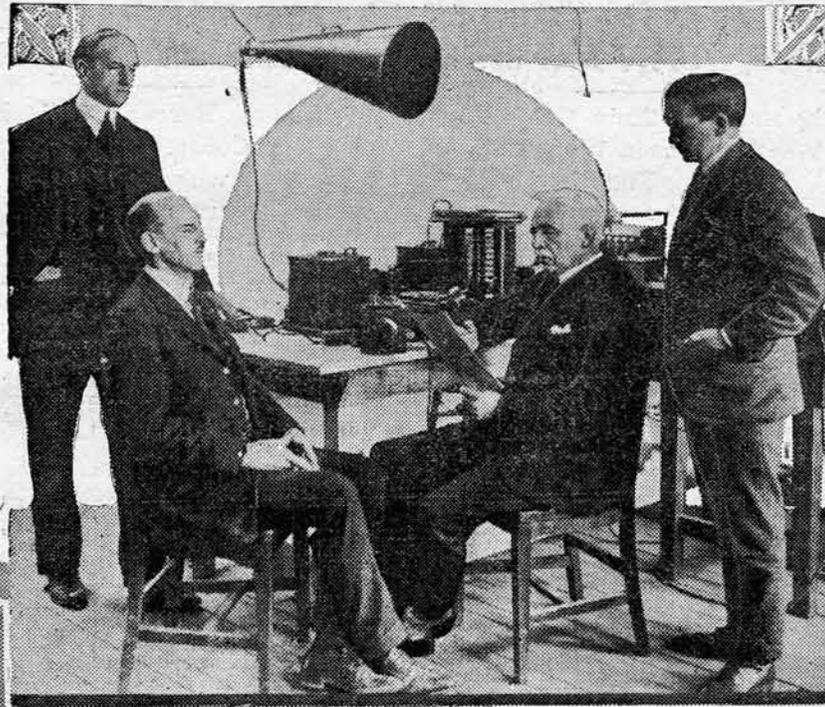
During all this time the controls of the radio set were left untouched, the operator being some distance away and in another room. The fading was explained by the chief engineer of the Westinghouse Company in this manner: The radio waves reflect back and forth from the upper stratum of the air to the earth, and as this upper stratum is constantly changing the waves are reflected more strongly to one point than another many times. This causes fading for which there is no remedy.

It is quite often asked about receiving from two points without interference from the other. This can be easily accomplished with some sharp tuning and loose coupling. But for the purpose of the experiment, the set was left untouched to see what would happen. An 80-ampere hour radio battery was used to light the filaments of the detector and amplifier tubes making it unnecessary to turn the filaments up on account of the drop in current from the battery in use. The radio battery used gives a very steady current as long as it holds its charge, making frequent adjustment of the detector or amplifier filament rheostat unnecessary.

DETROIT SEES RADIO AID PHTHISIS PATIENTS

Detroit.—Radiophone concerts have been recognized as therapeutic agents by the Detroit Tuberculosis Sanatorium, which soon will install a complete radio receiving set in its auditorium. Four hundred patients will hear the music and other entertainment broadcast by large stations throughout the country.

Commenting on this action, Dr. Henry F. Vaughan, commissioner of health, said: "Now that the Detroit Tuberculosis Sanatorium has seen the value of entertainment such as this I feel sure that other institutions of this kind will follow suit. I expect that until that is done, this sanatorium will have the best record for 'pulling through' patients."



Radio Faculty at Tufts College and Sets Which Reach 35,000 Persons as Far as Wisconsin and Florida

NAVY BANS NEW'S NEW RADIO USE

Indiana Senator's Political Debate by Airphone Cause of Bitter Wrangle

Denby Announces Rules

Secretary Declares Prohibition Is Temporary; Music May be Transmitted

WASHINGTON—Considerable comment has been made on broadcasting a speech made by Senator New of Indiana. The opposition is very indignant because New used the naval Radio transmitting station at Anacostia. It has started in motion a controversy likely to assume considerable proportions.

All arrangements for sending the speech through the air were made by the navy department. The Radiophone instrument in New's office was connected up with the naval apparatus at the Anacostia station and from there was transmitted to the country.

Indignation was expressed by Senator King of Utah for the reason that the speech was sent out on a wave length of 1100 which brings it within limits reserved for the government. King has asked the navy department for all facts.

All of this has resulted in barring all speeches from being broadcasted out of naval Radio stations. Secretary Denby has ordered all naval Radio transmitting stations closed to the public use for broadcasting speeches, lectures or any form of nonofficial communication, except for musical purposes.

Mr. Denby in announcing the order said it was temporary and designed to stop all use by private individuals of the naval Radio broadcasting facilities until a definite policy had been worked out by the government to handle the business.

DENTAL TALKS BY RADIO

University of Michigan "Wild" Over Future of Airphone

ANN ARBOR, MICH.—The University of Michigan is a hotbed of Radiophone activity. It has a sending station and any number of receiving sets. Students of physics, electrical engineering and kindred subjects gather around these receiving sets nightly to hear the news and concerts. Another feature of the U. of M. is to broadcast talks on dentistry. Dr. R. S. Bunting, professor of pathology and histology of the dental school of the university and president of the Michigan state dental society, will deliver the lectures.

ARMY POSTS LINKED BY TWO AIR LINES

Installation of Double Nets Enables Washington to Signal Distant Stations

WASHINGTON.—During the last two months nine army corps headquarters, camps and stations have been supplied with Radio telegraph nets. The nets will result in a reduction of forty per cent of the official messages previously handled by the commercial wire companies.

The system is a double net employment of the fifty stations now maintained by the war department over the country. The long distance stations linked together for operation is what is known as the "army net" and permits distribution from Washington of army orders and other communications by Radio to the corps center.

Washington is in direct touch with Fort Sheridan, Chicago, which in turn connects up with Fort Crook, Omaha, and from there by way of Fort D. A. Russell, Wyoming, and Fort Douglas, Utah, to reach the Presidio, San Francisco. This forms the central trunk line of communication across the country, while a similar border trunk system runs by way of a relay at Fort Sam Houston, Texas, to San Francisco.

Stations to be added to the nets before July 1, it was stated, will include that at Fort Brady, Michigan.

YANKS TRIM VIENNA BOOKIES BY RADIO

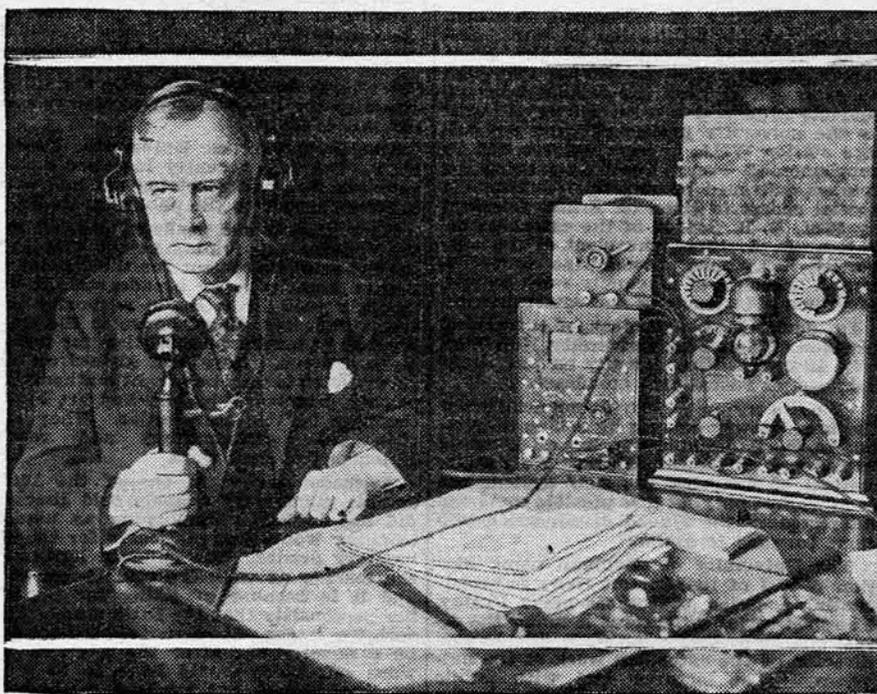
A NUMBER of Americans dropped into Vienna and located a "bookmaker" and placed a good sized bet on a certain long shot and the nag scooted home in first place. The next day the Americans practically doubled their winning on another long shot. It all happened through Radio. The Americans had confederates in France and as soon as a race was run a Radiogram was sent to the persons in Vienna giving the name of the horse which won. The Americans made haste to the bookmakers and placed the money on the winner.

DALLAS CHIEF HALTS AGE BY AIR CONCERT

"DAD" GARRETT is superintendent of police and fire alarms in the city of Dallas, Texas. "Dad" felt that he was growing old fast and would soon be cast into the discard, but along came the Radiophone and "Dad" instead of being the oldest man in Dallas, is priming himself for a contest to prove that he is the youngest of them all.

It was only recently that "Dad" fitted his automobile with a receiving set. It gives him great pleasure to get into a jam and while waiting for the traffic "cop" to give a Radio concert.

NEW WAY TO MAKE EAGLE SCREAM



(C) INT. Although the United States Navy has placed a ban on the use of its radio for political debate, the efficiency of the airphone for this purpose as proved recently by Senator New (pictured above) and his opponent, Albert J. Beveridge of Indiana, is likely to cause its adoption in future campaigns

RADIO NOW THRILLS MICHIGAN FARMERS

Pig and Calf Clubs Give Way to Airphone in Wolverine State

GRAND RAPIDS, MICH.—Farm boys and girls have a new language nowadays and a new interest. The Radio has intrigued them. The pig club and the calf club are being supplemented by the Radio club.

Everywhere the farm sky is woven with Radio antennae. Wherever farm boys and girls get together will be found both sending and receiving instruments. The ether is a huge lake filled with music and news and the fishing is fine.

The first Farmrad club to be organized was in Ocean county, New Jersey. Here a group of boys interested in Radio pooled their radio knowledge and resources for the purpose of receiving news reports on agriculture and general topics and relaying the messages by telephone and messenger to farmers and others in rural districts.

This organization, known as the Ocean County Radio club, has become extremely popular.

The success of the organization has given impetus to the formation of Farmrad clubs in other sections of the country and many state agricultural colleges have become interested in the work.

The method of organization is to get the boys and girls first to read all available literature on Radio. Simple Radio equipment for receiving messages on short wave lengths is installed and gradually the members of the club take up the more difficult phases of the art.

Airphone in New House Plans

PITTSBURG.—Owing to the fact that many new apartments are now being built with Radiophones as a part of the equipment, architects are making their plans to include the Radiophones. This was developed by members of the Pittsburg Chapter of the American Institute of Architects at a meeting and dinner in the Fort Pitt Hotel. Edward B. Lee, Pittsburg architect, was elected president of the organization.

RADIO FOR PATIENTS SCHEME IN CHICAGO

Physicians' Bureau Will Keep in Constant Touch with Sick

Chicago doctors are planning to install Radio outfits in country clubs and on the golf links, so that they may be summoned by ailing patients. The doctors' information bureau, with offices in the Masonic Temple, was commissioned to find out the best method for installing such sets.

"A great number of the medical profession are golf fans," says a letter from the bureau, "and last year we had a great deal of trouble communicating with them, to inform them of the serious condition of their patients and other urgent calls. We wish to obviate that this year.

"Our business is that of keeping the patient in constant touch with his doctor outside of his office and it has frequently been the means of saving lives. We wish to install Radio outfits on the golf links in order to locate and communicate with the doctors."

Airphone Sets Gladden Sick Cleveland "Kids"

CLEVELAND, OHIO.—"The very kind gentlemen who offered a Radio receiving set to some little crippled boy certainly has a big heart, hasn't he?" remarked Miss Marie Brinkman, of this city. The boy who received this outfit was an eleven-year-old victim of infantile paralysis—a boy who though attending school uses crutches and literally drags himself along. It seems as if the Radiophone is going to be a boon to the invalid, the sick person or the one who is confined to his room for any cause.

After announcement in a local paper of the distribution of Radio outfits to crippled children scores of letters came into the newspaper office. It is easy to foresee what an agent the Radiophone soon will be in gladdening the hearts of the little shut-ins of the world.

FIRE UNDERWRITER RULES FOR NOVICE

REGULATION IN NEW YORK ACCEPTED BY COUNTRY

External Ground with 3/4-Inch Periphery Considered Most Objectionable by Amateurs

There are some difficulties which the amateur will encounter when he starts to install a Radiophone in a house or apartment. The following is a condensed list of requirements of the New York board of fire underwriters in regard to Radio signalling apparatus which are more or less generally accepted throughout the country:

"1. The lead from the aerial must be kept at least 5 inches from the building wall.

"2. Where the aerial lead passes through the side of the building, an insulating tube must be provided which extends at least 5 inches beyond the wall of the building, both inside and outside.

"3. A ground wire of 3/4-inch periphery (No. 4 wire) must lead from the ground switch or lightning arrestor to an external ground. If the ground wire is more than 25 feet in length it must be supported by insulators 5 inches from the building wall.

"4. A ground switch or lightning arrestor with a gap of not more than 1/8 inch must be provided to connect the aerial lead with the external ground. The switch or lightning arrestor must be mounted at least 5 inches from the building wall. If a ground switch is used, the blade must have a periphery of at least 3/4 inch and the distance between terminals when opened must be at least 5 inches.

"The installation of tubes extending 5 inches inside and 5 inches outside of building wall is not easily accomplished, as it would injure the window frame, to say nothing of interfering with the operation of raising and lowering sash, and also disfiguring the premises.

"The most objectionable requirement of the underwriters is the installation of external ground having 3/4-inch periphery. Many of the finer apartments on Park and Fifth avenues are built of face brick all around and it would be a serious disfigurement to a building if a heavy conductor were carried down thirteen stories and into the building in basement to the street side of water pipe."

Nearby Charged Wires Often Cause Trouble

Don't blame all trouble on static, especially if the weather is fair. With humidity low and the temperature cool, static interference is usually at a minimum. If results are unsatisfactory in spite of good weather conditions look for some other kind of interference.

Sometimes when an aerial has been lined up parallel to a nearby telephone, power or telegraph line, trouble is caused. The close proximity to these lines will reduce the efficiency of the aerial. Crossed wires and poor connections in the receiving set will impair the effectiveness of the apparatus. If a little time is taken when installing these sets there will be more satisfactory results obtained from them.

FINGER MARKS BY AIR FOIL FRENCH FELONS

Paris Police Follow Berlin in Radio Application

The French government has adopted a newly invented apparatus for use in running down criminals quickly. The system works along lines similar to the Berlin method of transmitting photographs by Radiotelegraph. Many of these Radio outfits have been installed in the frontier cities and connected in a central office in Paris. These are principally for the police in preventing the escape of law violators. The transmission of a complete finger print by Radio from its source to a point several hundred miles away requires only fifteen minutes' time.

The instrument used is similar to the telephotographic reproduction apparatus invented by Belin. The device uses a copper cylinder which is turned by clockwork, the cylinder being attached to a small interrupter holding a needle. The finger print is transferred to the cylinder surface and as the cylinder turns the needle lifts every time it meets a line in the film of the picture being sent. This breaks the current and the receiving instrument registers the picture exactly as it was sent.

With this method successfully worked out in connection with wire telegraph, it has been found possible to adapt it to Radio. Scientists say that about the only trouble to be encountered is static.

AMATEUR'S STATION HELPS LACKAWANNA

BINGHAMPTON'S 8BTO TEST CONVINCES RAILROAD

Apparatus Operated by Arthur L. Kent Famous All Over the World

8BTO, formerly SAC, is one of the most highly efficient stations in the east, and is owned and operated by Arthur L. Kent at 199 Court street, Binghamton, New York. In the story of the use of Radiophones by railroads, given on the front page of this issue, the test of the Lackawanna Railroad is described in detail, and reference is made to the communication of the train Radiophones with a station in Binghamton. 8BTO was the Binghamton station which co-operated with the Lackawanna in its very successful test.

Test a Complete Success

In speaking of the success of the experiment, Mr. Kent said that he was able to hear the laughter and conversation of the students in the car in addition to the person who was directly holding conversation with him. He said that he could tell when a train went over an iron bridge and also when it went through a tunnel and that he was able to carry on conversation under these conditions despite the fact that it had been thought impossible.

Excellent Equipment at 8BTO

The station of Mr. Kent is excellently equipped. The antenna is of the inverted L type, 40 feet high, with a top 33 feet long consisting of four wires spaced three feet apart. The lead-in is a seven-inch eight-wire cage sixty feet long. An earth ground with no counterpoise is used.

For receiving, a Grebe CR-6, in conjunction with a two-step amplifier, is used for short waves, while a Grebe CR-7 and the two-step amplifier is employed for long wave reception. The long wave apparatus was built for the French navy originally.

Mr. Kent has a Sterns Radiophone and telegraph transmitter which he uses in connection with three Western Electric VT2 five watt tubes, radiating 1½ amperes, and an Electrical Specialty motor generator. For Radiophone transmission, 8BTO uses a Turner dictagraph microphone.

Does Much Distance Work

The station has done some remarkable long distance work, both in receiving and transmitting. In receiving short waves, Mr. Kent has heard stations in practically every state in the Union. His was the first eastern station to copy a boat in the Pacific ocean working with Portland, Oregon, a feat checked by the operator at Portland. On long wave lengths, 8BTO includes Warsaw, Poland, and all other high power stations in Europe.

As for telegraph transmission records of Mr. Kent's station, 8BTO has been heard in twenty-two states, a number which is steadily increasing. His best distance record of 1,650 miles was made when 5ZZ, located at Blackwell, Oklahoma, heard him distinctly using a four-foot loop antenna with a super heterodyne circuit and six stages of radio frequency amplification. 8BTO has also worked with Waverly, Tennessee, a distance of 1,100 miles.

Has Long Radiophone Range

Using the station described above, the "voice" of 8BTO has been heard distinctly in New York City, Syracuse and Buffalo, New York, which distances range from 200 to 280 miles. A whispered message was reported correctly over a distance of 44 miles. Mr. Kent says that use of a dictagraph doubles his voice range.

Mr. Kent's station was one of the few stations given special license to operate during the war.

Farmers Learn Market Prices Many Hours Earlier by Radio

Chicago Board of Trade One of Many Great Institutions Which Proves Almost Unlimited Use of Airphone; Daily Newspapers Show Varied Means of Application

The uses of the Radiophone for scattering information abroad are developing daily, says the Editor and Publisher, of New York. The Chicago board of trade began recently to broadcast prices on agricultural products. By this means the farmers within a radius of 500 miles may obtain the current prices on their crop within 30 minutes.

The Philadelphia Public Ledger co-operated with the American Telephone and Telegraph Company in giving the members of the Philadelphia Forum a demonstration of the work of the Radio telephone. At a test in the Academy of Music the whole house was filled with the exception of the top gallery. After an introductory lecture by Gen. John J. Carty, vice-president of the telephone company, John J. Spurgeon, editor-in-chief of the Public Ledger, sitting in his office, read the audience news dispatches from Washington, Chicago, Tokio, London, and Guatemala, which were clearly heard. Later, the assemblage heard a 12-year-old girl, Miss Betty Bates, daughter of Harry Bates, San Francisco representative of the telephone company, play a violin solo, Schumann's Traumerel, at her home on the Pacific coast. The music came clearly through the ether

waves. Some conversation between ships at sea and the Deal Beach (N. J.) broadcasting station of the telephone company were also picked up.

The Logansport (Ind.) Pharos-Tribune is installing a radio station and will shortly be broadcasting market reports and late news in conjunction with a local department store.

The experiences of a woman reporter, related by Miss Gertrude Gordon, feature writer for the Pittsburgh Press, were recently sent out from the Westinghouse Station at Pittsburgh.

The Rochester (N. Y.) Times-Union has established a station licensed by the Department of Commerce. News, weather forecasts, market reports, speeches and entertainment numbers are being sent out. The paper is also conducting a Radio column.

HOME-MADE AUTO SET MAKES NEW RECORD

Two Broom Handles and Lamp Cord Bring Distant Talk

QUINCY POINT, MASS.—Edward Dallin has installed a set in his automobile with a transmitting range of ten miles. While traveling in the vicinity of his home he has picked up messages from points as far distant as Key West, Fla., and Savannah, Ga. Dallin's aerial consists of two broom handles and a length of a lamp cord and his set is mounted in a wooden box under the back seat properly suspended by springs so that the vibration of the moving car will not throw the instrument out of adjustment or break the lamps. In a recent experiment he picked up his own call, 1FK, while traveling at 40 miles an hour and carried on a radiophone conversation.

Auto Schools Now Teach Principles of Airphone

DETROIT, MICH.—The schools that have been giving instruction to students in the automobile industry are now turning their attention to Radio. The first of these to make up this work is the Michigan State Auto School, the first class of which is now receiving instructions. On account of the present difficulties in getting supplies for the class, a limit of fifty students was set. The class will meet two evenings each week and the course will extend ten weeks. The instruction will include a comprehensive training in Radiophony and Radio telegraphy. The course is planned to train the student to construct, operate and repair radio receiving and transmitting equipment.

APARTMENTS, CLUBS, HOTELS USE RADIO

NEW BUILDINGS ALL OVER LAND DISPLAY DEVICE

Airphone Considered by Architects When Drawing Plans for Modern Structures

Clubs, hotels and apartment houses are being equipped with radiophone receiving sets. Some of the clubs and hotels are supplied with transmitting sets so that members of the club or guests of a hotel may talk direct home from their rooms.

The hotel Alexandria at Long Beach will be so equipped. The Alexandria Club occupies the top floors and here will be placed the high power receiving and broadcasting set. Each one of the 500 rooms will have a receiving set.

Some of the new apartment houses in New York and Chicago now in the course of construction are being equipped with radiophones.

At Hoboken, N. J. radiophone service will be included in the equipment of the Weisberg apartments, in course of construction at the northwest corner of Tenth street and Palisade avenue, West New York. The first unit of 72 apartments on Tenth street, of the buildings for 300 families has been completed and are renting.

In Cincinnati, Ohio, the radiophone is to be utilized for hotel purposes, as announced by the president of the Hotel Gibson company. All guest rooms, dining rooms, ball rooms, lobby and other parts of the hotel will be equipped with Radiophones. One advantage claimed for the ball rooms being equipped with the Radiophone is that when music is received, an orchestra is unnecessary. If the orchestra is played in one of the rooms and it is not heard in another the amplifiers of the Radiophones can be used to carry the music to the other rooms.

In San Francisco Radio equipment will be a part of the service innovations which will be introduced in the new high class corner of Sacramento and Powell streets by the A. C. Blumenthal company, according to an announcement made recently. Other modern equipment to be installed in the proposed Powell street structure are circulating refrigeration systems, individual elevators for each apartment, and separate service lifts. These innovations will also be installed in the high class apartment house which will be erected by the Blumenthal company on the site now occupied by the Earl C. Anthony home in Los Angeles.

Wire Screen Aids Radio Novice

When a dweller in a Denver, Colorado, apartment purchased a receiving set he asked the landlord to place an aerial on the roof. This was not granted. As the landlord has no rules against screening the windows, the Radio fan put in a copper wire screen in the window of his den, insulated it properly, hitched his lead-in to it and used the outfit to perfection.

New Rule for Radio "Parties"

A radio reception is now the latest thing in parties. When the invitations are sent out the initials "B. Y. O. H." are written in the lower left corner. The initials have nothing to do with a radio call or hootch. They mean: "Bring your own head set."

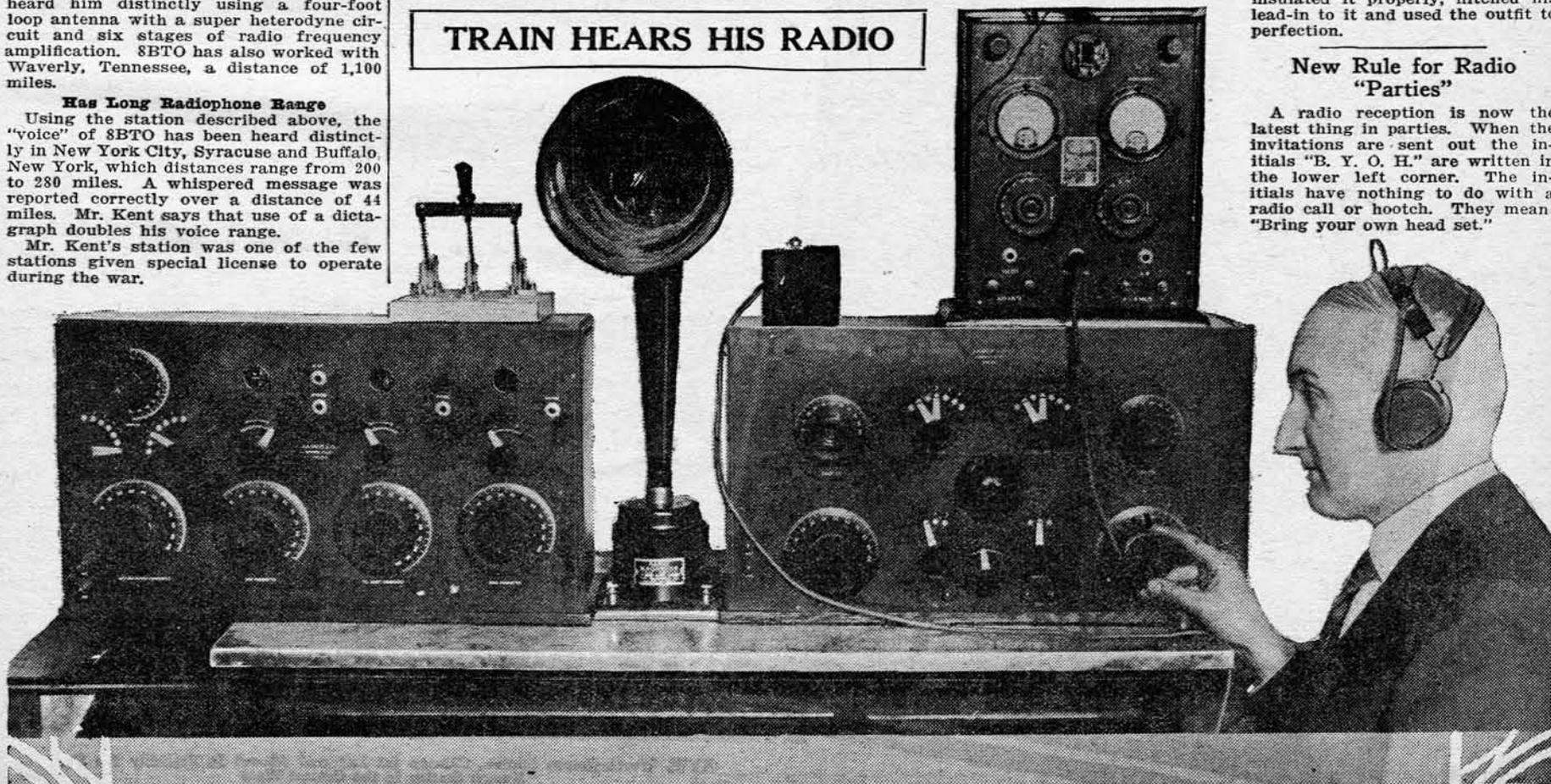
U. S. Aims to Send Messages to World

Greatest Station, at Port Jefferson, Seen Complete in Next Three Twelvemonths

Great things have been planned for Radio Central, the world's largest and most powerful Radio plant, at Port Jefferson. Last November, President Harding officially opened the station when its first unit of twelve towers was completed, and from the rate that the work of completion is being carried forward there is a probability that the station will be completed within the tenure of his office. The final installation will comprise twelve antenna units of seventy-two towers, each tower measuring over 410 feet in height and weighing about 150 tons. These towers will form the spokes of a great wheel of communication which will measure over three miles in diameter. Ten high frequency alternators will be used, giving a total power output of 2,000 kilowatts, or about 2,700 horse-power. The electric forces thus brought into play at Radio Central will permit the realization of the vision of communication experts and engineers to transmit messages to all parts of the world from a single centrally located source.

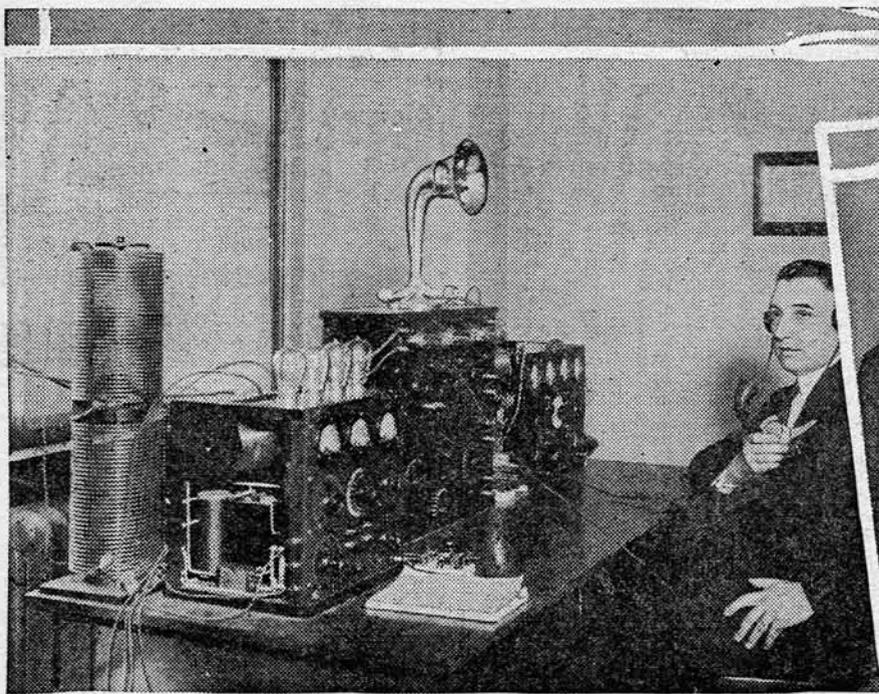
The call letters of this station are WQK, and all transmission is accomplished on a wave length of 16,400 metres.

TRAIN HEARS HIS RADIO



ARTHUR L. KENT, BINGHAMTON, N. Y., at his station 8BTO. Mr. Kent's station was one which worked with the Lackawanna Railroad recently in their tests

REASONS FOR THE MUSIC IN THE AIR



Station WHK, Cleveland, Ohio, Owned by Warren R. Cox, Has Range of 100 Miles, Often Working 350 Miles



"Famous Players" Broadcasting at Station WHK. Their Music Has Pleased Thousands Around Cleveland

STATIONS HEARD ALL OVER COUNTRY SHOWN

Elaborate Equipment Used By Radiophone Transmitters

WHK, Cleveland Ohio

Station WHK, owned by Warren R. Cox and operated by the Radiovox Company, located at 5005 Euclid avenue, Cleveland, Ohio, with an input of 100 watts has been doing some remarkable broadcasting work

within a radius of 100 miles. Using a crystal detector it is easily possible to catch WHK over a distance of fifteen miles, while the use of a vacuum tube detector and amplifier increases the effective range to 100 miles. The station has been heard 350 miles east and west of Cleveland, and 150 miles to the north. The range to the south is smaller, being only 150 miles.

The station sends broadcast a varied program with a regular schedule of hours. It can be heard daily from 1:30 to 2:00, 3:30 to 4:00 and 8:00 to 9:30 P. M., Eastern Standard time. The feature program of the week is a concert given on Sunday

evenings from 8:00 to 9:30 by the Cleveland Radio Association:

KYW, Chicago, Illinois

KYW, with antenna perched atop the Commonwealth Edison building, Chicago, Illinois, is owned and operated by the Westinghouse Electric and Manufacturing Company.

Radiophone broadcasting has stimulated a wonderfully new interest in the Chicago vicinity, the Mississippi Valley, and the middle west since the installation of the station. This station was started in operation Nov. 14, 1920, and broadcasted opera from the Chicago Grand Opera Association during its entire 1921-22 season.

Thousands and thousands of people in their homes and public assembly places were thus able to hear opera as given by some of the best artists the world over, among them: Galli Curci, Muratore, Rosa Raisa, Cyrena Van Gordon, and Mary Garden, General Director of the Chicago Opera Association.

The arrangements for broadcasting opera in itself presented a problem which had never before met anywhere in the United States. The telephone companies, whose business it is to transmit music and speech by phone, admitted it a problem they did not care to tackle, but by the installation of microphones in various locations of the Auditorium Theater, the headquarters of the opera company, as well as on the stage, together with a switching arrangement operated by someone at the opera each evening, this was made possible.

From the theater it was transmitted by telephone to the sending station and there broadcasted. Reports on the reception

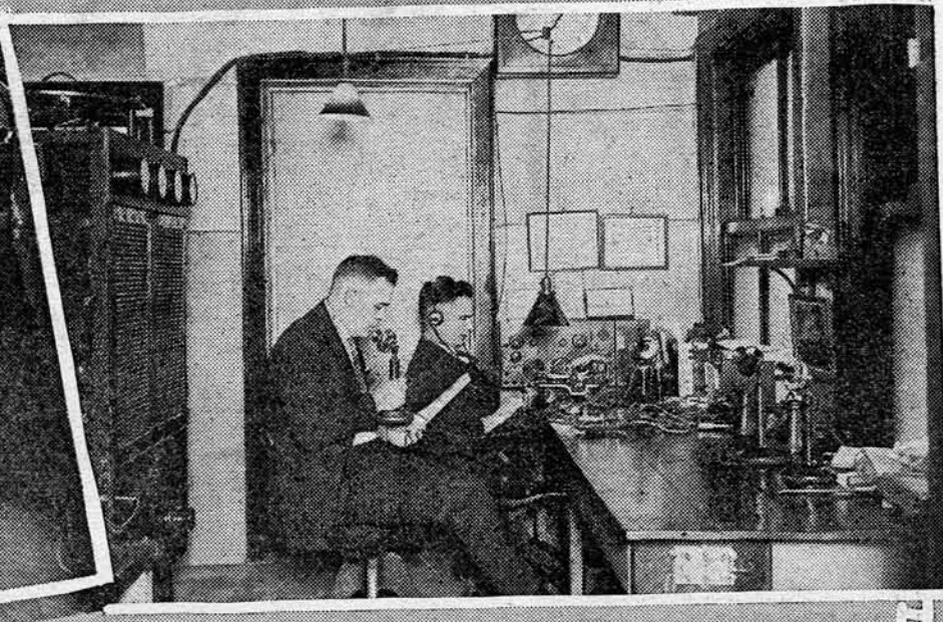
of this opera were received from every section of the country, including such points as Connecticut, Massachusetts, New York, the Carolinas, Georgia, Florida, Texas, California, Iowa, Nebraska, and various points in Canada.

Since the close of the opera season, Jan. 23, the Westinghouse Station KYW, Chicago, has been sending out nightly musical concerts every evening except Sunday. These concerts are made up of musical numbers both vocal and instrumental, and are given by the best talent available in this large metropolis. Among some of the best known artists that have sung from the studio are: Madame Schumann-Heink, Frances Ingram, Madame Showalter, and others.

At 2:15, and 6:30, the U. S. Bureau of Markets furnishes Station KYW with market reports, which are broadcasted on dairy products, live stock, potatoes, vegetables, grain, etc. This broadcasting alone has more than justified a radiophone sending station in Chicago.

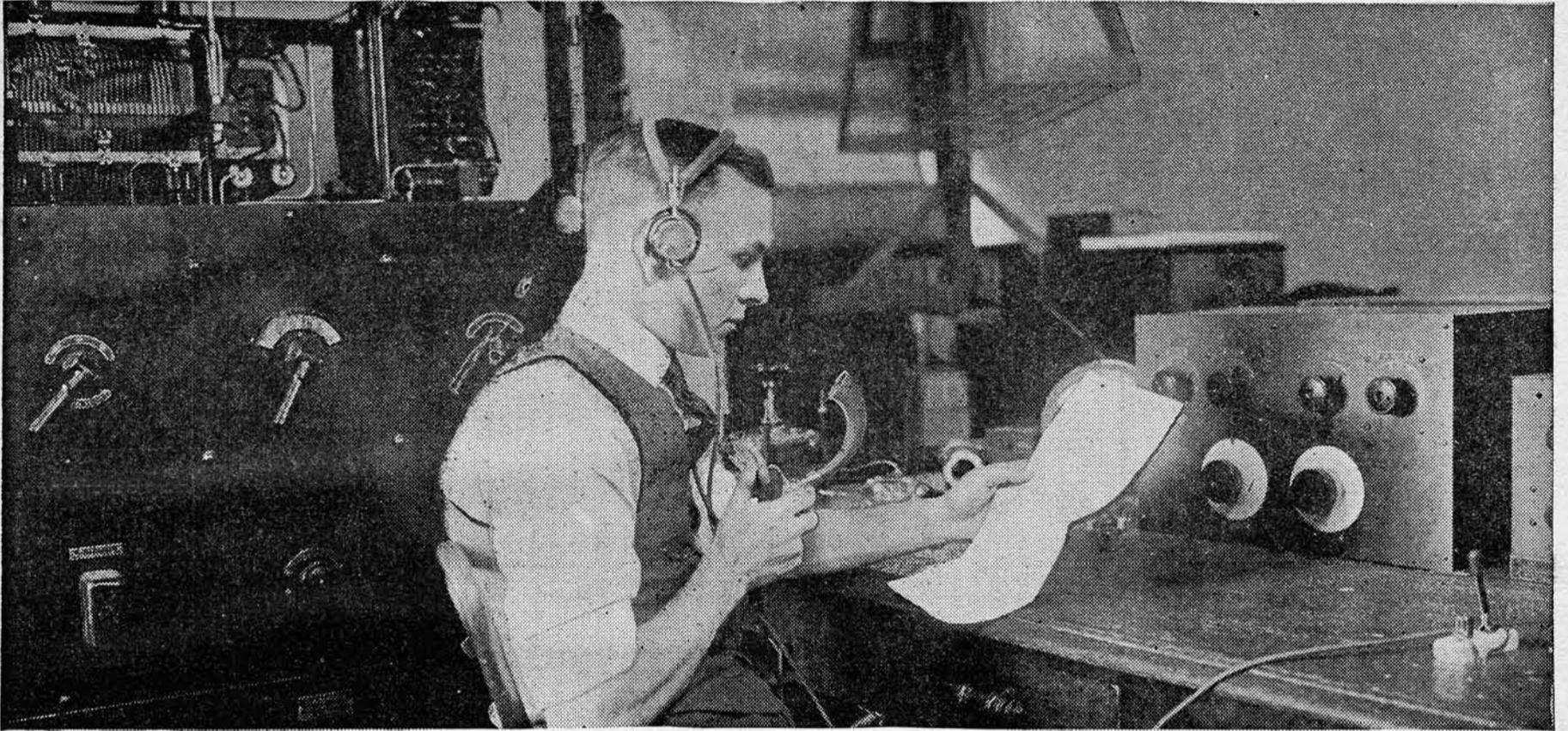
Another feature of Chicago's largest transmitting station is the dissemination of national news furnished by local papers. No endeavor is made to furnish those listening with other than bulletin service on up-to-the-minute news items, since this would consume too much time, and such information can be readily obtained through a local newspaper by those desiring it. Altogether, in working out the material for broadcasting from this city, several points were kept uppermost in mind, namely: public service with real information and entertainment.

(Continued on page 9)



KYW, Westinghouse Station, Chicago (at Left and Above) Is Probably the Best Known Station in the Central West

SHOWING WHK, KYW, KUO AND KDOW



(Continued from page 8)

On Sundays, Station KYW transmits a radio chapel service conducted by prominent ministers of Chicago, representing every church and creed, at 3:30 P. M. The tremendous popularity of this service is possibly due to the fact that the ministers always choose subjects which have a national appeal, and is seldom intended for individuals or groups of individuals.

WWX, Washington, D. C.

Farmers especially are interested in the broadcasts of WWX, the Post Office Department station located at Washington, D. C. WWX is employed by the bureau of Markets and Crop Estimates of the United States Department of Agriculture for transmitting information daily on national market conditions respecting live stock, fruits and vegetables, grain, and dairy products to all farmers within a 600-mile radius of Washington. The range of the station, however, is not restricted to that area, as WWX has often been heard distinctly in Texas and practically all states east of the Mississippi river.

Oftentimes the program is interspersed with messages from Secretary Mellon or other important government messages.

The station works on three wave lengths, 1,160, 1,980 and 2,500 meters respectively. Oscillating tubes are used in transmitting on the two lower waves, while arc continuous wave is employed on the 2,500 meter wave length.

WWX, Post Office Department, Washington, D. C., Is Well Known to Farmers. Mr. T. C. Gale Is Shown Giving Weather and Crop Reports © U. & U.

WWX is really a part of the air mail service, and is used for communication with mail planes in order to keep the pilots informed about the weather and other developments.

KDOW, S. S. America, New York and Vicinity

One of the most interesting Radiophone stations one can hear is that of the S. S. America, call signal KDOW, which has been operating with a number of Atlantic coast stations while 1,000 miles out at sea. The station is owned and operated by the Radio Corporation of America, while the vessel is the property of the United States Mail Steamship company.

The Radio Corporation of America has been experimenting with Radiophone stations for ship use and has had remarkable results from KDOW. Station 2XJ, Deal Branch, New Jersey, has been working with KDOW in the tests, and a range of 2,000 miles has been reached several times.

When the S. S. America was 1,000 miles out at sea, March 13th, a conversation by Radiophone was carried on with a land telephone in the Engineers Club, New York City. By use of a Duplex Radio transmitter installed by the General Elec-

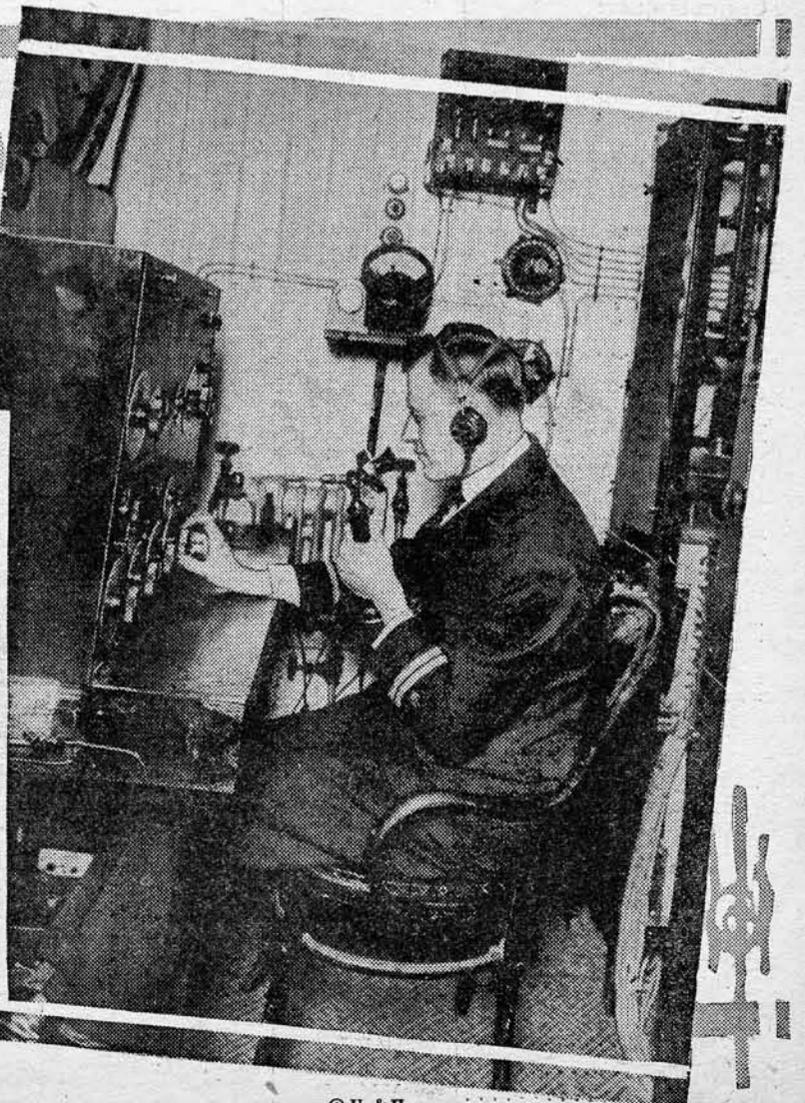
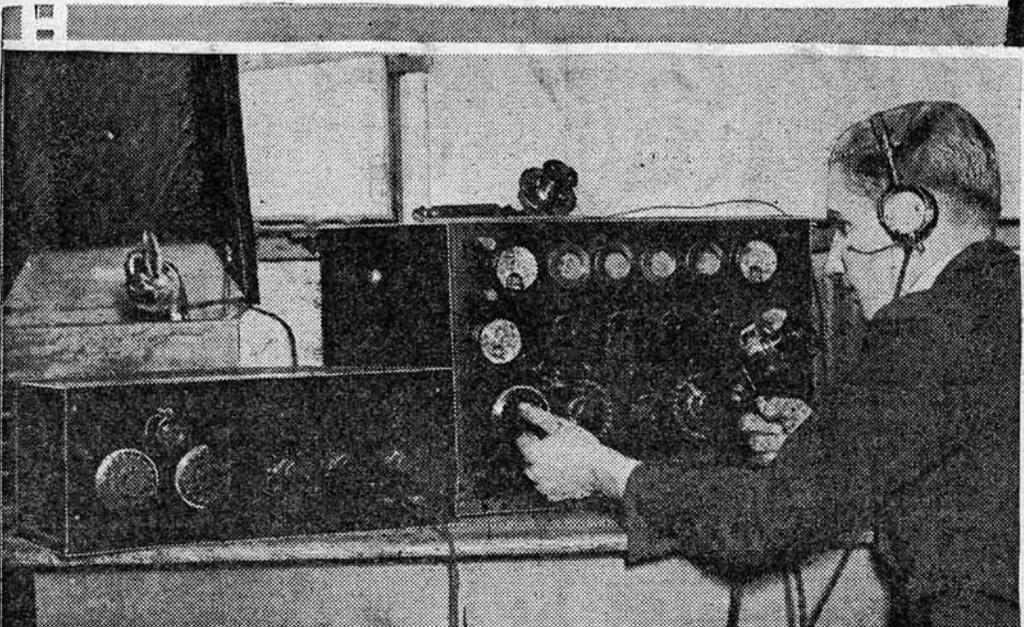
tric company on board the vessel, it was possible for E. F. W. Alexanderson, chief engineer of the Radio Corporation of America, to talk over a regular telephone at the Engineers Club in New York and hold a conversation with the S. S. America's radio operator. This established a record for distance in the use of this duplex transmitter for simultaneous sending and receiving.

Even more recently, Captain Ryan of the America talked to chairman Lasker of the Shipping Board in his office in Washington

while the ship was ninety miles off Ambrose lightship, inbound from England. The Radiophone conversation was received by 2XJ at Deal Branch, New Jersey, and was carried from there over land telephone wires to chairman Lasker's office at the Capitol.

KUO, San Francisco, California

A recent addition to the growing list of broadcasting stations is KUO, of San Francisco, California. It is operated by the Examiner Printing company, publishers of a large newspaper, and is broadcasting news, concert music, weather reports and other information all up and down the Pacific coast and to ships at sea.



KUO, Examiner Printing Company, San Francisco (Above), and KDOW, S. S. America, © Int. New York and Vicinity (at Right)

Radiophone Broadcasting Stations

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

State and City	Call	Wave Lengths	Miles Range	Program	By Whom Operated
Alabama:					
Montgomery	WGH	360	1,000		
Arkansas:					
Pine Bluff.....	WOK	360	.....	W; R; E; A; M; C.	Montgomery Light & Water Power Co.
California:					
Berkeley .....	.....	360	.....	Not known.	The Pine Bluff Co.
Gridley	KFU	360	.....	C.	Maxwell Electric Co.
Hollywood	KGC	360	.....	C.	The Precision Shop
Los Altos.....	KLP	360	1,500	C.	Electric Lighting & Supply Co.
Los Angeles.....	KJS	360	.....	C; N.	Colin B. Kennedy Co.
Los Angeles.....	KOG	360	.....	Not known.	Bible Institute of Los Angeles, Inc.
Los Angeles.....	KOL	360	.....	Not known.	Western Radio Electric Co.
Los Angeles.....	KYJ	360	1,000	Not known.	Arno A. Kluge.
Los Angeles.....	KZC	360	.....	C; M; W; N.	Leo J. Meyberg Co.
Monterey	DDV	360	.....	N; C.	Western Radio Electric Co.
Oakland	KLS	360	.....	Not known.	Noble Electric Works.
Oakland	KZM	360	1,500	C.	Warner Bros. (also operate 6XAM).
Oakland	KZY	360	.....	N. C.	Hotel Oakland (Preston D. Allen).
Pasadena	KLB	360	.....	C; R; N.	Atlantic-Pacific Radio Supplies Co.
Pomona	KGF	360	.....	Not known.	J. J. Dunn & Co.
Sacramento	KVQ	360	.....	Not known.	Pomona Fixture & Wiring Co.
San Francisco.....	AGI	360	1,500	C; N.	J. C. Hobrecht (Sacramento Bee).
San Francisco.....	KDN	360	.....	C; I.	Signal Corps, Presidio.
San Francisco.....	KGB	360	.....	C; M; N; W.	Leo J. Meyberg Co.
San Francisco.....	KUO	360	.....	Not known.	Edwin C. Lorden.
San Francisco.....	KYY	360	.....	Not known.	The Examiner Printing Co.
San Francisco.....	.....	360	.....	Not known.	The Radio Telephone Shop.
San Jose.....	KQW	360	.....	C.	The Emporium.
Stockton	KJQ	360	.....	C.	Chas. D. Herrold.
Stockton	KWG	360	.....	C.	C. O. Gould.
Sunnyvale	KJJ	360	.....	N; M; C.	Portable Wireless Telephone Co.
				C.	The Radio Shop.
Colorado:					
Denver	KIZ	360; 485	1,000	N; W; C.	Reynolds Radio Co. (also operate 9ZAF).
Denver .....	.....	360	.....	C.	Fitzsimmons Hospital.
Denver	KOA	485	.....	T; W; N.	Y. M. C. A. (W. H. Smith).
Connecticut:					
Hartford	WQB	425	900	C.	C. D. Tuska Co.
New Haven	WCJ	360	.....	Not known.	A. C. Gilbert Co.
D. of C.:					
Washington	WDM	360	.....	R; L; C.	Church of the Covenant.
Washington	WDW	360	.....	Not known.	Radio Construction & Electric Co.
Washington	WJH	360	.....	I; V; C; H.	White & Boyer.
Washington	WWX	1160	.....	W; M.	Post Office Department.
Washington	3YN	360	.....	I.	National Radio Institute.
Georgia:					
Atlanta	4CD	200-375	.....	N; C; L.	Carter Electric Co.
Illinois:					
Chicago	KYW	360; 485	800	C; L; N; M; R.	Westinghouse Electric & Mfg. Co.
Chicago	WBU	360	1,000	P; F.	City of Chicago.
Rock Island	WOC	360; 485	.....	Not known.	Karlowa Radio Co.
Indiana:					
Indianapolis	WLK	360	.....	C; V; N; L.	Hamilton Mfg. Co.
Indianapolis	WOH	360	700	M; C.	Hatfield Electric Co.
Richmond	WOZ	485	300	C; M; N; W; L.	Palladium Printing Co.
Iowa:					
Des Moines	WGF	360	.....	Not known.	Register-Tribune.
Iowa City	9YA	360	.....	M; N.	University of Iowa.
Kentucky:					
Louisville	9ARU	200	200	N. I.	Darrell A. Downard.
Massachusetts:					
Medford Hillside	WGI	360	1,000	N; C; L; I; H; R; M.	Am. Radio & Research Corp. (Also IXE.)
Springfield	WBZ	360	600	C; N; L; R.	Westinghouse Electric & Mfg. Co.
Michigan:					
Detroit	WWJ	360; 485	1,000	C; V; N; M.	The Detroit News. (Was WBL.)
East Lansing	WHW	485	150	M; W.	Stuart W. Seeley.
Minnesota:					
Minneapolis	WLB	360; 485	.....	W; M; C; N.	University of Minnesota.
Missouri:					
Jefferson City	WOS	485	.....	M.	Missouri State Marketing Bureau.
Kansas City	WOQ	360; 485	500	M; W; C; L.	Western Radio Co. (Also operate 9XAB.)
Nebraska:					
Lincoln	9YY	360	300	C; N.	University of Nebraska.
Omaha	WOU	360; 485	.....	Not known.	Metropolitan Utilities District.
Omaha	WOV	360	.....	Not known.	R. B. Howell.

State and City	Call	Wave Lengths	Miles Range	Program	By Whom Operated
New Jersey:					
Jersey City	WNO	360	500	C; N; L.	Wireless Tel. Co. of Hudson Cy.
Jersey City	2IA	200	70	L; C; R.	Jersey Review.
Newark	WOR	360	.....	Miscellaneous	L. Bamberger & Co.
Newark	WJZ	360	2,000	N; L; C; W; A; R.	Westinghouse Electric & Mfg. Co.
New Mexico:					
Roswell	5ZAO	360	300	M; W; N; C.	Roswell Public Service Co.
New York:					
New York	WDT	360	.....	Not known.	Ship Owners' Radio Service.
New York	WJX	360	.....	Not known.	De Forest Radio Telephone & Telegraph Co.
New York	WYCB	1,450	.....	N; C.	Amateur Radio Reserve.
Rochester	WHQ	360; 485	50	L; C; M; R.	Rochester Times-Union.
Schenectady	WGY	360	.....	Not known.	General Electric Co.
Schenectady	WRL	360	800	C; R.	Union College. (Also 2XQ.)
Ohio:					
Cincinnati	WLW	360	1,200	C; L; N; R.	Crosley Mfg. Co.
Cincinnati	WMH	360; 485	1,000	C; N; L; W; V; M.	Precision Equipment Co. (Also 8XB.)
Cleveland	WHK	360	100	C.	Warren R. Cox.
Columbus	8BYV	200	.....	C; N.	Electrical Specialty Co.
Columbus	8YO	275	.....	T; M; L; N.	Ohio State University.
Dayton	WFO	360; 485	300	M; N; C; W; L; R; A.	Rike-Kumler Co.
Dayton	WA-1	360	.....	Not known.	U. S. Army.
Fairfield	WL-2	360	.....	Not known.	U. S. Army.
Hamilton	WRK	360	1,000	C; R; T.	Doron Bros. Electrical Co.
Toledo	WHU	360	.....	Not known.	Wm. B. Duck Co.
Toledo	WJK	360	300	O; L; R.	Service Radio Equipment Co.
Toledo	WSZ	360; 485	.....	Not known.	Marshall-Gerken Co.
Oregon:					
Portland .....	.....	360	.....	Not known.	Hallock & Watkins.
Portland .....	.....	360	.....	Not known.	Northwestern Radio Mfg. Co.
Portland .....	.....	360	.....	Not known.	Ship Owners' Radio Service.
Pennsylvania:					
Philadelphia	WGL	360	.....	Not known.	Thos. F. J. Howlett. (Also 3AWI.)
Pittsburgh	KDKA	360	1,000	N; C; L; R; V; T; M.	Westinghouse Electric & Mfg. Co.
Pittsburgh	KQV	360	750	C.	Doubleday-Hill Electric Co.
Pittsburgh	WRB	360	200	Not known.	Newspaper Printing Co.
Rhode Island:					
Westerly .....	.....	360	.....	C; L.	Whitall Electric Co.
Texas:					
Dallas	WRR	450	.....	N; W; C; R.	Police & Fire Signal Department.
Dallas .....	.....	360	.....	Not known.	Radio Equipment Co.
Washington:					
Seattle	KFC	360	.....	N; C; V; H.	Northern Radio & Electric Co.
Seattle	KHQ	360	.....	Not known.	Louis Wasmer.
Seattle	KJR	360	.....	Not known.	Vincent I. Kraft.
Wisconsin:					
Madison	WHA	360; 485	600	W; C; N; M; L.	University of Wisconsin.
Canada:					
Montreal .....	.....	1,200	200	C; N; L.	Marconi Telegraph Co. of Canada, Ltd.
Toronto .....	.....	450	.....	Not known.	Canadian Independent Telephone Co.
Toronto .....	.....	1,200	.....	Not known.	Marconi Telegraph Co. of Canada, Ltd.

Your Directory—

To aid the beginner and to help him realize full benefits from his receiving station, RADIO DIGEST has compiled the foregoing list of radiophone broadcasting stations. To use the "radiophone directory" to its maximum advantage, the reader should not the broadcasting stations nearest, and attempt to tune them in at the wave lengths given.

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

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

Station Schedule

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

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

K D N, San Francisco, Calif.
Daily except Sundays, 4:30-5:30 P. M., markets, news and concert; 7:10-7:30 P. M., financial news and weather; Mondays, 8:30-9:30 P. M., concert; Thursdays, 7:30-8:30 P. M., concert; Saturdays and Sundays, 8:15-9:00 P. M., concert.

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

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

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

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

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

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

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

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

K O A, Denver, Col.
Daily, 9:55-10:25, time and weather reports.

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

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

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

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

K Y J, Los Angeles, Calif.
Daily except Sundays, 4:00-5:00 P. M., concert, markets, news and weather. Mondays, Thursdays and Saturdays, 8:00-9:00 P. M., same program.

K Y W, Chicago, Ill.
Daily except Sundays, 9:30 A. M., 10:00 A. M., 1:20 P. M. and 2:15 P. M., stock quotations and markets; 2:15 P. M., 3:00 P. M., baseball; 4:15 P. M. and 6:30 P. M., news and markets; stock report summary; 7:30 P. M., children's hour; 8:00-9:00 P. M., concert; 9:00 P. M., news. Sundays, 3:30 P. M., church service.

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

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

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

W B Z, Springfield, Mass.
Daily except Sundays, 7:30 P. M., children's hour; 7:45 P. M., market, weather, lecture; 8:00 P. M., concert, new lecture. Sundays, 3:00 P. M., concert; 8:00 P. M., church service.

W D M, Washington, D. C.
Sundays, 10:30 A. M., church service; 3:00 P. M., lecture; 7:30 P. M., church service.

W F O, Dayton, O.
Daily, 9:00-9:30 A. M., concert and news; 11:00-12:00 A. M., music, news, markets, weather; 4:00-5:00 P. M., music, news, markets, agriculture, weather. Mondays, Wednesdays and Fridays, 7:00-8:30 P. M., music and lecture. Sundays, 11:00-12:00 A. M., church.

W G H, Montgomery, Ala.
Daily, 11:05 A. M., weather; 4:05 agricultural. 8:30-9:30 P. M., educational, agricultural, stock quotations and concert. Sundays, 8:30-9:30 P. M., religious program.

W G I, Medford Hillside, Mass.
Mondays, 8:15 P. M., news. Tuesdays and Thursdays, 8:15 P. M., children's hour. Wednesdays, 8:15 P. M., concert. Fridays, 8:00 P. M., radio instruction. Saturdays, news.

W H A, Madison, Wis.
Daily except Sundays, 12:30-1:00 P. M., weather, markets; Tuesdays, Thursdays, Fridays and Saturdays, 12:00-1:00 P. M., weather, markets, time; Tuesdays only, 8:00-9:00 P. M., concert; Fridays, 8:00 P. M., news; 8:15 P. M., 9:00 P. M., concert; Saturdays, 1:05-1:20 P. M., lecture.

W H K, Cleveland, O.
Daily, 1:30-2:00, 3:30-4:00, 8:00-9:30 P. M., concert.

W H Q, Rochester, N. Y.
Daily except Sundays, 12:00-12:15 A. M., music and news; 7:30-8:00 P. M., markets, bedtime stories, lecture; 8:00-8:30 P. M., music. Sundays, 3:00 P. M. and 7:30 P. M., church service.

W J H, Washington, D. C.
Tuesdays, 7:30-9:30 P. M., radio instruction and vaudeville. Wednesdays, 9:00 P. M., concert and radio instruction. Fridays, 8:30 P. M., concert; 9:00 P. M., health lecture.

W H W, East Lansing, Mich.
Daily except Sundays, 11:30-12:30 A. M., weather and markets.

W J K, Toledo, O.
Daily except Sundays, 3:00-4:00 P. M., concert. Mondays, Wednesdays and Fridays, 7:30-9:00 P. M., concert, lecture, etc. Sundays, 7:30-9:00 P. M., sermon and concert.

W J Z, Newark, N. J.
Daily except Sundays, hourly from 11:00 A. M. to 8:00 P. M., music; 11:00 A. M., 12:00 M., 5:00 P. M. and 10:00 P. M., (See page 12, column one)

Characteristics of Vacuum Tube Amplifiers

By Benjamin F. Miessner

PART II

Characteristics of Vacuum Tubes

We now come to the electrical characteristics of vacuum tubes, a thorough understanding of which is quite necessary before beginning a study of amplifiers. These characteristics are best expressed by characteristic curves which trace the operation of a tube during changes of one or more of the controlling factors.

The two-electrode vacuum tube, or Fleming valve, the first type of tube used in Radio, consists essentially of a cathode or negative electrode, and an anode or positive electrode, both of which are enclosed in an evacuated space, usually a glass bulb or tube. The cathode is a thin filament of platinum, tungsten or other suitable material, with external terminals to which electrical connection is made for heating. The anode is a plate of conducting material, usually pure nickel, which is supported near the filament, but highly insulated from it.

Tube Acts Unlike Pure Resistance

If the cathode in such a tube be heated and a positive potential be applied to the anode with respect to the cathode, a current will flow in the tube and the external circuit. We soon find, however, by trying several different voltages selected at random, that the current in the tube is dependent upon several factors, and that the tube does not act at all like a pure resistance in following Ohm's law. Instead of the current being proportional to the applied voltage, we find some other and complicated relation existing between them.

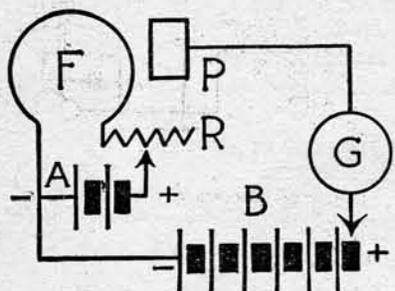


Figure 1

In order to determine definitely just what does occur under given conditions, we will connect a two-electrode tube as shown in Figure 1. Here the cathode (F) is heated by current supplied by battery (A), and (P) is the anode. The anode (P) and the cathode (F) are connected together through a galvanometer (G) and an anode battery (B). The temperature of the filament may be regulated by varying the heating current by means of the resistance (R).

If now we set this apparatus in operation and adjust the filament temperature to some low value which will liberate some of its free electrons by vaporization, and apply some low value of voltage at B, a small current will flow in the galvanometer. This current is set up by the attraction of the positively charged anode for the negatively charged electrons liberated from the cathode and their return through the external circuit to the cathode again.

Current Potential Curve Obtained

If we start at zero voltage in B, successively apply increasing voltages, and plot the current readings for each applied voltage, a curve will be obtained like that given by O-I₁ in Figure 2.

This indicates that at low voltages the current is very small, and very little rise in current results as the voltage is gradually

increased. However, a point is soon reached at A where the current begins to rise more rapidly, and still further at B it is rising with considerable rapidity; at C, however, it begins to rise less rapidly again, and at D very little current increase is noted. Beyond D, the curve becomes practically flat, and a very great increase in voltage will cause no appreciable further increase in the current.

If now we increase the cathode temperature by allowing more current from battery A to pass through it and then repeat this test, the results up to point C will be practically identical with the first test, but beyond this, the current rises higher before the curve flattens. This characteristic is shown by curve O-I₂. With a still higher

filament temperature, a curve such as O-I₃ may be obtained.

Current Flow Depends Upon Potential

It is evident from these results that the current which flows through the tube is dependent in some manner upon the potential applied across it, and also upon the temperature of the cathode. When the cathode temperature is constant, as in any of the curves shown in Figure 2, the apparent resistance of the tube is variable; it is obvious that this resistance is high from O to A, and nearly constant; from A to C, it decreases considerably, and beyond C, it increases continuously with the applied voltage. A curve for the tube's apparent resistance might be obtained by plotting as ordinates in Figure

increased anode potential, the curve O-A-E_{p2} may be obtained, and again, with still higher potential, curve O-A-E_{p3} may be obtained. The lower part of the curves O-A-

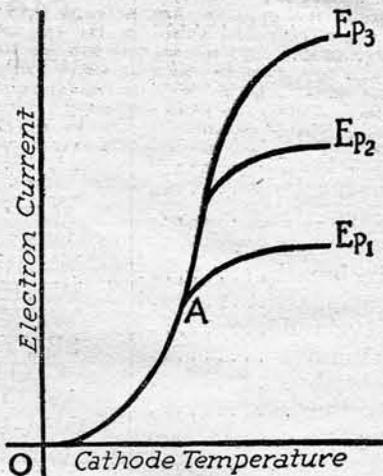


Figure 3

etc., may be taken to represent the rate of vaporization of electrons with varying temperature.

Space Charge Effect Described

At point A, however, the presence of the large number of electrons in the space between the cathode and the anode begins to affect their passage. These electrons are negatively charged, it will be remembered, and while their potential may not be so high as that of the anode, they are nearer the cathode and they neutralize by a repulsive force, the attractive force of the anode. This effect is known as the space charge effect, because the inter electrode space filled with negatively charged electrons possesses a negative charge.

It is seen in the curves of Figure 3 that this space charge can cause an equilibrium of forces acting on the electrons and so limit the amount of current flowing through the tube. The point A is called the "saturation" point because at this point further increase in cathode temperature produces no appreciable increase in electron current. It is analogous to the saturation point reached in the evaporation of liquid solutions. When a condition of saturation is obtained with a given anode potential, the electronic current can, of course, be increased by applying a higher anode potential. This is equivalent, in the saturation of space above liquids, to increasing the temperature of the space.

Characteristics Ready for Analysis

In these two sets of curves, we have in graphic form before us for critical analysis and adaption for special requirements, the chief characteristics of the two electrode vacuum tube. Since the chief use for such a vacuum tube has been the rectification of weak high frequency alternating currents, only those characteristics pertaining to this use will be discussed.

Editor's Note.—The third of the series of articles by Mr. Miessner will appear in the April 29th number of RADIO DIGEST ILLUSTRATED. In the third installment he will discuss the application of the vacuum tube to radio circuits.

Mr. Miessner—

IS UNDOUBTEDLY well known to many of our readers. He will be remembered as the inventor of the Electric Dog, which by means of Selenium cells and relays, would follow a light. In 1911 and 1912 he was associated with John Hayes Hammond, Jr., inventor of the Radio-Controlled Torpedo. During the War, Mr. Miessner was Radio Expert for the Navy Department. He is now working on research problems in acoustics and Radio for the Brunswick-Balke-Collender Company, Chicago, and is author of "Radio Dynamics," published by Van Nostrand Company.

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

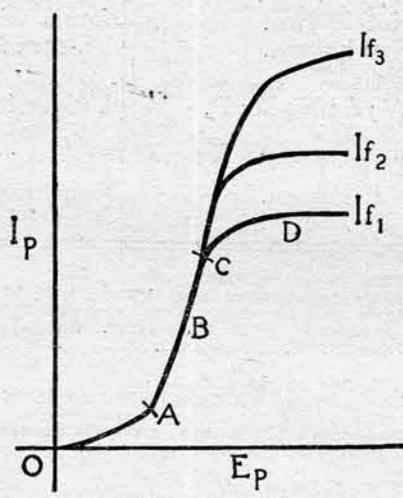


Figure 2

2 the ratio E_p/I_p , where E_p represents the voltage across battery (B) and I_p the current flowing through the external circuit (Figure 1) from the anode (P) to the cathode (F).

Current Temperature Curve Obtained

Suppose now we consider the effect on the operation of the tube of variation of cathode temperature. Using the circuit shown in Figure 1, we will choose some arbitrary value of anode potential and maintain that constant while varying the cathode temperature and observing the current in the galvanometer (G). The general nature of the results given by such a test are shown in the curves of Figure 3.

These curves indicate that at low temperature, as would be expected, no current flows because electronic vaporization does not occur. As the temperature increases, however, the electrons are liberated more rapidly and are practically all drawn to the anode. A point A, is soon reached however, where the current increases less rapidly and at a little higher temperature, it stops increasing and remains practically constant (on branch E_{p1}).

If now another set of data is taken with

STATION SCHEDULE

- Weather; 2:05 P. M. (except Saturdays), shipping news; 12:00 M. and 6:00 P. M. agricultural; 9:52 P. M., Arlington time signals. **Tuesdays**, 7:00 P. M., children's hour; 8:20-10:00 P. M., concert. **Thursdays and Saturdays**, 8:20-10:00 P. M., concert. **Sundays**, 3:00 P. M., church service; 8:20-10:00 P. M., concert.
- W L B, Minneapolis, Minn.**
Daily, 12:00 M., weather and stock quotations; 7:30 P. M., markets. **Wednesdays**, 8:00 P. M., concert.
- W L K, Indianapolis, Ind.**
Tuesdays, 8:00-8:55 P. M., concert; 9:00-10:00 P. M., vaudeville and news. **Thursdays**, 8:00-8:55 P. M., concert, lecture and news. **Sundays**, 8:00-8:55 P. M., concert, religious.
- W L W, Cincinnati, O.**
Tuesdays, Thursdays and Fridays, 8:00 P. M., music, news and lecture. **Sundays**, 8:00 P. M., church services.
- W M H, Cincinnati, O.**
Daily except Sundays, 11:00 A. M. and 4:00 P. M., weather and markets. **Monday, Wednesday and Saturdays**, 8:15-10:00 P. M., concert, lecture, vaudeville and news.
- W N O, Jersey City, N. J.**
Daily, 10:01 P. M., news, concert.

- W O H, Indianapolis, Ind.**
Daily except Sundays, 10:00-11:00 A. M., 4:00-5:00 P. M., stock reports and music; 8:30-10:00 P. M., music. **Saturdays**, 1:00-2:00 P. M., stock reports and music. **Sundays**, 10:00-11:00 A. M., music.
- W O Q, Kansas City, Mo.**
Daily, 11:30 A. M., 2:00 P. M. and 7:30 P. M., markets and weather; 8:30-9:30 P. M., concert.
- W O R, Newark, N. J.**
Daily except Sundays, 9:00 A. M., 5:00 P. M., hourly program.
- W O Z, Richmond, Ind.**
Daily except Sundays, 12:00-12:15 P. M., markets; 4:00-5:00 P. M., music, news, markets; 6:30-7:00 P. M., music, news weather and lecture.
- W Q B, Hartford, Conn.**
Tuesdays, Thursdays and Saturdays, 8:00 P. M., concert.
- WRK, Hamilton, O.**
Mondays, Wednesdays and Saturdays, 8:30-10:30 P. M., music and news. **Fridays**, 7:30-9:30 P. M., music. **Sundays**, 10:45 A. M. and 7:30 P. M., church service.
- W R L, Schenectady, N. Y.**
Irregular programme.
- W R R, Dallas, Texas.**
Daily, 7:00 P. M., police news, sports, weather; 8:30-9:30 P. M., concert. **Sundays**, 11:00 A. M. and 7:30 P. M., church service.

- W W J, Detroit, Mich.**
Daily except Sundays, 11:30-11:55 A. M. and 3:30-4:00 P. M., music; 7:00-8:30 P. M., concert, etc.
- W W X, Washington, D. C.**
Daily, 10:00 A. M., weather; 10:30 A. M., markets; 5:00 P. M., markets (code); 7:30 P. M. and 8:00 P. M., markets; 9:50 P. M., weather.
- 2 I A, Jersey City, N. J.**
Wednesdays, 7:00-8:00 P. M., concert and lecture. **Sundays**, 7:00-8:00 P. M., church service and concert.
- 3 Y N, Washington, D. C.**
Daily, 6:30-7:30 P. M., radio instruction (code and radiophone).
- 4 C D, Atlanta, Ga.**
Tuesdays, Thursdays and Saturdays, 7:30-8:00 P. M., news and concert.
- 5 Z A O, Roswell, N. M.**
Daily except Sundays, 7:00-9:00 P. M., weather, stock and news. **Mondays, Wednesdays and Fridays**, 7:00-9:00 P. M., music. **Sundays**, church service.
- 8 Y O, Columbus, O.**
Irregular, time signals, news, markets, etc.

- 8 B Y V, Columbus, O.**
Mondays, Wednesdays and Fridays, 7:30 P. M., concert, news, etc.
- 8 U X, Akron, O.**
Mondays, Wednesdays and Fridays, 6:30-7:30 P. M., concert.
- 9 A E U, Louisville, Ky.**
Mondays and Wednesdays, in evening, police news. balance of week irregular.
- 9 Y A, Iowa City.**
Irregular, markets, news, etc.
- 9 Y Y, Lincoln, Neb.**
Daily, 12:00 M. and 7:30 P. M., news, concerts.
- Berkeley, Calif. (Hotel Claremont).**
Sundays, 1:00-2:00 P. M. and 6:00-7:00 P. M., concert.
- Denver, Colo. (Y. M. C. A.).**
Daily, 10:00 P. M., time signals, weather, news.
- Denver, Colo. (Fitzsimmons Hospital).**
Thursdays, 8:00-9:30 P. M., concert.
- Montreal, Canada (Marconi Station).**
Tuesdays, 8:00-9:30 P. M., concert, news.
- San Francisco, Calif. (The Emporium).**
Daily except Sundays, 10:00-11:00 A. M. and 2:30-3:30 P. M., concert.
- Westerly, R. I. (Whitall Elec. Co.).**
Daily, in evening, concert.

Simple Instructions for the Beginner

By Harry J. Marx

In the last issue, we covered a series of simple instructions for the beginner on the Crystal Detector set and its conversion into a Vacuum Tube set. Both of the sets described last issue were given in their simplest forms. In order to cover the subject to the best advantage for the beginner, we will take up the various pieces of apparatus that can be added or that are alternative to those with which we have started out. It is not our intention at the present time to cover the subject of construction in these articles, but rather the method of operation and use, and hook-ups employed in the two types of circuits. Don't get the impression that we will disregard the construction of apparatus, for that will come later, but for the present, the beginner should know how the parts work and how to use them. If he does not understand that he will be unable to realize why certain methods of construction must be adhered to and he will have little success with self-made apparatus. While a Loose Coupler can be constructed at home, its price is usually not too high and the beginner will save time and patience, and will get better results with one of the standard types on the market at prices ranging from \$10 to \$20.

The Loose Coupler

Figure 1 gives us the conventional symbol that is usually used in a hook-up diagram. The coil on the left is the primary and has a single slide adjustment. Occasionally we have two slide adjustments, but the advantage of the extra slide is not so apparent. The secondary winding on the right side of the diagram is usually tapped and allows for a variation in the number of turns, and therefore varies the inductive effect of the winding. In addition to that, we have the feature of the secondary winding sliding in and out of the primary winding, permitting very fine adjustment for tuning purposes. These last two features are the main points in the advantage of the Loose Coupler over tuning coils. It permits the

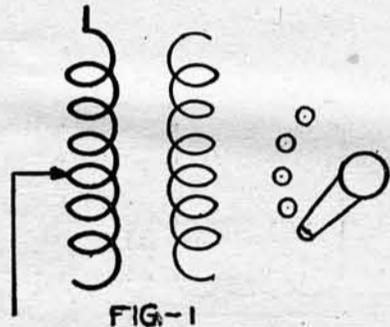


FIG-1

very high degree of adjustment so desirable in tuning out interference of any kind.

Figure 2 gives us a prospective view of the instrument as we usually see it in the catalogues, and illustrates the various points of construction which we have just discussed. Whether it is mounted on a base or adapted for panel mounting, there will be no radical change from these features. Occasionally the primary may be found tapped instead of fitted with the sliding adjustment. The tapped primary, if provision is made for cutting in a single turn at a time, is superior on account of the better contact of the switch control compared to the slider.

At this point it might be well to clear up the usual doubt that exists in the beginner's mind, about the difference between a Loose Coupler and a Variometer. As we stated before, the inductance effect is controlled by sliding the secondary winding in and out of the primary winding. Now the Variometer has no sliding adjustment between the coils, but operates with a different mechanical adjustment. In the Variometer, we simply rotate the secondary winding about its shaft, so that the coils have full inductive value when the cores or insides of the tubes are parallel. We decrease the induction as we turn the secondary from the normal to a position at right angles to the normal, while if we continue turning past that point we reverse the flow entirely. This last feature, however, will, as a rule, have no effect on the operation of our circuit, as we are dealing with an alternating current in which the flow has its periodic changes.

To those who have studied Physics, the theory of induction is easily understood. The simplest example is found in its application to the transformer. The principle is the same in the case of the Loose Coupler, except that no iron core is employed. The Loose Coupler is a transformer, in fact. The waves as received by the aerial travel through the primary winding and the adjustment for wave length is controlled by the slider on the primary. Magnetic waves are built up around this primary winding by this oscillating current, somewhat similar to the action in an electro-magnet. These magnetic waves creating an induced cur-

rent in it, cut the turns of the secondary winding, and since the current in the primary is alternating, we have a constant change in polarity in the magnetic field; therefore, we get continued cutting of turns or inductive flow in the secondary. As we move the secondary in and out we are moving its position in the magnetic field. As the strength of our magnetic field varies, the current induced in the secondary varies, as we move the coil through the different positions. Likewise, as we vary our number of windings in this secondary winding by means of our taps and the contact switch, we vary the ratio of the number of turns of secondary coil to that of the primary, this in turn varying the value of the induced current. Taking advantage of this induction feature, we can control the oscillations of our wave and are therefore passing on to our detector, whether it be crystal or tube, a series of waves that are better adapted for our detector operation than those we got with the simple turning coil, whether single or double slide.

Tuning the set with a Loose Coupler is a little more difficult, but the advice

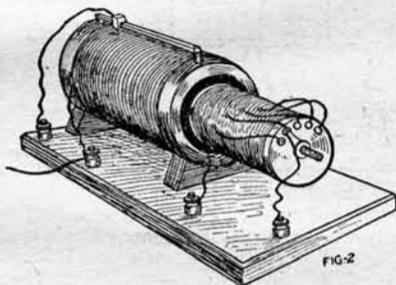


FIG-2

of an old sage, that experience is the best teacher, seems best after all. The best rule would be to use all the windings of the secondary, sliding it into the primary as far as it will go, then to vary your primary slider or switch until the wave-length has been adjusted. After this has been done the secondary can be pulled in and out, trying the various taps in conjunction until the best results are obtained. It will immediately be apparent which tap on the secondary gives best results and finer adjustments can be governed by sliding the secondary.

Of course it is apparent that the Loose Coupler is not as compact as the Variometer. This seems to be the former's main disadvantage in panel mounting, but when we consider its range and tuning facilities, we often wonder why its use is not more general. The writer prefers the Loose Coupler to the popular Variometer and double Variometer arrangement. It is much cheaper and when properly handled will give results that are rather surprising.

The Loose Coupler With the Crystal Set

As stated before, the range of a crystal detector set is very limited, but even that feature can be controlled to some extent. The Loose Coupler will add wave length to your aerial and in addition will give you considerable control over the tuning. The hook-up shown in Figure 3 shows the substitution of the Loose Coupler for the two slide tuning coil. In addition we have anticipated the fact that the beginner has already been bitten by the Radio Bug sufficiently to have added a variable condenser to the set. If not, however, leave it out, but the variable condenser should be the next addition to the collection.

Now to trace what happens. The waves are caught by the aerial and conducted through the primary of the Loose Coupler, going from here to the ground. If your aerial is high and long, and you have no difficulty in getting the longer wave lengths you might try adding another variable condenser in the Aerial or Ground circuit. Oh, yes, we can always figure on spending a few more dollars and adding to the collection.

No, we have not dispensed with the waves, just because we simply led them through without any connections to the remainder of our circuit. These waves, as explained before, have induced a similar current in the secondary that we control through our various adjustments. From the secondary on, our circuit and its operation is simply a repetition of what was explained in our last issue. Yes, we show the variable condenser that we added, provided that the pocket-book and the wife or sweetheart allowed us to purchase after the recent expense of the Loose Coupler. In hooking the variable condenser across the secondary coil, we did the same thing that we explained in the last issue when we added it across the tuning coil in the Vacuum Tube Set. It acts as an absorber for outside interference currents that will creep in. These are caught and are partially prevented from going over to the

rest of the set. It also has the advantage of acting as a capacity check on the secondary. The most convincing demonstration of its value is in trying your set with it added, and then removing it to see the difference in results.

Tuning the set is partially covered under the description of the Loose Coupler. Of course, the first step is to get the proper point of contact on the crystal. This can be done as explained in the last issue by means of the Buzzer Circuit. When the detector is adjusted and the hook-up completed, push the secondary all the way in and set the contact switch for the full winding of the secondary, then adjust the slider on the primary until the results are heard. Don't condemn the hook-up and the advice because you don't hear a band concert immediately. The band may not be playing (see Radiophone Directory), the hook-up may not have been properly followed, the aerial may not be long enough, the band too far away or a multitude of other troubles may be the cause.

You might also try your slider with the secondary in different positions and the tap contact positions at various points. The actual possible combinations are so many that it may take considerable time to try the full range of the set. When you are getting results, take careful note of the exact positions and the next time you use the set, you will know about where to begin if you are trying for a broadcasting station with a similar wave length. Of course if the wave length is much different, you will have to puzzle it out all over again.

The Loose Coupler and the Vacuum Tube Set

The real value of the Loose Coupler is only clearly demonstrated by the Vacuum Tube Set. Here we get the full benefit of the inductance value and the tuning range. The only real improvement that we can anticipate in this type of circuit now is the addition of one or two stages of amplification. As we are endeavoring to follow the growth in interest of the new beginner in Radio, we will take up the stages of amplification in later issues.

It doesn't pay to grow too fast. Rather understand thoroughly the first stages of Radio. The latter steps will unfold themselves. It may be mighty convenient to be able to afford a complete outfit of the most advanced type right at the start but the difficulty will be in getting acquainted with it all at one time. Many a schoolboy, starting out with the early stages of the spark set, now knows more about Radio Telephony than our best instructors; he grew up with it and went through all the various stages of the experience in development.

The disappointments and failures may have been many but he had the time to try all over again and in the end he got results. The development of Radio has been greatly assisted by the work of our boy Radio amateurs. Sometimes their spark transmission interferes with our reception of the music, but then all of us in our boyhood days might have been termed nuisances at some time or other.

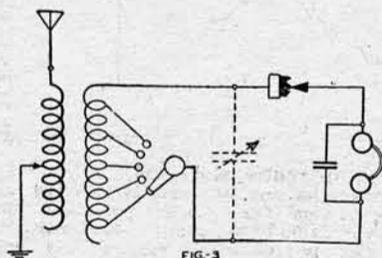


FIG-3

Figure 4 shows us the Loose Coupler and Vacuum Tube hook-up. In line with our plans, we have made no change in the general character of the apparatus and the hook-up outside of the substitution of the Loose Coupler for the Tuning Coil. The flow of the current through the primary is the same as that given above while the flow of the current from the secondary on, is the same as we described for the tube circuit in our last number, yet we have advanced the efficiency of our outfit one hundred per cent.

Tuning the Vacuum Tube Circuit is a series of successive steps, similar to the previous set. Naturally, the first step is the adjustment of the filament current, with a repetition of the old advice—not to try to burn out the filament by excessive current. It pays to use too little rather than too much, and after the remaining adjustments have been made the filament current can be increased to the point where the reception is the loudest. The tuning of the Loose Coupler is the same as before, while the variable condenser can be adjusted after the other adjustments have been made.

It will usually be found that slight adjustments for improvement should be

made after the rough tuning has been completed. With a set of this type it is not unusual to swing from one concert to another entirely different by a simple re-adjustment of the wave length and the tuning. This always seems queer and rather marvelous to the spectator, and is one feature that the Radio Bug delights in displaying. It demonstrates a good set and requires a little skill on the part of the operator.

It might be well at this time to add a few suggestions for the beginner. It is good practice to test the voltage across the filament terminals before adding the tube, especially when first trying out a new hook-up. This can be done with a small pocket volt-meter or a 6-volt light. Many new tubes have been ruined because the inexperienced fan has substituted the "B" battery for the "A" battery in the circuit. If available, a panel or board type of volt-meter can be permanently connected across the terminals to give a constant reading even while operating. Of course, if the voltage runs above six, something is wrong, and connections should be checked before damage is done.

Where connections are soldered, it is not advisable to use an acid flux unless well washed, as it causes corrosion.

Composition insulators are usually bet-

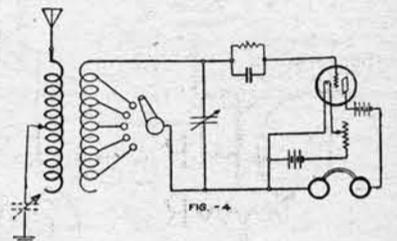


FIG-4

ter than the porcelain type, both on account of the easy breakage of the porcelain and also because the porcelain type will leak more, especially when rain collects on them.

When hooking up your set for the first time, and it doesn't appear to be working right, try reversing the storage battery leads. Polarity may not be shown on the hook-up, but it is a vital point in the vacuum tube circuit. If your set starts in giving weak reception, and you know the storage battery is charged, try a volt-meter on the "B" battery. Sometimes they are apt to go dead unexpectedly, or a few poor cells kill the efficiency of the remainder. Small units added together, to make up the required voltage will prove economical, as the weaker units can be replaced as required. Don't try to operate a detector tube and two stages of amplification all on one twenty-two volt battery. You may find your reception very defective! Try adding two more batteries. It is also a good stunt to tap your battery at various voltages and adjust for best results. As the batteries get weaker, the voltage can be increased again by adding on more cells through the tap switch.

Hook-ups are occasionally given, using the "B" battery for the filaments also, by tapping off at six volts. This is a poor practice. Don't forget that the "B" battery is supplied with little amperage, so don't be surprised if its life seems rather short. In Radio, it has often been demonstrated that cheapness at the start costs more in the end.

(Editor's Note)

The RADIO DIGEST has arranged for a series of Data Sheets the second of which is given in this issue. These sheets can be cut out, holes punched, and placed in a suitable cover to have handy as reference when questions arise that puzzle not only the amateur but also the regular operator. It is planned to furnish all the technical data comprising of all formulae, hook-ups, tables on capacity, wave length, inductance, etc., available. On the back of each sheet is an article written in non-technical language covering the operation, theory and use of the individual pieces of apparatus, the theory and operation of various circuits, and also any other information that may be called for by popular demand. Let us know what you want and the RADIO DIGEST will do its best to fill the requirements.

Telephone Wires

W. J.—Does it make any difference if the antenna crosses a telephone wire?

A.—No, providing it crosses at nearly a right angle. If the antenna runs parallel to power lines or telephone lines it will pick up induction noises from them.

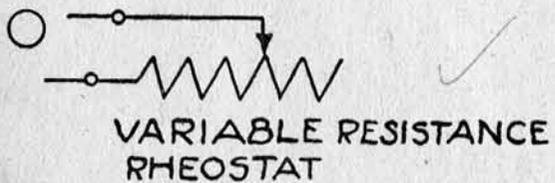
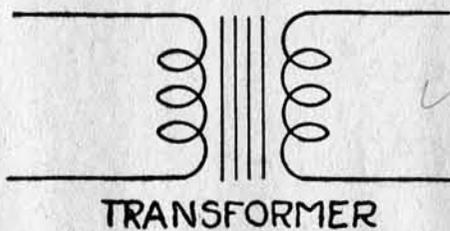
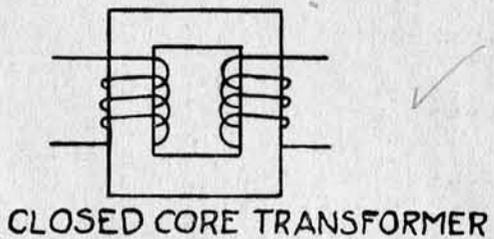
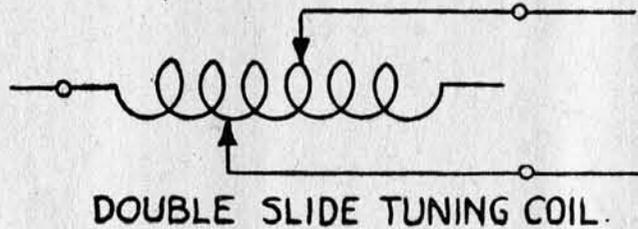
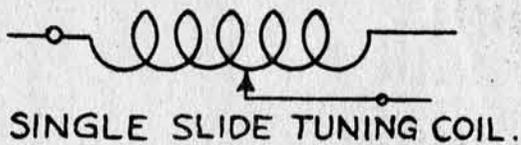
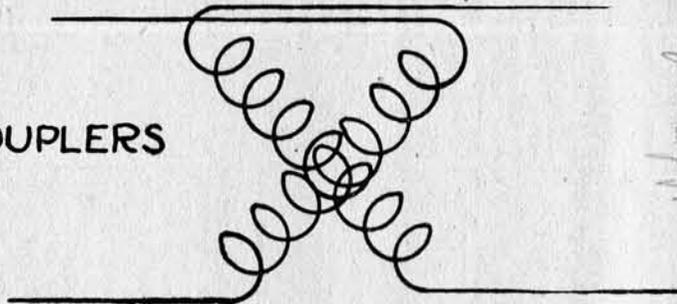
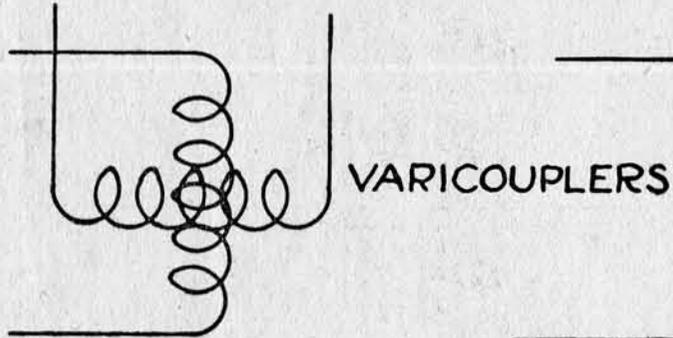
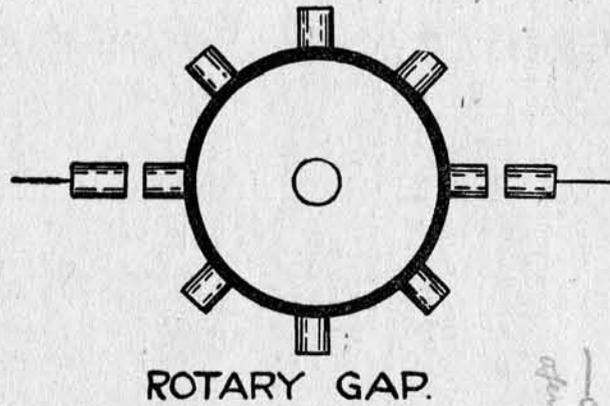
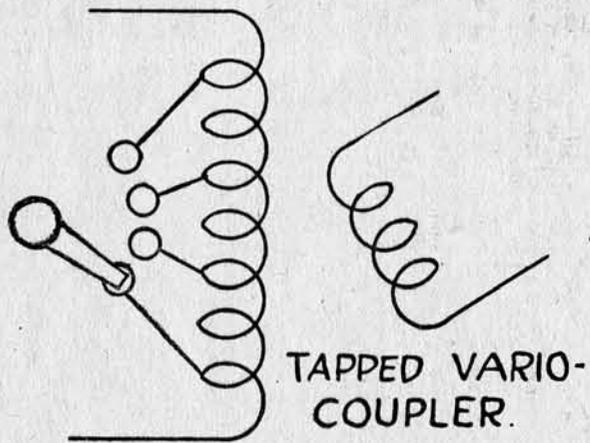
Foolish Question!

N. D.—Where can I get a call book? Is a vacuum tube detector better than a crystal detector?

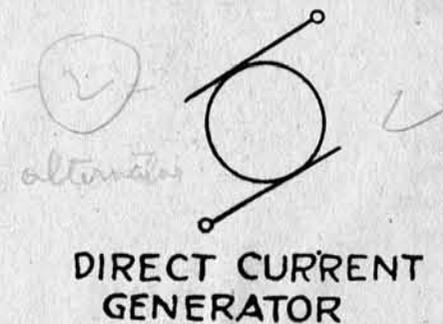
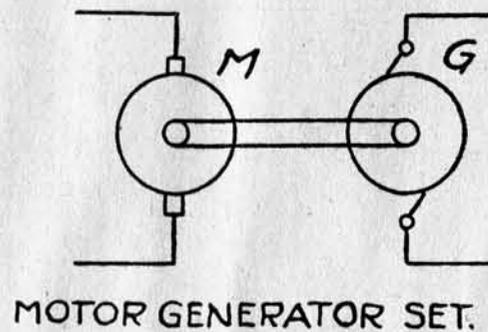
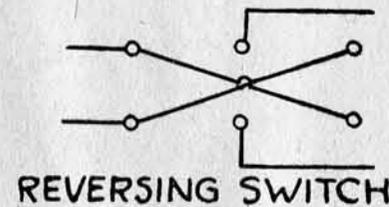
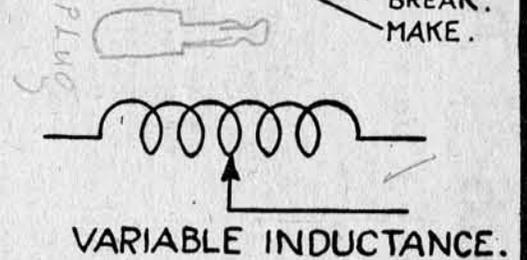
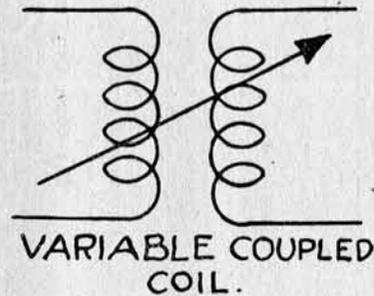
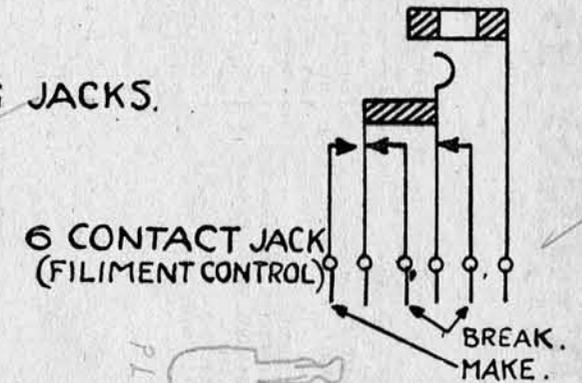
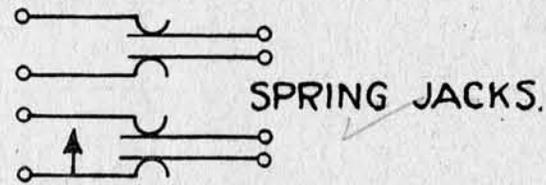
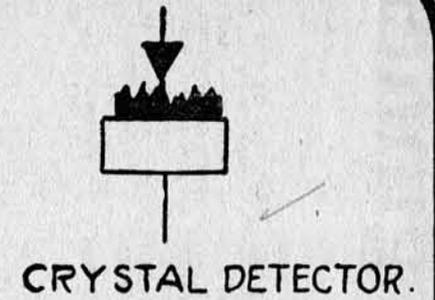
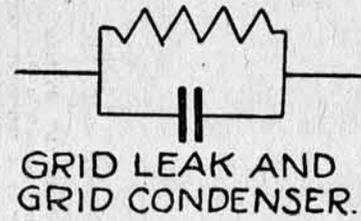
A.—Write Superintendent Documents, Government Printing Office, Washington, D. C., enclosing fifteen cents in stamps. Vacuum tube detector is far more sensitive than a crystal.

Radio Digest Illustrated

NO. 2



Harry J. Marx.



Questions and Answers

Aeronautical Radio

A. V. M.—Will you please answer the following questions:

Q. 1.—Would it be possible to install a transmitting set capable of carrying at least 300 miles on an aeroplane of the Fokker F-3 type and operate it by means of a loop aerial within a tubular steel fuselage?

Q. 2.—About how much would such an outfit weigh inclusive of the batteries?

Q. 3.—Could the same batteries be used for ordinary Morse signalling?

Q. 4.—Would it be necessary to enclose ignition system in a grounded metal housing to prevent interference?

A. 1.—Yes, it would be possible but the range is a little more than the standard sets used by the Navy Department. Satisfactory communication has been carried on between planes in the air at a distance of 100 miles, between planes and the ground at a distance of 150 miles. While the steel tubular fuselage would in itself be a good practical aerial, still due to its close connection with the motor and the ignition system it will cause considerable interference. It will probably be necessary to install a separate wire for aerial. There is an alternative, however, of using a tubular fuselage for aerial and in receiving the motor can be shut off leaving the plane to glide. This will assist the operator in view of the elimination of the motor noise.

A. 2.—An outfit of this type would weigh about one hundred pounds complete.

A. 3.—Yes, this set can be used for Morse signalling merely by adding a telegraph key.

A. 4.—It would probably be advisable to enclose ignition system to avoid undue interference from the high tension currents by induction.

Good Set—What's the Trouble?

G. H. S.—Please tell me what is the matter with my set. I have a short wave regenerative set up to 800 meters, a vacuum tube, and aerial of one wire 75 feet long and 45 feet high. I used to have four wires but was told it was too large. I cannot receive music broadcasts at all, and not even spark signals. The set includes one variable condenser and a vario-coupler with tickler and two 13 point switches on the primary of my vario-coupler. I would like to use a magnavox. Can I get good results without an amplifier? Is there any company that repairs burned-out vacuum tubes?

A.—Your aerial of 75 feet of single wire will do for receiving. For sending, however, you would require more strands. The information furnished is insufficient to judge what your trouble might be. I would suggest that you send a diagram of the connection, also always send self-addressed stamped envelope with your inquiries. The magnavox can be installed but would suggest at least one step of amplification. There have been very few attempts to repair burned out vacuum tubes. Information along that line will be published when we receive authoritative data.

Same Old Story

K. I.—I would like to know if a tuning coil or loose coupler with a vacuum tube is as good and will receive the same distance as two variometers and a vario-coupler with a vacuum tube.

A.—Read our article on loose couplers in this issue and the article on vario-coupler and variometers in the next issue. A tuning coil cannot be compared to either one of the other two instruments.

Radio and Audio Frequency

J. F. B. Q. 1.—Is it true that a radio frequency amplifier merely amplifies a distance over which we can receive and not the loudness by which the signals are read?

Q. 2.—Would a 110-volt electric light wire 6 feet from the aerial which does not run quite parallel to the aerial effect reception in any way?

Q. 3.—It is 75 feet from the top of the house to the top of the garage. An aerial of how many wires spaced how far apart would be best for receiving?

Q. 4.—Could you tell me who makes the attachment for fastening a head phone to the phonograph?

A. 1.—The Radio frequency amplifier increases the range of your set by the amplification of the current in the same sense that the audio frequency amplifies the sound. The Radio frequency amplifier amplifies audio frequency currents (less than 10,000 cycles per second).

A. 2.—Since you do not state what the angle is, in the statement "not quite parallel" it is difficult to give the effect. No doubt you will get a buzzing sound in the receivers which can be probably tuned out by the variable condenser.

A. 3.—Single wire 75 feet long will give the best results for receiving.

A. 4.—We have not the information available. Answer will be given in a later issue.

Wife Afraid of Fire

K. L. M.—Have an antenna in my attic. It is well insulated, also a good ground. Isn't it possible that this draws lightning

and liable to set the roof on fire? Please answer at once to pacify my wife.

A.—Don't be afraid of it. There is no more danger that the lightning will strike your aerial than there is that it will strike the gas pipes which connect to the ground and usually reach almost to the top of the building. A properly grounded antenna is a protection during lightning. It has the same effect as a lightning rod.

Picture Moulding Aerial

H. Johnson.—Will you please tell me if it is suitable to use a simple antenna made up of a single bare or insulated copper wire, running around the room, in back of the picture moulding? Both ends of the loop so formed are connected to a lead wire. Will suitable results be obtained from such an antenna when a crystal detector is used?

A.—This type of aerial will work, but do not connect both ends of the loop to a lead wire. Just connect one end of the loop to the instrument and leave the other end free. You can get some results with a crystal detector, but don't expect too much.

An Invitation—

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

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

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

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

Receiving Range

V. V.—Have been much interested in reading your column and would like to have a few questions answered:

Q. 1.—A point approximately 150 miles from Pittsburgh. Could Westinghouse station KDKA be heard distinctly with a regenerative set and a V. T. detector?

Q. 2.—In your opinion could it be heard as distinctly at that distance as at a distance of six miles from East Pittsburgh with a crystal detector, other conditions being equal?

Q. 3.—Using two stages of amplification, do you think that it could be heard distinctly with a Victrola attachment?

Q. 4.—The point I have in mind is almost due east from Pittsburgh. Should the aerial be erected north and south or east and west?

Q. 5.—Is the natural wave length of an aerial of more than one strand any greater than that of a single wire of the same length?

A. 1.—As you probably know, so many factors enter into the question of the receiving range of any receiving set that a positive answer cannot be given to your question. The probabilities are, however, that KDKA could be heard very distinctly.

A. 2.—There would likely be some difference in signal strength, but not much difference in the distinctness of the signals.

A. 3.—Yes.

A. 4.—Preferably east and west.

A. 5.—Yes; adding more wires to the aerial increases both its inductance and its capacity, and hence increases the wave length. The wave length of any oscillating circuit is equal to 59.6 times the square foot of the product of the inductance times the capacity.

Condensers

F. J. L. Q. 1.—Which would be better to make a variable condenser from, thick or thin aluminum plates?

Q. 2.—What kind of aerial would be suitable?

A. 1.—Use thick plates, as they will not bend and become short-circuited so easily.

A. 2.—A single wire about 100 feet long will be suitable.

Loose Coupler

J. Kern. Q. 1.—Please give data for a short wave loose coupler.

Q. 2.—How far would the following apparatus receive? Loose coupler, crystal detector, variable condenser and telephone receiver.

A. 1.—A loose coupler suitable for reception up to 600 meters should have about 200 turns on the primary and 300 on the secondary. Use No. 24 wire on primary and No. 28 on the secondary.

A. 2.—You might possibly be able to receive as far as 500 miles under good conditions and with the proper aerial. A certain range would be 25 miles under most conditions.

Range of Crystal Detector

H. Huber.—How far will a mineral detector receive music?

A.—A mineral detector is not reliable for music over long distances. We would say about five miles.

Aerial and Wave Length

P. L.—Kindly give me some information on the following questions:

Q. 1.—Is an outside aerial necessary to pick up your concerts within the five-mile circle?

Q. 2.—Is it possible to have an inside aerial, and if so, how is it installed?

Q. 3.—Would you recommend a crystal

receiving set or a vacuum tube receiving set?

Q. 4.—What wave length must I tune for?

A. 1.—An outside aerial is unnecessary.

A. 2.—An inside aerial can be constructed by stringing several wires across your attic, or through several rooms.

A. 3.—The question is not altogether clear. If you are satisfied to receive the concerts with head 'phones only, then the crystal detector will do; but if you want the music to fill an entire room, then you will need a vacuum tube receiving set.

A. 4.—The wave length of most broadcasting stations is 360 meters.

Tuning Coils

J. M.—What kind of wire do you recommend for a tuning coil?

A.—No. 22 enameled copper is very good.

WWJ Broadcasting

W. S.—Will WWJ continue to broadcast during the summer months?

A.—Yes, although some change will no doubt be made in the time.

Loop Aerial in Thunderstorm

R. L.—Is there any danger in operating a wireless receiving set using a loop aerial during a thunderstorm?

A.—No, but if you and the transmitting station are in the same areas covered by the storm you will get poor reception, if any. The transmitting station operates an outdoor aerial and during the storm they discontinue all operations because they cannot afford to take a chance on having their expensive instruments ruined by a stray bolt of lightning. The high static condition that exists in any storm area is against reception of any kind.

Hook-up and Battery

K. R.—Kindly inform me if the hook-up given in this letter will work and how many volts I will need for the "A" battery and also for the "B" battery. I am using UV200 for the detector and UV201 for amplifying.

A.—The hook-up in your letter will work, but not to the best advantage. The "B" battery should be 22 volts and the "A" battery should be 6 volts.

Strengthening Weak Reception

M. W.—I have a crystal set which is guaranteed for a radius of fifty miles. I can hear WWJ very plainly, but WNO comes very faintly. Is there anything

that I can add to this set to strengthen these weak signals? I would also like to know what to add to receive WYCB.

A.—There is nothing that you can add to this set that would bring WNO stronger, but you may be able to improve your reception by more careful tuning and adjustment or by changing the direction of your aerial. To receive WYCB, add a loading inductance to your set in series with your antenna.

Detroit News Station

H. R.—What is the power and the wave length of The Detroit News Station?

A.—The power of The News Station is one-half kilowatt output; the wave length 360 meters for concerts and 485 meters for stock market reports.

Comparison of Sets

Radio Editor.—Would a one-step radio frequency amplifier and a one-step audio frequency amplifier bring in nearby broadcasting stations as loud as a two-step audio frequency amplifier? Fan.

A.—The best results may be had from the audio frequency amplifier, where loudness is wanted. However, a two-step audio frequency amplifier demands three tubes, while a one-step radio frequency (Armstrong circuit) coupled with a one-step audio frequency amplifier needs only two tubes.

Loud Speaker

Q. R. M.—Could a radiohorn loud speaker be used in connection with a sensitive crystal detector, a pair of 'phones and a single slide tuner?

A.—Such an arrangement would amplify the sound from your telephone receivers a bit, but don't expect any great volume.

4-Volt "A" Battery

D. M.—Can I operate a six-volt vacuum tube detector on a four-volt storage battery with enough "B" battery? Can I use a loud-speaker with a regenerative set employing one vacuum tube?

A.—Your vacuum tube will operate at maximum efficiency only when used with a six-volt battery. A loud speaker can be used with a regenerative receiver.

Improvement of Crystal Set

J. B.—I now have a crystal set as follows: Loose coupler, detector, fixed condenser, variable condenser and 2,000 ohm 'phones. What should be my next move to improve this set? If I cannot greatly improve this crystal set what apparatus is needed for a fairly good regenerative set? How far would this detect music? My aerial is 90 feet long, 7 stories high. Would it be better to have more than one wire?

A.—The editor would not advise you to spend any more money trying to improve your crystal set. With the money you would spend upon improvements you could buy a vacuum tube and its auxiliary apparatus. Buy a single vacuum tube, a "B" battery, filament rheostat and filament or "A" battery. The "A" battery can be either a small storage battery or a number of dry cells. You can use the rest of your apparatus with this. Watch these columns for data concerning regenerative receivers. It would be better to have more than one wire for an aerial. The larger the "grip" we get on the other the better.

Loading Coil

S. M.—I have small crystal receiving set and I want to receive from the stations with longer wave lengths. What should I do? Can I buy some kind of an attachment for my present outfit?

A.—Yes, go to a Radio shop and ask for a small loading coil. Tell the clerk what kind of an outfit you now have and the wave lengths of the stations you want to receive from.

Cost of Set

J. E.—I do not want to spend much money on a Radio set and would like to know if I can receive opera on a tuning coil. If not, what do I need? I live about ten miles from Chicago Westinghouse station. How much would one of the cheap sets cost?

A.—Yes, you can receive opera from Chicago with a tuning coil, detector, head telephones and a condenser. About the cheapest crystal detector set which would do this work would cost from fifteen to twenty-five dollars.

A Simple Set

J. O.—Can I hear WJZ 25 miles away with a galena detector, fixed condenser, two slide tuning coil and a 1,000 ohm receiver? Is a battery necessary?

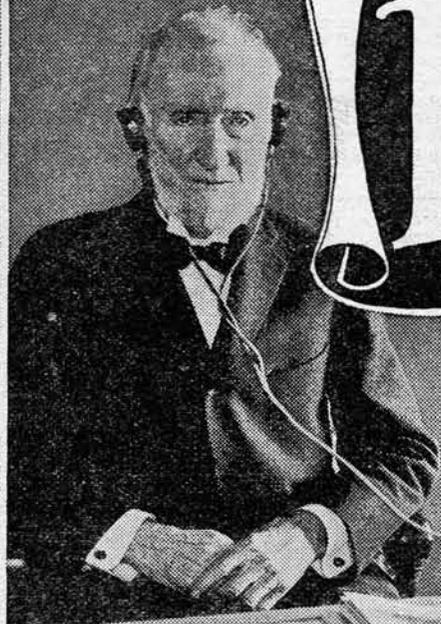
A.—The editor cannot tell whether any set will receive a certain station. However, a lot of our readers are getting the broadcasting with similar sets. We recommend that a pair of 1,000 ohm ear phones be used. A battery is not necessary with this set.

Burnt Out Tubes

X. Y. Z.—Is there any market for burned-out tubes?

A.—We doubt that if at present there is anybody interested in a dead tube.

Radio Illustrated



"UNCLE JOE"—Representative in congress from Illinois, has a Radio set in his office. But where the cigar?
© U. & U.

YOUNGEST RADIO OPERATOR—Only four years old, son of Walter J. M. Garvey, Fordham, N. Y.
© Keystone



RADIO SHOW DREW BROOKLYN—Pretty Miss Victoria Merritt, popular debbie, enjoys distant concert.
© Keystone



HIDES RADIO UNDER HAT—Mary Elizabeth Martin, high school girl, Washington, D. C., secretary amateur radio club, shown here with outfit under her hat.
© Keystone



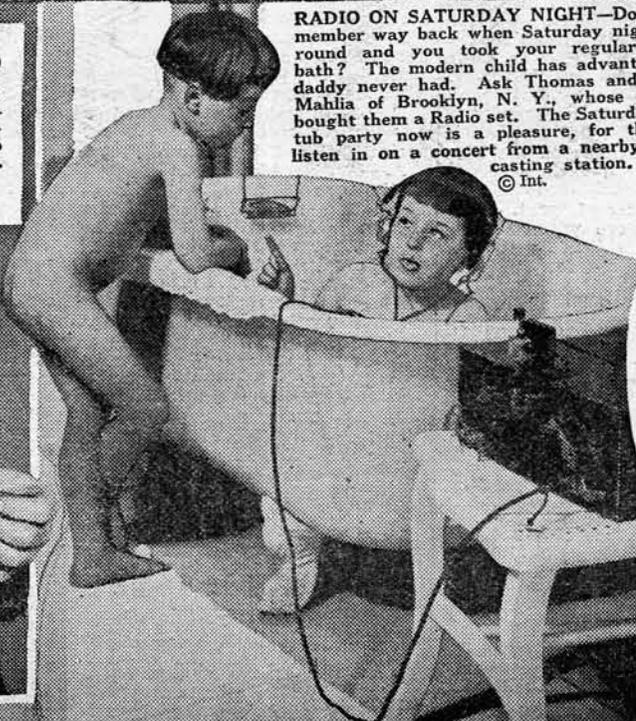
RADIO CLUBS HOLD SHOW IN NEW YORK—Where "Wuffie," the Radio dog, just had to get an earful every day.
© Keystone



LISTENING IN—Miss Victoria Merritt, with her miniature receiving outfit, listening in on concert during demonstration at Radio show, New York.
© Keystone



FRISCO POLICE TAP AIR TAPPER—Who carries Radio under coat.
© Int.



RADIO ON SATURDAY NIGHT—Do you remember way back when Saturday night came round and you took your regular weekly bath? The modern child has advantages his daddy never had. Ask Thomas and George Mahlia of Brooklyn, N. Y., whose dad has bought them a Radio set. The Saturday bathtub party now is a pleasure, for they can listen in on a concert from a nearby broadcasting station.
© Int.



WENDELL BERNHEIMER, SAN FRANCISCO—Has rigged receiving apparatus with camera and received messages 700 miles away; he proposes to experiment with radiophotography.
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