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Radio Digest Illustrated

TRADE-MARK

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SECRET RADIO A SUCCESS

TWO WAVES BEAR HARDING'S SPEECH

NAVY STATIONS SEND HIS MEMORIAL ADDRESS

President, in First Public Demonstration, Uses Dual Broadcasting System

(Special to RADIO DIGEST)

WASHINGTON.—President Harding spoke to everyone in the country who has a good receiving set, through the Naval Broadcasting system, when he made his address at Arlington Cemetery on Decoration Day. This was the first time that he or any Chief Executive has addressed as large a number of citizens, and it officially opened the Navy's dual broadcasting system using two wave lengths simultaneously.

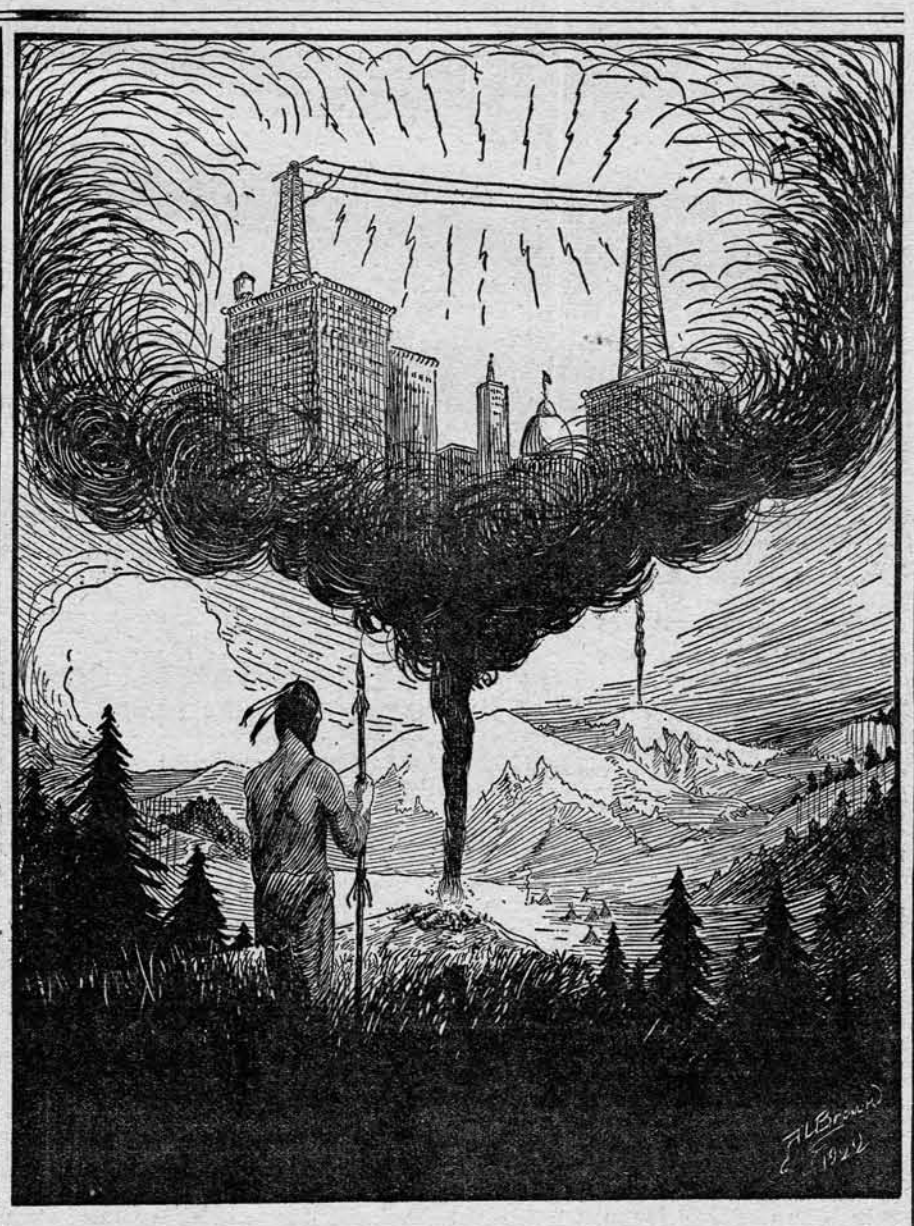
Through the cooperation of the A. T. & T. Co., wires were strung from the Amphitheatre, where a microphone was placed in front of the speaker, to the Naval Radio Stations at Arlington, near at hand, and to the Air Station at Anacostia across the Potomac. Arlington, NAA, transmitted the speech on a 2650 meter wave, and Anacostia on a 412 meter wave. This dual broadcasting, just perfected by the Naval Communications Service, carried The President's address to receiving stations within a radius of about 550 miles on the short wave from Anacostia, and distant stations on the Pacific Coast and to ships on the Atlantic on the long wave from Arlington, which carried 1500 miles. This was the first public demonstration of this system capable of expansion so that a Government official could talk to the English speaking world.

City Friend Radiophones Latest to Country Editor

BUTTE, MONT.—The editor of a paper in an isolated town in the Northwest is using the Radio in a most ingenious and effective way. An amateur friend in a big city 50 miles away buys the latest editions of the city papers as soon as they are off the press, reads the best news into his transmitter, and a typist in the country office copies the news as it comes in over the office receiver. The editor is always "First With the Latest" in his home town.

LIGHTHOUSE TO HAVE RADIO FOG SIGNALS

WASHINGTON. — An automatic Radio fog signal is one of the features of the newest and largest light vessels in the United States lighthouse service, vessel No. 105, which will shortly go into commission off Cape Hatteras, on the dangerous outer Diamond shoal, one of the most treacherous and exposed points on the Atlantic coast.



SELL ARMY TUBES AT BROOKLYN POST

Signal Corps Offer Ten Thousand Vacuums to Licensees

WASHINGTON.—Ten thousand vacuum tubes, type V. T. eleven (11) manufactured by the General Electric Company, have been declared surplus by the War Department and will be offered for sale to the public, at a price of $5.50 each, not more than three to any one person, as is and where is, licensed only for amateur, experimental or entertainment use, at the Signal Station, New York General Intermediate Dept., 59th Street, South Brooklyn, New York, beginning June 5.

These tubes have never been used, are part of the current stock of the Signal Corps, and have released to fill an urgent demand of the amateurs of the United States, as a part of the training activities of the Signal Corps.

Broadcasts Pay, Says Ohio State President

College Courses by Radio Adds Prestige to School

COLUMBUS, OHIO.—Colleges throughout the country have adopted this form of extending their courses to Radio enthusiasts who care to listen in. And the lectures are given without charge.

But it pays, says President William Oxley Thompson of Ohio State university. It adds to the popularity and prestige of the college that brodacasts its courses, he maintains.

That's why President Thompson has had a Radio transmitting set put up at the college. From this station members of the Ohio State faculty are broadcasting their lectures.

The station is conducted by the signal corps unit of the Reserve Officers Training Corps in Columbus.

NEW METHOD DISCOVERED BY HAMMOND

In Personal Interview Inventor Gives Details of His Private Communicating Device

Ether Freedom Assured

Secondary Frequency Used—Multiple Broadcasts Can Be Carried on at Same Time

F. N. Hollingsworth

Special to RADIO DIGEST

BOSTON, MASS.—As announced in Radio Digest last issue, John Hays Hammond, Jr., has realized what has been the hope of both the scientific world and the public at large—namely, a secret or private method of Radio communication. Many who know intimately of Mr. Hammond's work and its possibilities have been eagerly awaiting the perfection of the apparatus. This problem has occupied the mind of Mr. Hammond for the past fourteen years.

A few days ago Radio experts were, to use a rather apt colloquial expression, up in the air. A serious problem in congestion faced those who took it upon themselves to puzzle out the difficulties Radio communication. The number of Radio sets had jumped from 50,000 to 600,000 in this country.

Mr. Hammond Interviewed

Then came Mr. Hammond's announcement. In an interview Mr. Hammond says:

"The capacity of the ether is limited. It is like a single wire conductor. And inevitably, with the enormous increase in Radio communication, it became congested. For twelve years we have given persistent attention at this laboratory to this and other difficulties of Radio. Toward the close of the Great War, we had discovered a practicable method of making Radio communication more secret. It was already at work on the Western Front

(Continued on page 2)

AIRPHONE MONEY TO PASSENGERS ON SEA

ARRANGEMENTS are being made by a Canadian bank and some banks in England whereby Radio payments may be made at any time to passengers en route on board Mauretania, Aquitania and Beregaria. There will be branch banks on board these ships, and passengers may also order payments to persons on land.

SECRET RADIO

(*Continued from page 1*)

when Germans stopped fighting.

"Today we have perfected this device to such an extent that I can conservatively say that it will double the amount of Radio traffic. It will not abolish the telephone. It simply affords a new means for communication. Methods of communication are like transportation. As a city grows, the traffic grows. We can use every possibility.

Secondary Frequencies Basis

"The discovery is a method of utilizing 'secondary frequencies.' The secret of the new device rests upon this secondary frequency. Its working may be likened to the working of the human voice. Two people carry on a conversation in a room shaken with shouting. Each one recognizes a characteristic quality in the voice of the other, a certain definite tone color. This analyzes and concentrates upon the quality. The ear analyzes this quality and the shouting does not stop the conversation.

Privacy Assured

"The 'secondary frequency' gives this tone, to speak popularly, to the Radio conversations. Each of the two parties engaged in inter-communication has a device which takes messages of that tone and gives messages of that tone to the exclusion of the rest. Now a machine is tuned to the ordinary frequency. With my device it is double tuned to different frequencies. Unusual privacy is possible. The two parties concerned in the conversation have what you may call a mutual 'key-note' when set to this particular key-note, a secret conversation is possible.

"The system has other advantages. Transmission of code and voice are both possible. This can be accomplished over the same set in such a manner that several code messages and telephone conversations can be carried on at the same time.

Can Use Squier's Invention

"Furthermore, it is a Radio system that may be used on wires or applied to Major-General Squier's 'wired wireless.' Today a telephone organization can, on 'carrier frequency' send four or five conversations simultaneously over the same pair of wires. My selective system will enable them to treble this number of simultaneous conversations.

"It now only allows private means of communication through the ether, preventing all stations except those especially equipped from picking up the messages, but it also allows a far greater number of stations to communicate over a given number of wave lengths.

Selectivity Limited

"It must be remembered, however, that this selectivity is not unlimited. Such multiplexing reaches a point after which further multiplexing is impracticable. Some day, I have no doubt, someone will discover a new method for expanding Radio communication."

Mr. Hammond gives great credit to Dr. E. Leom Chaffee, professor of physics at the Cruft Laboratory, Harvard University, who, as consulting engineer did much by his painstaking accuracy and vision to make success possible. Also to E. S. Perrington and R. F. Field, the latter staff instructor in physics, and to Professor J. W. Pierce, all three of the Cruft Laboratory, for their assistance.

TO HAVE OPEN FORUM AT THE CHICAGO SHOW

Speakers to Talk to Manufacturers, Jobbers and Retailers

Open Forum discussions for manufacturers, jobbers and retailers in the Radio industry will be one of the features of the National Radio exposition, to be held in the Leiter building, Chicago, June 26th to July 1st. Prominent speakers will talk to the representatives of the three branches of the trade and many of the problems which now confront the manufacturer, the jobber and the retailer of Radio supplies will be brought out in the Open Forum discussions.

An aducation program also is being arranged for the visitor to the exposition outside of those actually in the business. The amateur and the layman who wants to learn the inside facts about Radio, in addition to seeing the exhibits on display, which will comprise every device known to Radio science. Certain days will be set aside for the public lectures when doctors, hospital people, ministers, golfers, business men, students, in fact, every class interested in Radio, may have an opportunity to ask questions of the experts and couple their viewing of the outfits and Radio parts with expert information given in these talks.

Milo E. Westbrooke, general manager of the exposition, announced that he had sent out to 15,341 Radio supply retailers and to 736 jobbers a sixteen page booklet containing information about the exposition, as well as being a handbook on Radio for the amateur. Manager Westbrooke also announced that hotel reservations may be made through his office, 417 S. Dearborn Street, Chicago.

Plans have been perfected for the participation of the Navy, Department of Commerce of the United States, Weather Bureau, Boy Scouts, Girl Scouts, Camp Fire Girls, Sea Scouts and the Technical schools of Chicago. The school participation will be one of the big educational features of the exposition. Albert G. Bauersfeld, in charge of technical education in the Chicago schools, will supervise this phase of the display. Boys from the technical schools will manufacture the various parts of Radio outfits right on the spot and at the same time will print on their own printing presses booklets explaining all about their work.

"Our aim in giving the high school boys such a prominent part in the exposition," said general manager Westbrooke, "is to make Radio manufacturers out of these youths instead of clerks, and to give to the Radio industry, now in its infancy, a high type of manufacturer for the future. Chicago is putting forth great efforts to make the western metropolis the Radio center of the country, and these boys are the ones from among whom the master minds in the industry may be expected to come."

In the general interest of the exhibitors, the management of the exposition has decided to regulate the use of Loud Speakers so that there will be no pandemonium and confusion, as has been the experience in some of the Radio shows in other parts of the country. The unrestricted use of the amplifiers at these expositions resulted in endless screeching, thus interfering with the business talks of the exhibitors to their customers. The time for the use of the Loud Speakers will be fairly apportioned both afternoon and evening. Accommodations for antennae, both roof and loop, will be furnished.

The Navy will provide an interesting exhibit, showing the obsolete, the semi-obsolete and the most modern and up to date devices.

Radio to Change News Services Says Editor

Lord Northcliffe, one of Europe's most successful editors, in speaking of the future of journalism, predicted that Radio would have an effect upon the publication of newspapers that will equal the invention of the linotype and high speed press. He said that Radio would undoubtedly come into general use by newspapers and news gathering agencies.

Photographs and Movies Sent by Long Distance Camera Via Radio

Epoch-Making Invention of C. Francis Jenkins, Inventor of Motion Picture Camera, Utilizes Two Glass Disks—Initial Experiments Indicate Practicability of Sending Photos by Radio

Photographs and perhaps motion pictures can be sent by Radio. The noted inventor, C. Francis Jenkins, says this can be accomplished by an epoch-making invention, the long distance camera. The device which he uses will send a photograph in secret, a great weapon in warfare on criminology.

The inventor, Jenkins, says that within a year he expects to have apparatus so perfected that long distance cameras with sending and receiving sets will be in the hands of the public for sending photographs by Radio any distance.

Pictures have already been sent from one room to another in the inventor's laboratories and the reproduction is faithful in every respect.

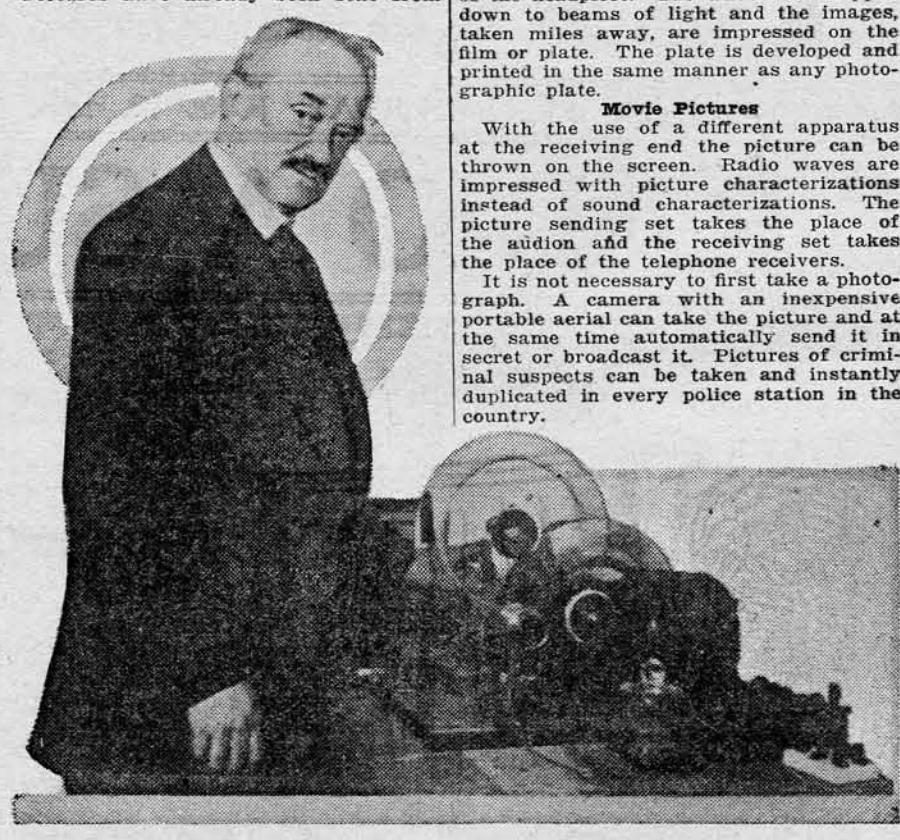
Uses Glass Disks

Two prismatic glass disks are used in front of the lens to take the picture. The view is caught by a sensitive photo-electric cell which is connected with an ordinary Radio sending set. Beams of light are stepped up to high frequency electric waves. They are sent in the same manner as sound waves are translated into Radio waves and broadcasted. At the receiving end there is a device that takes the place of the headpiece. The waves are stepped down to beams of light and the images, taken miles away, are impressed on the film or plate. The plate is developed and printed in the same manner as any photographic plate.

Movie Pictures

With the use of a different apparatus at the receiving end the picture can be thrown on the screen. Radio waves are impressed with picture characterizations instead of sound characterizations. The picture sending set takes the place of the audion and the receiving set takes the place of the telephone receivers.

It is not necessary to first take a photograph. A camera with an inexpensive portable aerial can take the picture and at the same time automatically send it in secret or broadcast it. Pictures of criminal suspects can be taken and instantly duplicated in every police station in the country.



C. Francis Jenkins, inventor of the motion picture camera, and his latest invention—the Radio moving picture machine © U. & U.

To Use Mound Top for Sending News

High-power Broadcast Station to Be Built on Ancient "Mountain"

LONDON, ONT.—On the top of a peculiarly formed conically shaped mound at Mapiedene, 14 miles north of here, a group of Radio experimentors have proposed to establish a high-power broadcasting station, with a view to selling, if their experiments are successful, a Radio news service to subscribers purchasing specially constructed receiving sets.

The Mapledene "mountain" as it is called, is believed to have been erected by the ancient mound-builders who inhabited western Ontario and the central states long before the advent of the North American Indians. It is believed the mounds were connected in some way with the religion of this primitive race, and also served as mausoleums for their dead.

The mound rises at a very sheer slope out of a perfectly level meadow, lying on the fertile plateau which tops the highlands of Middlesex county. It is about 200 feet in diameter and rises to a height of about 80 feet. The mound has been considered as a Radio station site because of the elevation it will give above neighboring forests, and the territory has been selected because of its high altitude above sea level as compared with the city of London where the proposal to establish a thrice-a-day Airphone news service originated. It is also a picturesque district free from the confusion of sounds which might have to be overcome in the city.

Dance Music from Four Cities

(*Special to RADIO DIGEST*)

FT. WAYNE.—A fox trot from Chicago, a one-step from New York, a waltz from Indianapolis, and an old-fashioned quadrille from Denver, music for which was transmitted by Radio from those cities was a feature of a dance given by employes and officers of the First National Bank here recently. It enjoys the distinction of being the first "radio dance" in Ft. Wayne.

Radio Digest Illustrated

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Broadcasting Directory. The Only Complete, Correct Station and Schedule List. Growing Every Week.

Famous Broadcasting Stations You May Have Heard. Weekly Pictorial Shows New Stations.

Live News of Radio Every Week.

RADIO WILL TAKE PLACE OF PHONES

BOSTON EXPERT PREDICTS PASSING OF WIRES

Prof. R. A. Fessenden Claims Radiophone Exchange Practical—Gould Regrets Refusal

(Special to RADIO DIGEST)

BOSTON, MASS.—Radiophone communication will, within a few years, completely supplant the wire telephone business of the country, according to Prof. Reginald A. Fessenden, a pioneer in Radiophone work, expert engineer, inventor, and said by many to be more responsible for the successful development of the Radiophone than Marconi himself.

Professor Fessenden says:

"With reference to certain statements by technical engineers that Radio telephony can never be used for exchange work because of interference, my experiments and investigations show or indicate that the Radio telephone will to a large extent supplant the large wire telephone exchanges.

"This does not mean that I consider myself as knowing more about the subject, but it must be remembered that it is a historical fact that no organization engaged in a particular line of activity has ever invented, developed or adopted any radical improvement in that line.

"For example, the land telegraph company did not invent or develop, and would have nothing to do with the cables, and ever after the laying of the first Atlantic cable were still engaged in trying to establish overland communication with Alaska. Neither wire lines nor cables would have anything to do with the Bell telephone, although offered the rights for $200,000.

"It is not generally known that the identical Radio patents that were recently bought by the Radio Corporation of America for $5,000,000, were offered to the Commercial Cable Company in 1907 for $250,000. After the refusal of the Commercial Cable Company, the patents were offered to George Gould, who replied: "I have much more important business to attend to—I am going duck shooting in North Carolina and cannot spare the time"—a misjudgment which no doubt he seriously regrets at the present time.

Equip Laundry Wagons With Radiophone Sets

LONDON, ONT.—Laundry-wagons are now equipped with Radio receiving sets here. W. R. Jarmain of the Forest City laundry, has experimented along this line for some time. Mr. Jarmain was one of the first Radio amateurs in London, and conceived the idea of much advantage lying in being able to communicate with his wagon-drivers to inform them of telephone calls from along their routes, after they had left the office in the morning or afternoon.

The system is said to work admirably and the drivers can hear distinctly even when the cars are in motion. It is not even necessary to stop, unless the office has a long list of new calls to be made which the driver may see fit to copy down on a memo book.

Explains Recent Grand Uproar

If you happened to have been in on the "grand uproar" this week and thought it part of a broadcast course in higher mathematics, you were mistaken. It was Arthur Korn, a German inventor, transferring a photograph from a high power station in Rome to an American naval vessel at sea by means of Radio. Professor Korn's success brings into actual and practical use another variation of the now versatile science.

SAME INSURANCE ON LIGHTING AND RADIO

CONTRARY to prevalent opinion that the installation of Radio equipment increases the rate of insurance, a ruling of the Suburban Fire Insurance exchange, which is maintained by the leading fire insurance companies, announces that Radio installation is considered in the same class as the installation of electric lighting wiring which has no effect on insurance rates in most states. Houses wired for Radio will therefore be protected at the same rate.

"PUT AND TAKE" HAS RIVAL IN AIRPHONE

FOR the inveterate gambler Radio on ocean liners furnishes a new field. Reports from the steamship George Washington and the steamship Homeric, which sailed from New York on the same day and reached Cherbourg on May 14, state that passengers were busy betting all the way over on the speeds of the two boats. Each of the ships was kept informed of the exact location of the other by Radio, and the betting was done by Radio messages.

HEART OF THE RADIO COMPASS

E. Brent, third Radio operator of the Majestic, holding the Gonia-meter from Marconi direction finder © Galloway, N. Y.

SUMMER RADIO COURSES

Indiana University Lists Radio Among Summer Studies

BLOOMINGTON, IND.—Radio telephony will be included in the list of studies for the summer term at Indiana University, according to Dr. R. R. Ramsey, who is a pioneer in Radio investigations and was one of the first men in the country to receive messages by Airphone. The plan for teaching Radio in the university has not been announced by Dr. Ramsey.

EMPLOYEES GIVE AUTO MAKER A SET AS GIFT

Charles Endlich Dodge Official Presented with Airphone

SOUTH BEND, IND.—Charles Endlich, secretary-treasurer of the Dodge Manufacturing Co., who recently celebrated his fortieth year with the company received a Radio receiving set made in the company's plant five, as a birthday gift from the employes.

USE COIL AERIALS TO REDUCE STATIC

BUREAU OF STANDARDS GIVES INSTRUCTIONS

Ground Antenna Offers Some Relief from Hot Weather Atmospherics and Summer Strays

(Special to RADIO DIGEST)

WASHINGTON, D. C.—Don't be surprised this summer if your new Radio receiving set gives forth a first class imitation of a boiler shop in full operation instead of an anticipated lecture on the culture of silk worms, says the Bureau of Standards of the Department of Commerce in announcing that the "bad Radio weather" season is now on.

According to the Bureau of Standards these summer disturbances, called "strays," "static," "atmospherics," and other names are in evidence from about April 1 to October 1. Their seriousness varies from weak interference for brief intervals to a continuous succession of boiler shop noises which may last throughout the night.

Coil Aerial Good Reducer

A great deal of work has been done by Radio engineers and scientists in an effort to reduce the interfering noise caused by these strays. At important government and commercial stations certain devices and methods are in use by means of which strays are considerably reduced, and it is made possible to obtain fairly reliable receptions during the summer. The apparatus and methods now employed at such stations are usually too elaborate to be used at the ordinary amateur station. One method which the amateur will find helpful in reducing certain types of strays is the use instead of the usual elevated antenna, of a coil antenna and a more sensitive receiving set. A coil antenna may be constructed by winding a suitable number of turns of wire with proper spacing on a square wooden frame about 4 feet square.

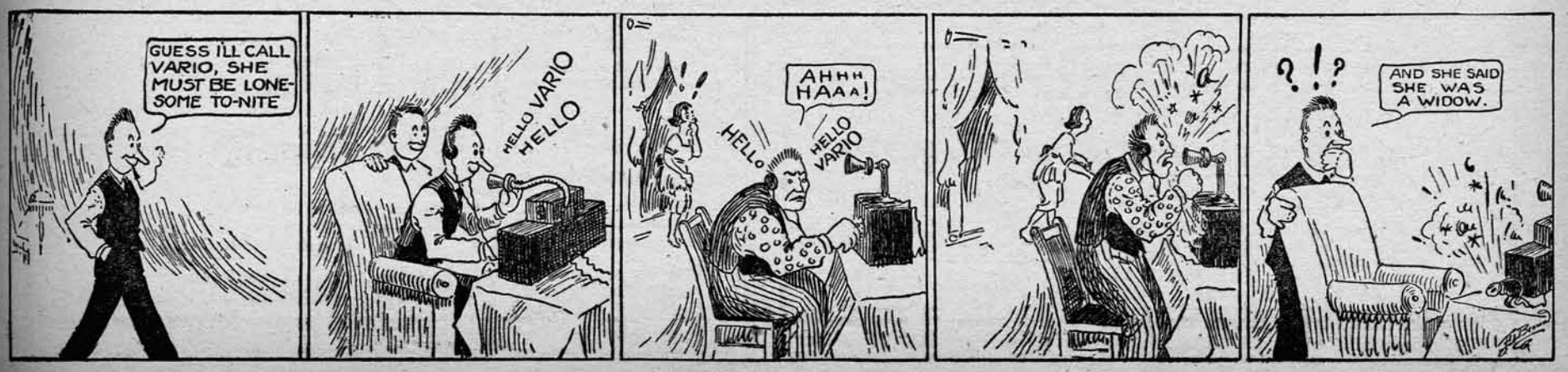
Certain types of strays seem to come from a particular direction. Many strays, however, have no directional properties, including those due to local electric storms. The coil antenna has the property of receiving a stronger signal when pointed in the direction from which the signal is approaching, and receiving only a weak signal when pointed at right angles to that direction. Thus by rotating a coil antenna to the proper position the directional types of strays can be greatly reduced and a better ratio of signal to strays will be obtained. The ordinary elevated antenna does not possess marked directional properties, and therefore can not be used like the coil antenna for stray elimination. However, the strength of signal picked up by a coil antenna is much smaller than the strength of signal picked up by the ordinary elevated antenna, and good results should not be expected from a coil antenna unless three or more stages of amplification are used.

Some relief can also be obtained by persons having good amplifiers by using a "ground antenna." This is a long insulated wire run in a shallow trench or on the surface of the ground. The ground wire should be run in the direction of the station from which the most signals are to be received, and should preferably be several hundred feet long.

Nearby Stations Heard Easier

Through strays of given intensity, better results can be obtained in receiving strong signals than weak signals. Nearby stations can be received much better through the strays than distant stations. It is therefore fortunate that broadcasting stations are being established at a considerable number of different cities located in all parts of the United States, so that for most parts of the country there is a broadcasting station from which fair reception can be expected even when strays of moderate intensity exist.

THE ANTENNA BROTHERS Spir L. and Lew P. . HUBBY WAS A FAN, TOO



FULL DESCRIPTION OF RECEIVING SET

HOW TO OPERATE AEREX COMBINATION UNITS

Seventh Photo Diagram of Series on Page Five Explained in Detail

(See Diagram, Page 5)

The set shown in this number is the Aerex Radiophone Corporation combination units of crystal detector, audion detector and 2 step amplifier. The crystal detector unit is known as BR-1, the audion detector unit as BA-2, and the 2 step amplifier unit as ALS-3. This combination set is exceptional in both, the unusual circuit used for crystal detector and also in its connections for using the Audion detector and 2 step Audio Frequency amplification connections.

Connections

In the diagram page, taking the front view of the 3 units, the one on the left is Audion detector unit, the one in the center is the tuning and crystal detector unit, and the one on the right is the 2 step amplifier unit. On the right hand side of the Audion detector unit are 2 binding posts marked "Antenna" and "Ground" corresponding to the similar two on the left hand side of the tuning unit. The antenna binding posts are connected together and in addition the aerial is connected to one. Likewise the 2 ground binding posts are connected together and the ground will be connected to one. The 2 binding posts marked "Telephone" in the lower right hand corner of the tuning unit and the 2 binding posts marked "in" in the lower left hand corner of the amplifier unit are connected together. In the lower left hand corner of the Audion detector unit, and in the lower right hand corner of the amplifier unit are 2 binding posts in each marked "B—" in the lower right hand marked "A—" and "A+" to which the terminals of the "A" battery are connected. The third terminal in a detector unit is marked "B—" and should be connected to the negative side of the "B" battery. The "B" battery is made up of 2-22½ volt units in series. The positive terminal of the first battery is connected to the binding post marked "No. 2" in the detector unit. The negative side of the first "B" battery is also conected to the binding post corner of the amplifier unit. The positive side of the second "B" battery in the series is connected to the binding post marked "B+" in the amplifier unit. The binding post in the lower right hand corner of the Audion detector unit is connected to the No. 1 binding post, on the tuning unit. The receivers or loud speakers are connected to the 2 posts marked "Out" on the right hand side of the amplifier unit.

Tuning

The tuning of this set is practically the same whether the crystal or Audion detector is used except that the Cat Whisker on the crystal set should not be touching while the Audion detector is being used. The tapped switch in the tuning unit, controls the windings on the primary or antenna circuit. This, therefore gives the rough wave length adjustment. The large dial on the left is connected to the variometer coil, permitting finer adjustment for wave length. The large dial on the right controls the tuning of the secondary circuit, when the crystal detector is used, but acts as a feed back control, when the Audion is used. The knob on the audion detector unit and the 2 corresponding knobs on the amplifier unit control the filament current adjustment. The 3 point switch in the top center of the amplifier unit is used to connect the phones into the detector, first or second stages of amplification.

In actual tuning the top switch on the tuning unit is first adjusted, then the dial on the left hand side, afterwards the dial on the right hand side. Of course, the filament current for each stage must be adjusted at the proper time.

RECEIVING RECORDS? WATCH 'EM GROW—

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

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

Records to date are given below.

—Broadcast Editor.

Station, Miles Record, and By Whom Heard.

DD5—790—T. E. Buchholz, La Grande, Ore.
KDKA—870—D. G. Mickle, Red Oak, Ia.
KDOW—1,370—F. D. Weeks, Milwaukee, Wis.
KFC—260—T. E. Buchholz, La Grande, Ore.
KLP—1,300—H. Wantuck, Fayetteville, Ark.
KNJ—1,150—N. M. Holmes, Chippewa Lake, O.
KQW—600—T. E. Buchholz, La Grande, Ore.
KVQ—520—T. E. Buchholz, La Grande, Ore.
KWG—560—T. E. Buchholz, La Grande, Ore.
KYJ—1,300—H. Wantuck, Fayetteville, Ark.
KZM—570—T. E. Buchholz, La Grande, Ore.
WDY—1,000—F. D. Weeks, Milwaukee, Wis.
WEI—2,000—Wm. Hayes, E. Liverpool, O.
WGY—1,170—H. Wantuck, Fayetteville, Ark.
WHA—900—J. B. Dusak, Worcester, Mass.
WJZ—1,200—N. H. Schensted, Brooten, Minn.
WLB—600—Thos. Carr, Willard, O.
WOH—900—A. W. Lee, Gardiner, Me.
WOK—700—F. D. Weeks, Milwaukee, Wis.
WWJ—2,200—F. W. Hill, Cristobal, C. Z.

MANY BOOKS ON RADIO FOR BROADCASTING FANS

Electric Oscillations and Electric Waves. By George W. Pierce, Ph. D. Professor of Physics in Harvard University. 515 pages, 6x9, Illustrated. The author is widely known for his work in this field of Radio theory. Price $5.00.

Radio for Beginners. By James R. Cameron. A book that covers the subject from beginning to end, and written so that the novice can understand it. Fully illustrated. 160 pages. Price $1.00.

The A B C of Vacuum Tubes in Radio Reception. By E. H. Lewis. An elementary and practical book on the theory and operation of vacuum tubes as detectors and amplifiers. Explains non-mathematically the fundamental principles upon which all vacuum tube circuits are based. Price, $1.00.

Home Radio. How to make and use it. By A. Hyatt Verrill. 12 full page illustrations and diagrams.

This book is intended particularly for the amateur and for those who wish to know how to make and adjust Radiophones. The author has avoided technical terms and has aimed to make the directions plain and simple. 75 cents.

Radio Time Signal Receiver. By Austin C. LesCarboura. This new book tells you how to build a simple outfit designed expressly for the beginner. You can build the outfits in your own workshop and install them for jewelers either on a one-payment or a rental basis. The apparatus is of such simple design that it may be made by the average amateur mechanic possessing a few ordinary tools. Price, 35 cents.

How to Make Commercial Type Radio Apparatus. By M. B. Sleeper. A guide book for those who desire to make their equipment equal in appearance as well as performance the commercial type of apparatus. It gives a world of data on how to make efficient Radio stations. The illustrations more than the descriptions show the niceties of design developed by the commercial companies. Price, 75 cents.

The book department of the Radio Digest is prepared to send you any of the books on Radio published, whether listed in our Book Review or not. Let us know what book you want, send us your check and we will see that the book is mailed to you. Book Department, Radio Digest Illustrated, 123 W. Madison St., Chicago, Ill.

Radio Receiving Sets

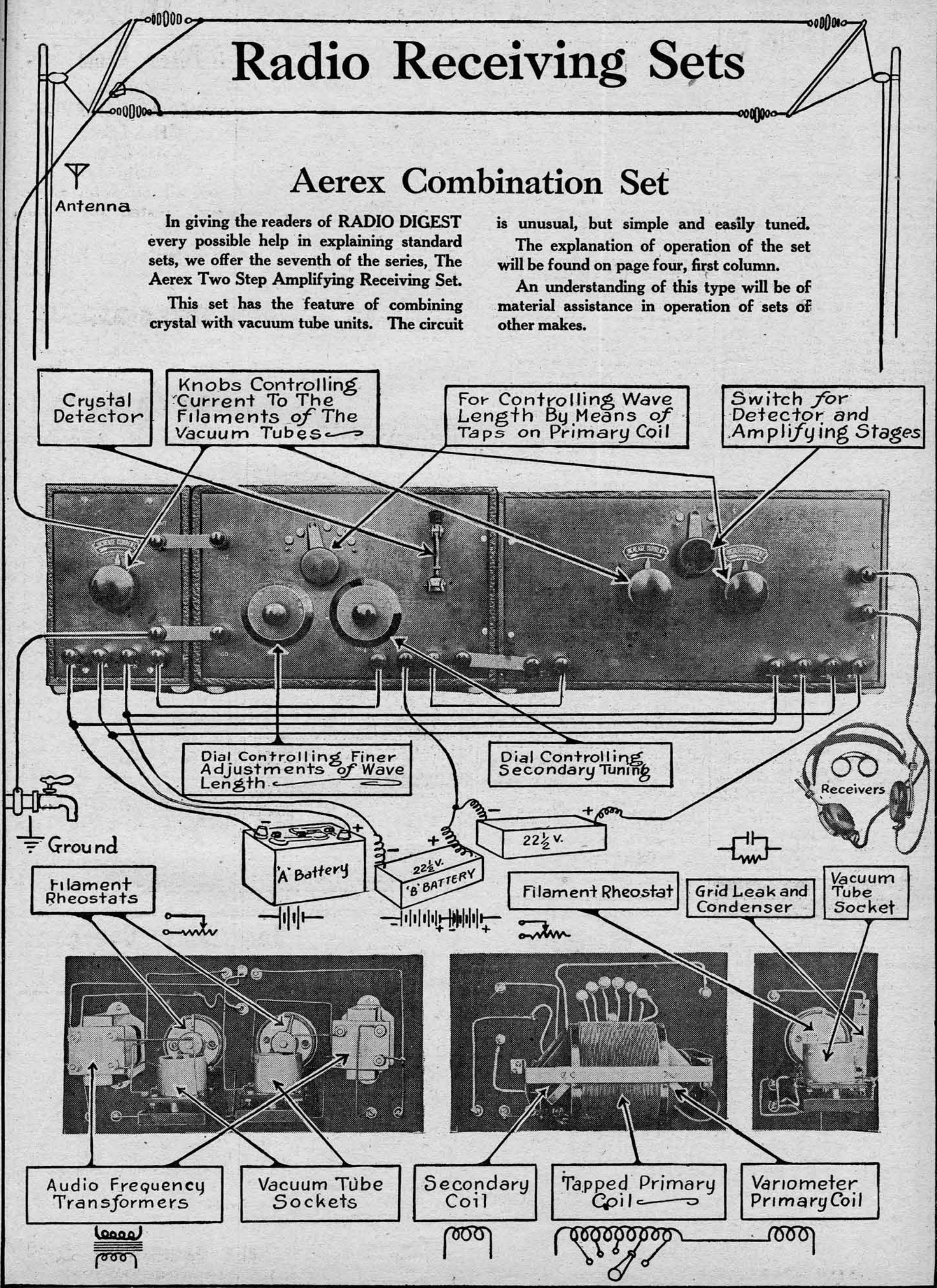
Aerex Combination Set

In giving the readers of RADIO DIGEST every possible help in explaining standard sets, we offer the seventh of the series, The Aerex Two Step Amplifying Receiving Set.

This set has the feature of combining crystal with vacuum tube units. The circuit is unusual, but simple and easily tuned.

The explanation of operation of the set will be found on page four, first column.

An understanding of this type will be of material assistance in operation of sets of other makes.



WOZ CONVERTS SUNDAY

Rev. William Ashley Sunday ("Billy Sunday") listening in to WOZ

Special to RADIO DIGEST

RICHMOND, IND.—Rev. William Ashley Sunday, known everywhere as "Billy" Sunday, has been converted—to Radio.

This famous evangelist, who for more than a quarter of a century has been preaching the gospel in town and city from coast to coast, "listened in" recently on a concert given by members of his evangelistic party, and believed.

There is little doubt about it being the first time any evangelistic party had thrown the power of gospel in song out into the wide expanse of ether to be heard and enjoyed by amateur and professional listeners for an area extending at least 150 miles.

It was during Mr. Sunday's six weeks' campaign "against the devil" in Richmond, Ind., that the Richmond Palladium, Station WOZ, persuaded the noted evangelist to let them install a receiving set in his hotel room. Arrangements had been made for vocal and instrumental numbers by members of his party, consisting of Homer Rodeheaver, Robert Matthews, Albert Peterson, Miss Florence Kinney and Mrs. William Asher.

WOZ Initiates "Billy" Sunday

Not only was it the first time that Mr. Sunday had been given the opportunity to witness the wonders of Radio, but it was also the initial performance over broadcasts ever given by the talented Sunday party. Mr. Rodeheaver and Mrs. Asher, both well known for their "phonograph" achievements, had their first chances to broadcast their voices.

The picture accompanying this article, showing the Rev. Sunday reclining while hearing the first fragments of the Radio concert coming to his room, indicates the interest with which he received his "conversion." It was during the evangelist's rest hour that the little party was staged. The only antenna used was a vertical wire extending from the fourth story window of his room. Water pipes in the adjoining bathroom were used for a ground.

Continues to Listen In

The sending set in the Palladium Radio room is equipped with four five-watt tubes. A 500-volt, motor generator connected with the lighting circuit furnishes the power. The sending set was radiating three amperes during the performance.

Although the concert was given between 6:30 and 7 o'clock in the evening, the bulbs of the receiving set burned until 10:30 o'clock that night while the new Radio fan listened to local stations, following his tabernacle service. When the concert was completed the set was left in place so that the former star of the ball diamond might follow the fortunes of the different league teams as they are given in the daily broadcast of baseball scores, and to get other sport news "hot off the bat."

Complete success for the special program, in spite of unusually adverse weather conditions, was reported by listeners for many miles around.

WOZ Second in Middle West

The Richmond Palladium station WOZ was the first newspaper broadcasting station in the middle west, outside that of the Detroit News. This station is now giving three programs daily, these being at noon, afternoon and evening.

Rural communities in the vicinity of Richmond have awakened to the value of Radio service in a new way sice the first announcement of the Palladium broadcasting service made in August, 1921. The station was first opened for demonstration purposes in May, 1921.

Radio phones, hitherto unknown in Richmond, came to the front rapidly after the Palladium installed its station and started demonstration work in May. Approximately 100 demonstration concerts were given before lodges, churches, and country gatherings in the few months' time before the regular broadcasting service was established.

Localized Broadcasts Given

The "local angle" was stressed as much as possible in those programs. When the first demonstrations were made, it was the custom to give a musical program, and to have some speaker well known to that particular community to address the people by telephone.

The early concerts were given under the supervision of Fred Clark, Radio "bug" and later the regular operator for the Palladium. He holds a second class commercial license. Country programs were held within a few miles of Richmond at first, but later the scope of the work was extended until they reached a radius of 30 miles from the city.

Proves Aid to Farmers

"Well, I got your markets in time to get my hogs sold at today's prices," is a remark that has been heard more than once, when farmers, dropping in to visit W. R. Sanborn, farm editor of the Palladium, pass through the Radio room.

The broadcasting service as used at present includes live stock market from Indianapolis, and Chicago grain prices at noon; summary of local news and further market reports with music in the afternoon; and music, baseball scores and local news summaries at night.

The idea of establishing the Radio service in Richmond first came to the manager of the Palladium while he was on a trip in the East. The Westinghouse company was making some experiments in church music broadcasting at that time, and it occurred to him that Radio might be useful in newspaper work.

Ex-President's Operator Erects Station

Lt. H. F. Breckel, former Radio operator on the George Washington, and the man who handled President Wilson's messages on the high seas, was called from his business in Cincinnati. He built the Palladium set, which at that time was a four-tube, five-watt apparatus. Later it was increased to six tubes.

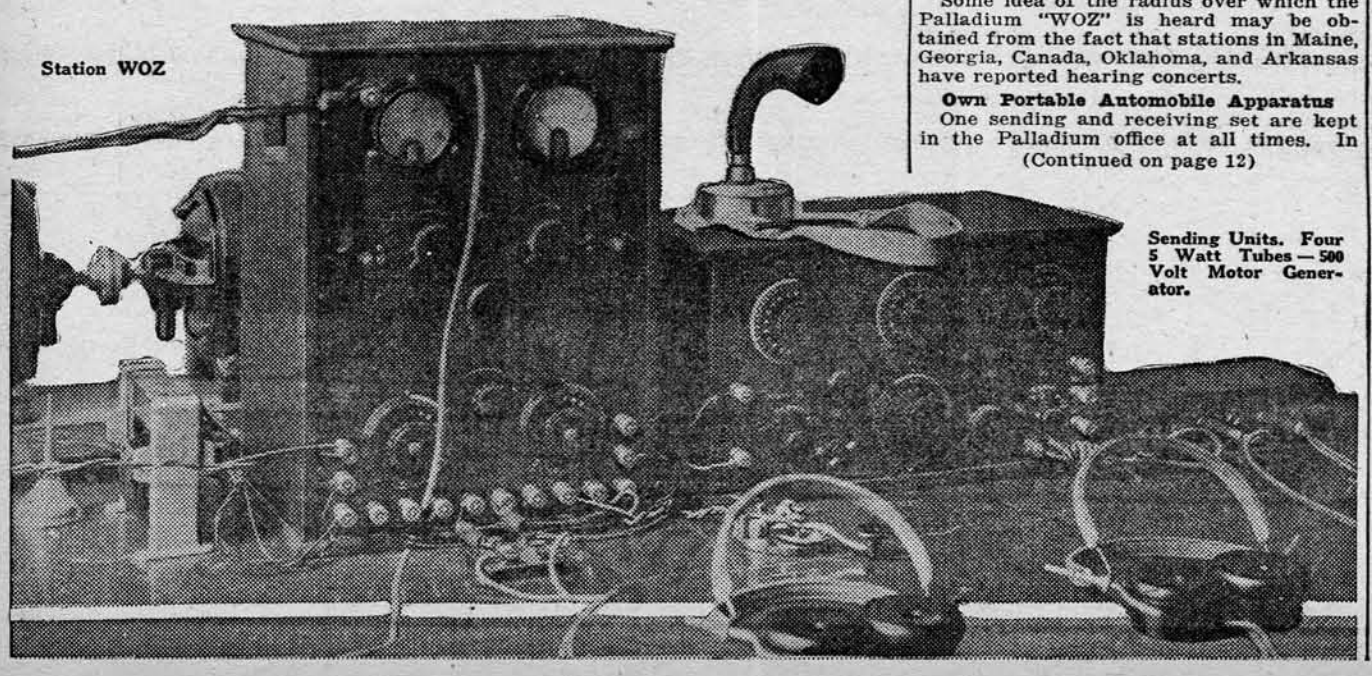
Some idea of the radius over which the Palladium "WOZ" is heard may be obtained from the fact that stations in Maine, Georgia, Canada, Oklahoma, and Arkansas have reported hearing concerts.

Own Portable Automobile Apparatus

One sending and receiving set are kept in the Palladium office at all times. In

(Continued on page 12)

Station WOZ



Sending Units. Four 5 Watt Tubes — 500 Volt Motor Generator.

St. Louis Post Dispatch Installing Powerful New Apparatus for KSD

Another well known Radiophone broadcasting station owned by a newspaper is that of the Post-Dispatch, St. Louis, Mo., call letters KSD. This station has been broadcasting since early in March and has become indispensable to the many fans in and close by to the "show me" state. Those from Missouri who have had to be shown are agreed on one thing—that KSD is doing a real service.

Programs are sent out three times a day except Sunday. There is a mid-day concert for the lunch hour period of the many factories which have installed Radio receiving sets; a service at 4 o'clock giving the markets, news bulletins and music; and a more elaborate evening program starting at 8 o'clock, with vocalists, instrumentalists and speakers.

Building Larger Station

The demand for the service and its increasing popularity has caused the Post-Dispatch to increase the size of the station materially. This work is not as yet completed.

Shown in one of the photographs is one of the two steel towers which have been erected on the roof of the Post-Dispatch building to serve as supports for the antennae of the new station, to be as powerful as any in the United States.

The towers are 14 feet square at the base and rise to a height of 70 feet. The supports go through the roof so as to rest upon the steel framework of the building itself, which is eight stories in height.

The aerial will be of the cage type, 131 feet long, and of T design. The lead-in will go to a brick building, now under construction upon the roof, which will house the ario transmitting apparatus. The studio itself will be upon the second floor. A system of switches and signals will provide perfect co-ordination between the program director in the studio and the operator in charge of the electrical devices upon the roof.

Range of Apparatus

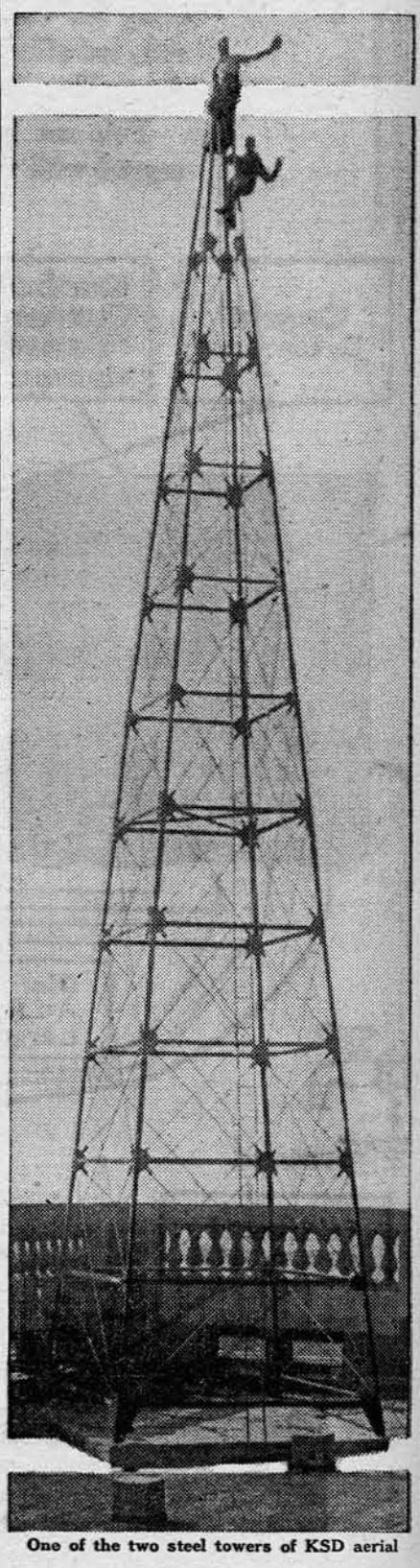
The apparatus now nearing completion for station KSD will be the second to be delivered by the Western Electric Co., the manufacturing branch of the American Telephone and Telegraph Co. The first is installed in the Bell Telephone Co.'s building in New York City.

The range of the new transmitter is guaranteed to be 1,000 miles under favorable conditions. Tests have shown similar apparatus to have carried the voice more than 3,000 miles. During the hot summer months the thousand-mile radius cannot always be expected, as solar heat and static conditions materially affect Radio waves. For this reason all distance records are made at night.

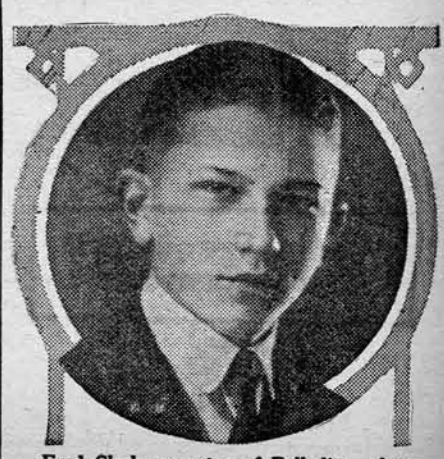
Difference in Power

The difference in the power of the new KSD station and the apparatus at present in use is considerable. The small transmitter now employed makes use of only six five-watt power tubes, or 30 watts in all. The new transmitter will have an input of 100 watts. The small transmitter panel and its apparatus could be picked up by a boy and carried away under one arm. The new transmitter cabinet weighs just a ton, minus the crate of wood. The speech input apparatus weighs 500 pounds and the motor generator a ton and a half. In all, the new apparatus weighs 5,700 pounds. The power panel alone has a weight of 700 pounds.

Expert Radio engineers estimate that, for at least nine months in the year, there will be within the range of KSD several hundred thousand Radio receiving sets.



One of the two steel towers of KSD aerial



Fred Clark, operator of Palladium plant

How to Make an Indoor Loop Aerial

Cross Sticks Make Base for This Loop Aerial

It is quite evident that the loop aerial is coming into its own and the day is not far distant when it will be developed for long distance work. The loop aerial eliminates the necessity for putting up an outside aerial. Such an aerial can be made ornamental. At present the loop aerial is confined to short distances.

If you are close to a broadcasting station and wish to carry on experimental work with the indoor loop an efficient one can be made in the following described manner:

How to Make Loop Aerial

The frame is made up of two lengths of wood six feet long and two inches square, crossed and joined at the center. When these pieces are firmly fastened together nails are driven in the arms of the frame as shown, about one inch apart. The nails are started one inch from the outer ends of the frame pieces.

The winding consists of annunciator wire run around the nails, as shown. Two binding posts are placed on one arm near the center and the ends of the aerial are connected to them.

Where to Use Loop Aerial

The loop aerial is not adapted to use with a crystal set or even with a regeneration set using less than three tubes. There are several things to keep in mind when using the loop aerial. The energy picked up by the loop is not sufficient when using two steps of amplification to operate a loud speaker in conjunction with the set.

It is sometimes very difficult to receive signals sufficiently loud to make them audible in the earphones and for that reason where a loop aerial is to be employed it is found necessary to add additional steps of Radio frequency as well as additional steps of audio-frequency. It is not advisable to try to get good results with less than two steps of Radio frequency backed up by three steps of amplification. This layout for ordinary use in connection with a loop aerial will be found quite satisfactory for use in the home, but will be found wanting in a large lecture room or auditorium.

Advantage of Loop

One of the advantages of a loop aerial is that it permits directive operation—that is, one may turn the plane of the loop aerial in the general direction of the broadcasting station and exclude by this operation all other stations not in the same line. Then, too, the additional steps of detection and amplification make the instrument highly selective and practically all interference can be cut out, giving almost perfect reception of the desired signals.

The loop aerial is becoming more popular every day. In apartment houses and other places where an outside aerial cannot be had the value of the loop is recognized. It is not necessary to stand the loop before a window or to set it on the fire escape. It will pick up its signals just as easily through a brick wall as it will through a window.

Caution

Do not make the frame of steel, use wood. A pivot stand is not necessary. The aerial can be placed on any solid stand so that the whole unit may be moved about, giving the same results as a pivot stand. Suspending it from the ceiling seems like a simple way, but it is difficult to keep the aerial turned in the direction from which one is getting the best results. As we all know anything that is suspended has a natural direction and when turned from its natural position it will return as soon as the diverting force is released. A point to remember in loop operation is that the ground connection is not necessary. The two loose ends of the loop should be carried to the terminals of the receiving set, one to the aerial terminal and the other to the ground terminal.

An Efficient Fixed Condenser

For the beginner in Radio who is constructing his own set the following hint on the making of a condenser may be appreciated. The condenser is made by separating each of four pieces of tinfoil 2 by 4 inches in size with a piece of oil or tissue paper. Each piece of paper must be a little larger than the tinfoil so that no two pieces of the tinfoil will touch. The edges of the first and third pieces should protrude from one side and the second and fourth should protrude from the opposite side and allowed to touch. The condenser is then placed on a block of wood 6 inches long, 3 inches wide and ½ inch thick and a strip of wood is tacked across it to hold it firmly in place. A binding post should be mounted on each of the two protruding tinfoil edges.

ROTARY TYPE CONDENSER

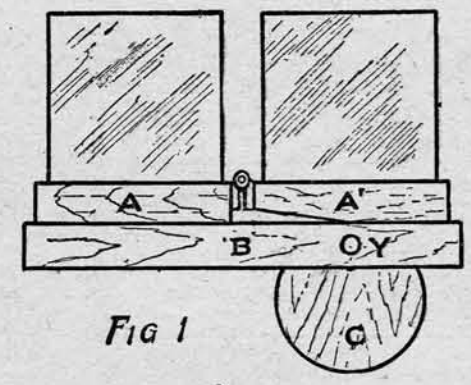


FIG 1

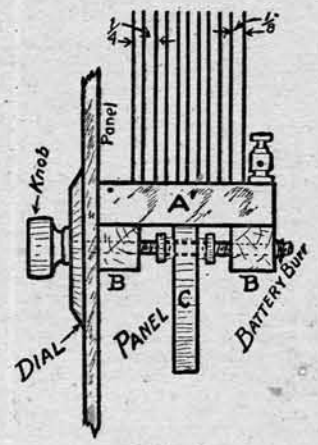


FIG. 2

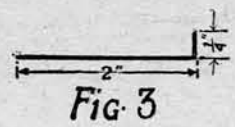


FIG. 3

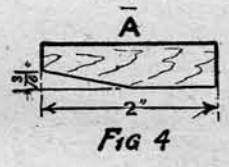


FIG 4

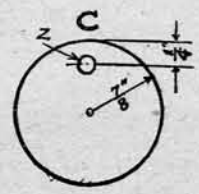


FIG. 5

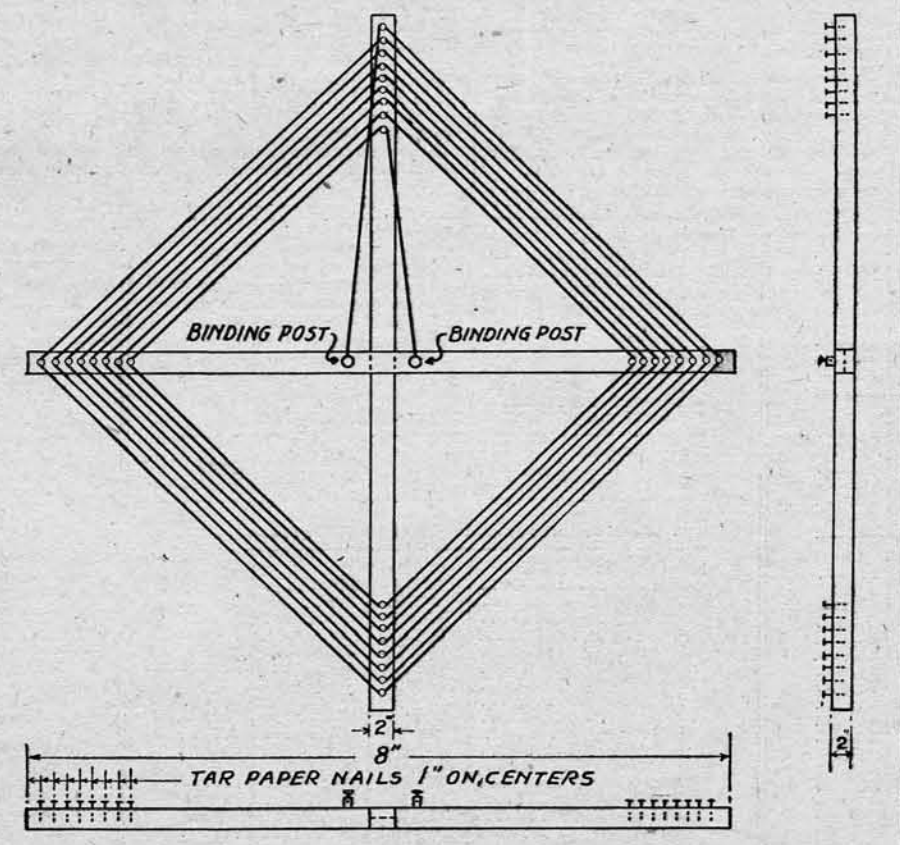
Radio Kinks

RADIO DIGEST is interested in any of those little kinks that every amateur discovers in his workshop. Sometimes it's a How to Make Article, or a little tip in operation of the set, how to use parts that are not thought of, perhaps some new hook-ups that haven't been published yet.

Send them in, with full details, sketches and diagrams if necessary. One Dollar will be paid for every one published. If a self-addressed, stamped envelope is included, rejected copy will be returned. Work must be original, however, and not copy from others.

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

AERIAL ON CROSS STICKS



Break Crystal for Best Results

When you use a new crystal, you should break it in halves or thirds and use a new surface as there is where you are most liable to find sensitive points. This will give more than one surface to select from.

Never Use Wood Panels in Sets

A wooden panel for mounting receiving sets should not be used. Formica or condensite insulation material does not absorb moisture and leak radio frequency current as wood does.

Variable Condenser Made with Eleven Plates

Every amateur knows the value of a variable condenser in the receiving set circuit. But because of the cost of the rotary type plate condenser the beginner usually finds it quite out of his means to obtain one of them. The condenser described as follows can be built cheaply without the knob or dial.

The following are the materials needed for an eleven plate condenser:

- 2 pieces wood ½"x2"x2¼".
- 2 pieces wood ½"x½"x5".
- 11 pieces metal 2"x2¼".
- 1 piece wood 1¾" diameter.
- 1 piece threaded brass rod 8/32" thread.
- 2 ½" brass hinges.
- 6 ¾" No. 8 flat head wood screws.
- 22 ¼" No. 6 flat head wood screws.
- 2 Binding posts.
- 3 Battery burrs.
- 1 6"x6" panel.

Cut all the pieces of wood as shown in Figures 1 and 2. The piece A' should be cut as shown in Fig. 4. All holes are drilled before you start assembling. Hole Y should fit the brass rod tightly.

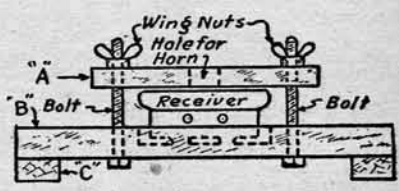
The metal used for the plated may be tin, copper, zinc, or aluminum. Tin should not be used if any of the others are procured. The plates are bent as shown in Fig. 3. Six plates are mounted on the board A' beginning ¼ inch from the front edge and five on board A beginning ⅜ inch from the front. All the plates should be placed ¼ inch apart. Under the edge of the plates on each board fasten a piece of wire which is connected to the binding posts in the rear. Boards A and A' are now fastened together with the two brass hinges.

Fasten the board A to boards B and B' with ¾ inch screws. The other two screws are used for mounting the condenser to the panel. Piece C should be exactly the same size as shown in Fig. 5. Hole Z is ¼ inch from the edge. Fasten piece C onto the brass rod with two burrs.

When the condenser is assembled none of the plates should touch. It may be found necessary to arrange a spring either to open or close the plates. When all is finished it is mounted on the panel, which is either wood or fibre. If possible all wood parts should be paraffined or shellaced. If desirable the condenser may now be mounted in a cabinet.

Receiver Holder for a Horn

Every amateur experimenting with a receiving set desires to try out a loud speaker. In experimental work the amateur does not always care to put the



money into some of the attachments which cost so much for a try out. An old phonograph horn can be used for the loud speaker, but there must be an attachment for holding the ear phone and the horn together. Herewith is an illustration of a device made by myself that has given good results. The upper part A clamps over the receiver. The hole in the piece A is bored to fit on the horn end. The base B may be any size desired. To have the base set solidly three small blocks are attached to the under side and covered with pieces of felt.—Melburne McGinnis.

Hydrometer to Test Battery

A hydrometer is needed to test your storage battery acid solution to keep you informed on its condition. It operates by giving a reading of the specific gravity which indicates the relative charge in the battery.

Care of Radiophone Receivers

Radiophone receivers are very delicate and should be handled carefully. Do not unscrew the caps or push your fingers into the holes from which the sound issues, as it is liable to injure the diaphragm or the fine wires with which the magnets inside the cases are wound.

Do not drop the receivers on the floor or slam them down, as this sudden jar will knock part of the magnetism out of the permanent magnets and thus weaken the strength of the receiving signals. Every knock or jolt decreases their sensitivity. It is suggested that you hang them on a hook, such as a coat hook. This will prevent their being dropped to the floor. Treat them as carefully as you would your watch and they will last indefinitely.

Radiophone Broadcasting Stations

Corrected Every Week.

State and City	Call	Wave Lengths	Miles Range
Alabama:			
Birmingham	WSY	360	
Montgomery	WGH	360	1,000
Arizona:			
Phoenix	KDYW	360	
Tuscon	KDZA	360	
Arkansas:			
Fort Smith	WCAC	360	200
Little Rock	WCAV	360	
Little Rock	WSV	360	
Pine Bluff	WOK	360	1,000
California:			
Altadena	KGO	360	
Bakersfield	KYI	360	
Bakersfield	KRE	360	
Berkeley	KDZB	360	
Berkeley	KQI	360	
El Monte	KUY	360	
Eureka	KNI	360	
Fresno	KMJ	360	
Fresno	KDZH	360	
Gridley	KFU	360	500
Hollywood	KGC	360	300
Long Beach	KSS	360	25
Los Altos	KLP	360	1,500
Los Angeles	KNX	360	
Los Angeles	KJC	360	100
Los Angeles	KNR	360	
Los Angeles	KNV	360	
Los Angeles	KON	360	200
Los Angeles	KUS	360	
Los Angeles	KWH	360	
Los Angeles	KXS	360	
Los Angeles	KZI	360	
Los Angeles	KJS	360	
Los Angeles	KOG	360	300
Los Angeles	KQL	360	
Los Angeles	KYJ	360	1,000
Los Angeles	KZC	360	
Los Angeles	KFI	360	
Los Angeles	KHJ	360	50
Los Angeles	KNN	360	
Los Angeles	KDZD	360	
Los Angeles	KDZF	360	
Modesto	KOQ	360	
Modesto	KXD	360	
Monterey	KLN	360	150
Oakland	KLX	360	
Oakland	KLS	360	150
Oakland	KZM	360	200
Oakland	KZY	360	1,500
Pasadena	KDYR	360	
Pasadena	KLB	360	300
Pomona	KGF	360	150
Reedley	KMC	360	100
Redwood City	KDYN	360	
Sacramento	KVQ	360	1,000
San Diego	KDYM	360	
San Diego	KDYO	360	
San Diego	KDPT	360	250
San Diego	KYF	360	
San Francisco	AG1	360; 1,450	50
San Francisco	KDN	360; 485	250
San Francisco	KGB	360	
San Francisco	KSL	360	50
San Francisco	KPO	360	
San Francisco	KUO	360	1,500
San Francisco	KDZG	360	
San Jose	KQW	360	
San Jose	KSC	360	
Stockton	KJQ	360	
Stockton	KWG	360	1,500
Sunnyvale	KJJ	360	
Colorado:			
Colorado Springs	KHD	200; 485	100
Denver	KDYY	360	
Denver	9WD	235	
Denver	DD-5	340	1,500
Denver	KLZ	360; 485	1,000
Denver	KOA	485	
Connecticut:			
Greenwich	WAAQ	360	600
Hartford	WDAK	360	
New Haven	WCJ	360	
District of Columbia:			
Washington	WMV	360	
Washington	WDM	360	
Washington	WDW	360	
Washington	WJH	360	250
Washington	WWX	1,160	600
Washington	3YN	360	
Washington	WPM	360	
Washington	WIL	360	
Florida:			
Jacksonville	WCAN	360	
Jacksonville	WDAL	360	
Tampa	WDAE	360	
Georgia:			
Atlanta	WGM	360	
Atlanta	WSB	360	1,000
Atlanta	4CD	200; 375	
Atlanta	WAAS	360	
Atlanta	WDAW	360	
College Park	WDAJ	360	
Illinois:			
Chicago	WGU	360	
Chicago	KYW	360; 485	800
Chicago	WBU	360	1,000
Chicago	WAAF	360; 485	
Chicago	WDAP	360	
Decatur	WCAP	360	
Decatur	WBAO	360	
Peoria	WBAE	360	
Quincy	WCAW	360	
Quincy	WCAZ	360	
Springfield	WDAC	485	
Tuscola	WDZ	360	70
Urbana	WRM	360; 410	200
Indiana:			
Anderson	WMA	360	25
Indianapolis	WLK	360	300
Indianapolis	WOH	360	700
Richmond	WOZ	485	300
South Bend	WBAQ	360	100
Terre Haute	WEAC	360	
West Lafayette	WBAA	370	100
Iowa:			
Ames		360	
Canterville	WDAX	360	
Davenport	WOC	360; 485	150
Des Moines	WGF	360	
Fort Dodge	WEAB	360	
Iowa City	9YA	360	
Kansas:			
Atwood	WEAD	360	
Eldorado	WAH	485	
Emporia	WAAZ	360	250
Lindsborn	WDAD	360	
Manhattan	WTG	485	75
St. Anthony	WBL	360	
Wichita	WEY	360; 485	500
Wichita	WAAP	360	
Kentucky:			
Louisville	9ARU	200	200
Louisiana:			
New Orleans	WCAG	360	
New Orleans	WWL	360	
New Orleans	WGV	360	
New Orleans	WBAM	360	
New Orleans	WAAC	360	
New Orleans	WAAB	360	
Shreveport	WAAG	360	50
Shreveport	WDAN	360	
Maine:			
Auburn	WMB	360	
Maryland:			
Baltimore	WCAO	360	
Baltimore	WKC	360	100
Massachusetts:			
Boston	WAAJ	360	50
Medford Hillside	WGI	360	500
New Bedford	WDAU	360	
Springfield	WBZ	360	500
Worcester	WCN	360	100
Worcester	WDAT	360	
Worcester	WDAS	360	
Michigan:			
Bay City	WTP	360	100
Dearborn	WWI	360	300
Detroit	WWJ	360; 485	1,000
Detroit	KPO	360	
Detroit	WCX	360	1,000
East Lansing	WHW	485	150
Flint	WEAA	360	
Minnesota:			
Minneapolis	WCAS	360	
Minneapolis	WAAL	360	
Minneapolis	WLB	360; 485	
Minneapolis	WBAH	360	
Minneapolis	WBAD	360	
Minneapolis	WCE	360	
Redfield	WCAL	360	
St. Paul	WAAH	360	200
Missouri:			
Columbia	WAAN	360	
Jefferson City	WOS	485	
Kansas City	WDAF	360	
Kansas City	WKB	360	
Kansas City	WOQ	360; 485	300
Kansas City	WPE	360	300
St. Louis	KSD	360	1,000
St. Louis	WAAE	360	
St. Louis	WCK	360	50
St. Louis	WEB	360	
St. Louis	WEW	485	100
Montana:			
Great Falls	KDYS	360	
Nebraska:			
Lincloln	WCAJ	360	
Lincoln	9YY	375	300
Omaha	WOU	360; 485	
Omaha	WOV	360	
Omaha	WAAW	360; 485	
New Jersey:			
Camden	WRP	360	200
Deal Beach	2XJ	380	
Jersey City	WAAT	360	70
Moorestown	WBAF	360	
Newark	WAAM	360	
Newark	WJX	360	
Newark	2XAI	360	
Newark	WOR	360	150
Newark	WJZ	360	1,500
Newark	WBS	360	75
Patterson	WBAN	360	100
New Mexico:			
Roswell	KNJ	360	300
State College	KOB	360	
Nevada:			
Reno	KOJ	360	
New York:			
Albany	WNJ	360	60
Buffalo	WGR	360	
Buffalo	WWT	360	
Canton	WCAD	485	
Newburgh	WCAB	360	100
New York	WBAY	360	
New York	KDOW	360	1,000
New York	WVP	360; 1,450	
New York	WWZ	360	200
New York	WDT	360	
New York	WDAM	360	
Rochester	WHQ	360; 485	50
Ridgewood	WHN	360; 485	
Schenectady	WGY	360	1,000
Schenectady	WRL	360	800
Syracuse	WDAI	360	
Syracuse	WBAB	360	150
Tarrytown	WRW	360	1,500
Utica	WSL	360	
North Carolina:			
Charlotte	WBT	360; 485	500
North Dakota:			
Fargo	WDAY	360	
Ohio:			
Akron	WOE	360	50
Athens	WAAV	360	500
Canton	WWB	360	50
Cincinnati	WAAD	360	
Cincinnati	WLW	360	1,200
Cincinnati	WMH	360; 485	1,000
Cincinnati	WIZ	360	
Cleveland	WHK	360	100
Columbus	WBAV	360	
Columbus	8YO	275	
Dayton	WFO	360; 485	300
Dayton	WA-1	360	
Defiance	WCAQ	360	200
Fairfield	WL-2	360	
Granville	WJD	360	100
Hamilton	WBAU	360	
Hamilton	WRK	360	1,000
Lebanon	WPG	360	
Marietta	WBAW	360	
Portsmouth	WDAB	360	100
Toledo	WHU	360	
Toledo	WJK	360	300
Toledo	WBAJ	360; 450	
Youngstown	WMC	360	
Youngstown	WAAY	360	
Zanesville	WPL	360	
Oklahoma:			
Muskogee	WDAV	360	
Oklahoma City	WKY	360; 485	500
Oklahoma City	5XT	360	
Tulsa	WEH	360	
Oregon:			
Hood River	KQP	360	100
Klamath Falls	KDYU	360	
Portland	KDYQ	360	
Portland	KQY	360	100
Portland	KYG	360	700
Portland	KGW	360	200
Portland	KGG	360	500
Portland	KGN	360	500
Pennsylvania:			
Bridgeport	WBAG	360; 485	300
Brownsville	WDAQ	360	
Clearfield	WPI	360	
Erie	WSX	360	75
Erie	WJT	360	1,000
Harrisburg	WBAK	360	
McKeesport	WIK	360	500
Philadelphia	WCAU	360	
Philadelphia	WFI	360	350
Philadelphia	WIP	360	
Philadelphia	WGL	360	2,000
Philadelphia	WOO	360	
Philadelphia	WPJ	360	30
Philadelphia	WDAR	360	
Pittsburgh	WCAE	360	
Pittsburgh	KDKA	360	1,000
Pittsburgh	KQV	360	750
Pittsburgh	WAAX	360	
Pittsburgh	WPB	360	
Villanova	WCAM	360	
Wilkes-Barre	WBAX	360	
Rhode Island:			
Pawtucket	1OJ	200	
Pawtucket	1XAD	200	
South Dakota:			
Rapid City	WCAT	360	
Tennessee:			
Memphis	WKN	360; 485	
Memphis	WPO	360	200
Nashville	WDAA	360	
Texas:			
Amarillo	WDAG	360	
Austin	WCM	360	
Dallas	WRR	360; 485	200
Dallas	WDAO	360	
El Paso	WDAK	360	
Fort Worth	WBAP	360	100
Fort Worth	WPA	360; 485	500
Houston	WCAK	360	
Houston	WEV	360	
Paris	WTK	360	300
San Antonio	WCAR	360	
Utah:			
Salt Lake City	KDZV	360	
Salt Lake City	KZN	360	
Vermont:			
Burlington	WCAX	360	
Virginia:			
Norfolk	WSN	360	100
Richmond	WBAZ	360	300
Washington:			
Aberdeen	KNT	360	400
Lacey	KGY	360	100
Seattle	KFC	360	700
Seattle	KHQ	360	
Seattle	KJR	360	200
Seattle	KTW	360	
Seattle	KZC	360	50
Seattle	KDZE	360	
Spokane	KFZ	360	300
Spokane	KOE	360	
Tacoma	WAAG	360	
Tacoma	KMO	360	
Wenatchee	KZV	360	
Yakima	KFV	360	
Yakima	KQT	360	
West Virginia:			
Charleston	WAAO	360	
Huntington	WAAR	360	
Morgantown	WHD	360	
Wisconsin:			
Milwaukee	WCAY	360	
Milwaukee	WAAK	360	
Madison	WHA	360; 485	600
Canada:			
Calgary	CFAC	430	
Halifax	CFCE	440	
Montreal	3AM	440	200
Montreal	CKAC	450	
Montreal	CFCT	440	
Montreal	CHYC	410	

State and City	Call	Wave Lengths	Miles Range
Montreal	CJBC	420	
Regina	CKCK	420	
Toronto	CFCA	400	
Toronto	CHCB	440	
Toronto	CHCZ	420	
Toronto	CJCD	410	
Toronto	CJSC	430	
Toronto	CKCE	450	
Vancouver	WEI	450	
Vancouver	CFCB	440	
Vancouver	CFYC	400	
Vancouver	CHCA	430	
Vancouver	CJCE	420	
Vancouver	CKCD	410	
Winnipeg	CHCF	430	
Winnipeg	CJCG	410	
Winnipeg	CJNC	400	
Winnipeg	CKZC	420	
Hawaii:			
Honolulu. Waikiki..	KGU	360	

Station Schedules

AG1, Presidio of San Francisco, Cal. Signal Corps, U. S. A. Sun, 7-9 pm, instruction. Pacific time.

DD5, Denver, Colo. Fitzimmons General Hospital. Daily ex Sun, 8:15 pm, weather, news, concert. Thurs, 8:15-9:30 pm, special concert, speech. Mountain time.

GAM, Montreal, Quebec, Canada. Marconi Wireless Teleg. Co. of Canada, Ltd. Daily ex Sat and Sun, 1-1:30 pm, concert. Mon, Thurs, 8-9 pm, concert. Eastern time, daylight saving.

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

KDN, San Francisco, Cal. Leo J. Meyberg Co. Daily ex Sun, 11-12 am, 1-2 pm, 4:30-5:30, concert; 7-7:15, weather; 8:30-9, concert. Sat, nothing after 5:30 pm. Sun, 10-11 am, sacred concert. Pacific time.

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

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

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

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

KFZ, Spokane, Wash. Doerr Mitchell Elec. Co. Daily ex Sun, 7:30-9:30 pm, concerts and voice. Pacific time.

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

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

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

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

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

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

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

KHD, Colorado Springs, Colo. Aldrich Marble & Granite Co. Daily except Sun., 8:15 am, weather, forestry bulletins, etc. Mountain time.

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

KJC, Los Angeles, Calif. Standard Radio Co. Daily ex Sun, 11:30-12 noon. Mon, 10-11 am. Wed, 9-10 am. Sun, 1-2 pm, 5-6. Pacific time.

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

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

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

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

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

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

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

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

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

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

KNJ, Roswell, N. M. Roswell Public Service Co. Daily, ex Sun, 7-9 pm, weather, financial, markets, news. Sun, 7-9 pm, church service. Mountain time.

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

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

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

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

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

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

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

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

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

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

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

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

KUO, San Francisco, Cal. San Francisco Examiner. Daily ex Sun, 3-3:30 pm, and 5:30-6:45, news, etc. Sun, 5-6 pm, news, etc. Pacific time.

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

KWH, Los Angeles, Calif. Examiner. Daily ex Sat, 12:30-1 pm, music, news, crop reports. Daily, 5:30-6:30 pm, music, news. Sunday, 2-3 pm, sacred concert.

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

KWG, Stockton, Cal. Portable Wireless Telephone Co. Daily ex Sun, 4-5 pm, news, concert, markets. Tues and Fri, 8-9 pm, concert. Sun, 2-3 pm, concert. Pacific time.

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

KYW, Chicago, Ill. Westinghouse Elec. & Mfg. Co. Daily ex Sun, 9:35 am-1:20 pm, market quotations every half hr; 2:15, news, markets; 3, baseball; 4:15 and 6:30, news, final markets and stocks; 7:30, baseball, bedtime story; 7:45, feature; 8-9, concert; 9, news. Sun, 3:30 pm, church service. Central time, daylight saving.

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

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

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

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

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

WAAJ, Boston, Mass. Eastern Radio Inst. Mon, Wed, Fri, 9-10 pm, concert. Eastern time.

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

WAAV, Athens, O. Athens Radio Co. Daily, 7-9 pm, miscellaneous. Central time.

WAAZ, Emporia, Kan. Hollister-Miller Motor Co. Daily ex Sun, 9:45-1:15 pm, market quotations every half hr; 7-8 pm, concert, weather. Sun, church service, 2 pm. Central time.

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

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

WBAB, Syracuse, N. Y. Andrew J. Potter. Daily ex Sun, 7-8 pm, concert, baseball, weather, news, bedtime story. Sun, 6:30-7:30 pm, church service, etc. Eastern time.

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

WBAJ, Toledo, O. Marshall-Gerken Co. Tues, Thurs, Sat, 6-7:30 pm, news, bedtime story. 8:00 pm, concert.

WBAM, New Orleans, La. I. B. Rennyson. Daily ex Sun, 10-11 pm, real estate bulletins, lecture, concert. Eastern time.

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

WBAP, Fort Worth, Tex. Star Telegram. Daily ex Sun, 11-11:30 am, weather; 2-2:30 pm, road conditions; 3:30-4 pm, news, markets; 630-7, baseball; 8-8:30 pm, bedtime story, lecture; 10:30-11, concert. Sun, 2-2:30 pm, sermon, 3:30-4, concert. Central time.

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

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

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

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

WCAB, Newburgh, N. Y. Newburgh Daily News. Daily ex Sun, on half hour 12:30-6:30 pm, news, sports, concert; 10:30-11 pm, concert, feature. Eastern time, daylight saving.

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

WCAQ, Defiance, O. Tri-State Radio Mfg. Co. Daily, 11:30-12:30 pm, 3, baseball; 6-6:30, baseball, concert; 8, special program. Central time.

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

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

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

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

WEY, Wichita, Kan. Cosradio Co. Wichita Beacon). Daily ex Sun, hourly, 8:40 am-12:40 pm, stock markets. Daily, 10:45 am and 4:30 pm, weather; 8-10 pm, baseball, concert, lecture; 10:45 weather. Sun, 8-10 pm, church service, concert. Central time.

WFI, Philadelphia, Penna. Strawbridge & Clothier. Daily ex Sun, 1:16 pm, news; 3:30-4:30, concert; 5:30-6, baseball. Mon, Fri, 6:30-7 pm, Radio talk. Wed, Fri, Sat, 7:30-8:30 pm, concert. Fri, Sat, (alternate weeks) 7:30 pm, concert at 8:30 pm. Sun, 4 pm, church service. Eastern time, daylight saving.

WFO, Dayton, O. Rike-Kumler Co. Daily ex Sun, 9-9:30 am, concert, news; 11-12 and 4-5 pm, concert, news, markets, weather. Mon, Wed, Fri, 7-8 pm, concert, lecture. Sun, 11-12 am, church service. Central time.

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

WGI, Medford Hillside, Mass. Am. Radio & Research Corp. Daily ex Sun, 2:55 pm, music; 3, news; 7:30, baseball, news; 7:45 pm, police reports. On Tues and Thurs, 7:30 and 7:45 pm programs at 7:45 and 7:55 pm, respectively. Sun, 8 am, church service; 8:45 am, sacred concert, Special features week nights, 7:30-9 pm. Eastern time.

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

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

WHA, Madison, Wis. Univ. of Wis. Daily ex Sun, 12:30-1 pm, weather, markets. Tues, Thurs, Fri, Sat, 12-1 pm, weather, markets, time. Tues, 8-9 pm, concert. Fri, 8-9:15 pm, news, concert. Sat, 1-1:20 pm, instruction. Central time.

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

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

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

WHW, East Lansing, Mich. Stuart Wm. Seeley. Daily ex Sun, 11:30 am and 12:30 pm, weather and markets. Eastern time.

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

WJD, Granville, O. Dennison University. Daily, 5-6 pm, concert, lecture. Central time.

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

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

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

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

WKC, Baltimore, Md. Jos. M. Zamoiski Co. Tues, Thurs, Sat, 7:30-8:30 pm. Eastern time, daylight saving.

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

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

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

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

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

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

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

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

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

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

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

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

WOR, Newark, N. J. L. Bamberger & Co. Daily ex Sun, 20 minutes or half hour from 10:30 am to 6:30 pm, miscellaneous. Eastern time, daylight saving.

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

WPA, Fort Worth, Tex. Fort Worth Record. Daily, 11:30 am, weather; 7:30 pm, baseball, concert; 9:30, news; 9:50, weather. Central time.

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

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

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

WPO, Memphis, Tenn. United Equipment Co. (News-Scimitar). Daily, 7-9 pm, concert, news. Central time.

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

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

WRM, Urbana, Ill. Univ. of Ill. Thurs, 8:30-8:55 pm, 9:05 on, news, concert, lecture. Special concerts irregular. Central time.

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

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

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

WSB, Atlanta, Ga. Atlanta Journal. Daily ex Sun, 12 m, weather; 2:30 pm, markets; 4, concert; 5, baseball, news, bedtime story; 7-8, concert. Sun, 11 am and 5 pm, church service. Central time.

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

WSX, Erie, Pa. Erie Radio Co. Tues, Thurs, Sat, 10-10:55 pm, news, concert, lecture. Sun, 12:15-1:30 pm, sermon. Eastern time. Daylight saving.

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

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

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

WWI, Dearborn, Mich. Ford Motor Co. Wed, 10-11 pm. Eastern time.

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

WWX, Washington, D. C. Post Office Dept. Daily ex Sun, 10 am, weather; 10:30, markets; 5 pm, 7:30, 8, markets; 9:50, weather. Eastern time.

(Continued on page 13)

Radio Digest Illustrated

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

Vol. 1 Chicago, Saturday, June 10, 1922 No. 9

Commercial Aspects of Radio

Standardization of Parts Takes Time to Work Out

IN ORDER to systematize the construction of Radio receiving set parts it is necessary to take considerable time in the making of drawings so that there will be a standardization of the pieces entering into the sets. Radio broadcasting, which started the latter part of last year, completely upset the Radio market. Consequently many parts on sale are of no special size or dimensions, not even tested out for the proper requirements. A great many of the home-built receiving sets are only experimental, just because no definite requirements were given.

Most of the parts for the better class of receiving sets are now made by the large manufacturers of electrical apparatus. They have taken time to produce special dies, tools, jigs and other fixtures required for standardized production.

It has taken time for these large companies to bring out an efficient and well constructed set. Now that much of the work is caught up, other sets designed to meet the demand, as it exists and as it develops, will be brought out from time to time. We will soon have a complete line to select from and when an outfit is purchased the buyer will know just what he may expect.

Tubes, batteries and rectifiers also have had to be made in large quantities to keep up with the market. Special batteries were made, also rectifiers, and these parts of the outfit required much attention by the manufacturers to speed up the work to meet the demand.

No doubt the boom which has hit this country, and which is the largest in history of the electrical industry, will soon be under control.

Airphone Presidential Messages

Installation of Transmitting Station at Arlington

MESSAGES delivered by the president were broadcasted from a special transmitting station at Arlington. This seems to be a most practical way in which to make use of the new science to an advantage. While such a transmitting station can be used for broadcasting debates in congress, it is supposed that more persons will be interested and listen in to hear what the president has to say. The station will be equipped with the best and most improved apparatus so that messages delivered in the congressional rooms can be heard all over the eastern half of the United States.

The White Bill on Radio

Bill to Empower Hoover to Make Regulations

DETAILS of the White bill drawn to regulate Radio are withheld, but this much is understood that in its present form the enactment of a law of the technical items suggested by experts is not contemplated, it merely gives the Secretary of Commerce, Hoover, authority to promulgate such rules and regulations as were found necessary to carry out the government's plan.

In empowering the Secretary of Commerce to issue licenses for the conduct of Radio activities, the White bill also stipulates the erection of a station or completion of construction already begun shall be prohibited until permission is granted by the commerce department.

In this way, Mr. White explains, expenditure of large sums on the erection of stations which might eventually be disapproved by the department would be obviated and the resultant loss through inability to operate avoided.

Friends of the legislation frankly admit that this section is liable to be questioned as unconstitutional, but they declare it would be unfair to the industry itself to permit the investment of a large amount of capital in construction when its utilization might not receive the sanction of the government.

Authority for the imposition of a graduated scale of fees for registration, inspection and licensing also being conferred upon the department under the terms of the measure.

Radio Now Becoming a Necessity

The Radiophone Now Playing an Important Part

AS WE are beginning to slip past the experimental point on Radio equipment it now behooves us to find a very practical way to use it so that it will be more than just a fad. A good many ways and means are presenting themselves, and the amateur as well as the professional, is quick to grasp and make use of the new science.

The development of Radiophones has now passed the experimental stage, and while it is not yet a necessity, it is in the intermediate period, where it is being taken into the homes of all classes of people. Its greatest expansion and usefulness is yet to come, and it will, no doubt, have a great growth and become as much a necessity as the telephone.

"Push Button" Set Needed

Set Without Much Adjustment Sought

TODAY the Radio amateur is in the limelight. Most members of this tribe put up their own sets and experiment with the apparatus until they get what they desire. The number of novices is small compared with the amateurs. This condition is brought about by the fact that Radio receiving sets on the market today require some knowledge of Radiophones to secure the best results. Novices will spring up when a set comes out that will require no more attention than the modern phonograph. The pushing of a button, a minor adjustment and the Radio concert desired will "come in."

Radio and the World

The Hotbed of Airphones Is the United States

COMMENTS come slipping through from time to time about other countries just beginning to get interested in Radio. England and France, the two countries that we would suppose would be among the first to come to the front in this new science, are being kept back on account of certain restrictions still existing from the war. England seems to be waking up a little. The Star (Lincoln, Nebraska) says:

"The Radiophone has not developed in England as it has in this country. For one reason England does not have the great distance such as we have in the United States, and second, it is impossible to imagine the people of any other land so quick to react to a new invention. Americans, perhaps by training and perhaps by temperament, assert a free hand in doing the things they like to do."

According to what we hear from London, England, our Radio engineers, fans and amateurs in the United States must keep "plugging" Radio in all of its phases if this country wishes to retain its supremacy. Britain will soon lay down its barriers now existing against the Radiophone and definitely challenge the world for Radio honors. Following are some paragraphs from the Post (Boston, Mass.) in regard to Radiophones abroad:

"England, which today can claim no more than a few thousand Radio fans against the million in this country, plans to start right in on the Radio business and show America just how the Radio game should be played, is the warning from London.

"Government control," says Sir Godfrey Isaacs, managing director of Marconi's Wireless Telegraph Company, "is responsible for England's inferior position in Radio development. The use of receiving apparatus by private persons has been made almost impossible up to the present by the continuance of the licensing system by the postoffice."

"Radio Flu" is what Isaacs terms the phenomenal growth of the Radiophone operation in the United States. Lack of technical skill or knowledge is not responsible for the seeming inactivity in Radio in England, but due wholly to the position which England took in not releasing wartime conditions. British experts are not one bit behind those in America, and in the handling of valve reception and transmission are possibly in advance, it is said. The only difficulty has been the official restrictions."

England seems to be ready to accept the possibilities of the Radiophone. The following paragraphs, taken from a correspondent of the London Times, are interesting from the viewpoint of the Radiophone as regarded by the English, but it gives us a hint of the worldwide development of the miraculous invention:

"Mr. Godfrey Isaacs tells me that his company is preparing important plans for extending the use of Radio in England.

"The use of the receiving apparatus by private persons has been made almost impossible to the present by the continuance of the licensing system by the postoffice. The postoffice is now about to change its policy and to allow every facility for the extension of Radio. An important announcement is expected when the house meets.

"When the restrictions have been removed or modified there will be nothing to prevent a big advance. The Marconi company's plans are not complete, but I gather from Mr. Isaacs that there will be a central station from which messages will be transmitted to all the users of the company's receivers. The receiving apparatus will be hired out by the company at a charge which will probably not be more than that of the telephone installation.

"The company is ready to make millions of foolproof instruments, and this would create an important new industry. The company has been making experiments for a long time in preparation for the scheme, and everything is now ready for putting Radiophones in general use, although, of course, there is no question of issuing transmission plants to the public."

RADIO INDI-GEST

Be Sure You Get the Right Cat Whisker

Dear Editor:—I recently tried to construct a crystal detector from, as an article in one of the radio publications put it, "odds and ends around the house." I have used up all of our cat's whiskers, but find that none of them seems to work. Can it be that I have used the wrong kind of cat? Ours is a Maltese.

Answer—Cat whiskers from a Maltese cat will be of no value in a crystal detector unless the feline is rubbed vigorously in a dry room (until static electricity is generated) prior to the removal of the aforesaid whiskers.—Globe.

Ode to a Bulb

It's far from a thing of beauty, I know,
But for wonder, it hasn't a mate—
I'm speaking now of that little glass tube
With filament, grid and plate!

They cost like the devil, but still we buy;
We'll have them whate'er the rate,
For you can't do much sans the little glass tube
With filament, grid and plate!

It puzzles us all as to just how it works,
But knowledge will come if we wait,
And some day, perhaps, we'll know all about
The filament, grid and plate!

You'll put your galena in a box,
And for money your folks you'll bait
Till they "come through" with sufficient jack
For a filament, grid and plate!

And when you have a tube in your set
You'll turn down date after date,
For your only love, my lad, will be
A filament, grid and plate!

EPILOGUE

Of all the things that we don't like,
Our most particular hate
Is to burn out one of those doggone tubes
With filament, grid and plate!

—Detroit News.

Darn it

Static Editor: My younger brother unintentionally (he says) connected my new vacuum tube to the house lighting circuit one afternoon last week. We have not been able to hear the concerts since. What shall I do?

IGNORANT.

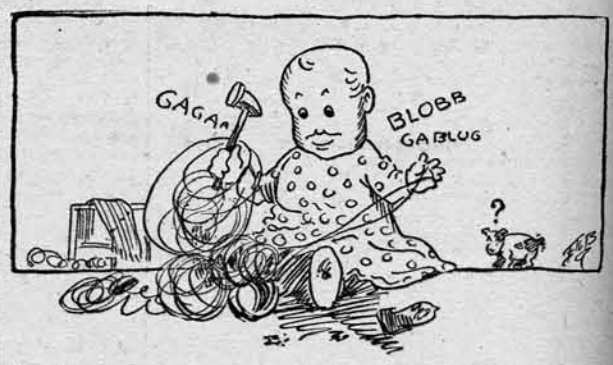
Answer.—We fear that the bulb will prove unsuitable for further Radio work. However, your wife will find it a useful article over which to darn socks.

Unwired Variometers

An advertisement in one of the Radio magazines is headed as follows:

VARIOMETERS
UNWIRED.

Our kid brother did that to ours one day last week.



Clients desiring to have their variometers unwired, audions devacuumized, or galena made unsensitive are urged to leave such articles in places where the younger element can readily find them.

The Tunes Come from the Tuning Coil

Skeptic:—Say, what is this part of the machine?
Radio Hound:—That! Why, that's a tuning coil.
Skeptic:—Oh! So that is where the tunes come from. I thought you said they came from Pittsburgh.

Return My Nickel, Please!

What we may expect to hear next:

"I am returning your coin. The air is busy," or perhaps, "Say, operator, you gave me the wrong wave length."

Radio Telephony for Amateurs and Beginners

Condensers

By Peter J. M. Clute

Part IV

One of the most important attributes of a Radio circuit is its ability to store up energy in the form of an electrostatic field, through the functioning of the condenser. This phenomenon is referred to as the "electrostatic capacity."

Any contrivance in which two conducting surfaces are separated by a thin non-conducting medium, which has sufficient dielectric strength to prevent discharge between them, is a "condenser," so-called, because it can take a large or heavy charge at a small potential.

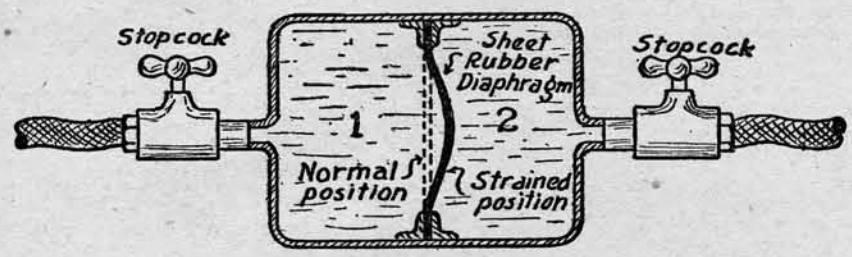


FIG. 1: HYDRAULIC MODEL OF A CONDENSER

Condensers, as used in wireless operation, are divided into two general classes, namely, those used in transmitting stations and those employed in receiving systems. In the latter case, only small potentials are met and the usual practice is to construct fixed capacity condensers with mica for a dielectric medium and variable capacity condensers with air as the dielectric.

Condensers for high-potential circuits differ materially from low-voltage condensers in the puncture-proof quality of the dielectric medium, when connected to a high-potential supply. In transmitting

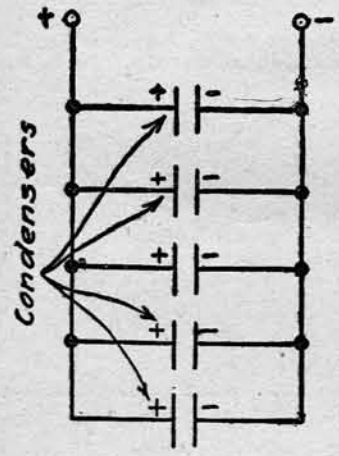


FIG. 2
CONDENSERS CONNECTED IN PARALLEL OR MULTIPLE

systems, high potentials are involved, and hence current leakages and ruptures caused by dielectric breakdowns must be avoided. The dielectric for high-voltage condensers may be air, glass or mica, and for low-voltage condensers, paraffined paper, mica, or thin sheets of hard rubber or bakelite are used.

When connected to a source of potential, a condenser acts as a reservoir for the

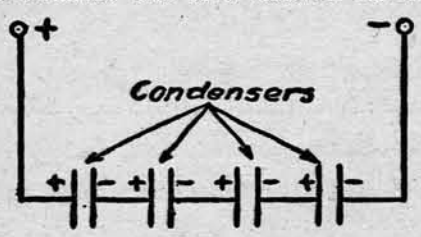


FIG. 3
CONDENSERS CONNECTED IN SERIES

energy of the circuit in electrostatic form. The maximum possible charge of a condenser depends upon its insulation and the strength of the dielectric between its coatings to resist disruptive charge. One condenser may be charged to many times its capacity before it discharges, while another may discharge or break down before it is charged to one-tenth of its capacity. The strength of a dielectric is the measure of its ability to resist puncture or leakage discharges. The "specific inductive capacity," or "dielectric constant" of any material is its ability to store up electrostatic charges, as compared to air, at normal pressure, taken as a standard.

A list of dielectric constants is given below:

Air (normal pressure)	1.000
Air (compressed)	1.004
Hard Rubber	2.500
Crown Glass	6.960
Flint Glass	7.000
Mica	8.000
Paper	2.500
Paraffin	2.000
Common Glass	3.500
Plate Glass	8.460

At this point, it may be found profitable for a clearer understanding of its functioning, to consider the hydraulic analogy of a condenser. Referring to Fig. 1, a box is divided into two sections by a thick sheet rubber diaphragm. Each side of the container is provided with an opening controlled by a stopcock. While immersed in water, with stopcocks open, the pressure is the same in parts 1 and 2 and the rubber is not strained. In this condition, it is similar to a condenser, uninsulated and discharged. Next attach a pump to 1 and force water in while the stopcock of 2 is left open, or connect the pump to both 1 and 2, so that it can pump water out of 2 and into 1. The rubber sheet will be strained as shown, the side 2 being at zero pressure, while side 1 will be at a higher pressure. The difference in pressure between the two sides is due to the strain of the rubber.

If now, parts 1 and 2 are connected by a tube, with both stopcocks open, there will be a flow from one side to the other as the rubber springs back into the unstrained condition. Similarly, when a condenser is discharged, electricity may be thought of as being forced from one coating to the other by the springing back of the stored energy in the dielectric.

If the rubber diaphragm were thicker, more pressure would be required to produce a given strain. Likewise, in a condenser, the thicker the dielectric the greater the potential difference between its coatings, when it has a given definite charge.

In case the diaphragm was made of material more yielding than rubber, it would correspond to a dielectric of greater specific inductive capacity, inasmuch as a given pressure would then force in a greater charge.

The larger the charge given to a condenser the greater is the difference of potential between the plates, so that we have Q=VC, where Q is the charge, V is the difference of potential between the plates, and C is a constant called the "capacity" of the condenser. From this relation when V=1, C=Q and hence it is found that the capacity of a condenser is the quantity of charge required to make unit difference of potentials between its plates.

Capacity depends upon the area of the plates, upon the dielectric medium, and upon the thickness of dielectric between the conducting surfaces. The capacity varies directly as the area of the plates, directly as the dielectric constant and inversely as the distance between the plates. This relation may be expressed by formula, as:

$$C = \frac{SK}{4 \times 3.1416 \times d}$$

where C is the capacity, S is the area of one plate, d is the thickness of the dielectric separating plates, K is the dielectric constant. Thus, a condenser with a thin dielectric, or a small spacing between plates, has a larger capacity than one having a thicker dielectric, all other conditions being equal.

The "farad' is the unit of capacity. It represents the capacity of a condenser, which will hold a charge of one coulomb when the potential difference between plates is one volt. This is so large that ordinary condensers are rated in "microfarads", or millionths of a farad. The coulomb is the quantity of electricity or

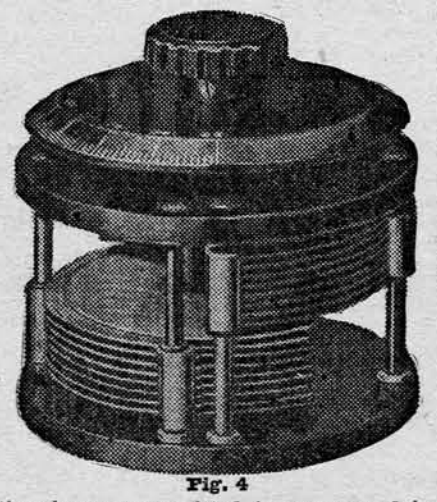


Fig. 4

the charge transmitted in one second by a current of one ampere.

Fig. 2 shows a number of condensers connected in parallel, or multiple. In this case, the combination is equivalent to a single large condenser having a capacity equal to the sum of the capacities of the separate condensers.

When, however, say four condensers of equal capacity are connected in series, as in Fig. 3, they are like a single condenser, having a dielectric four times as thick, and the capacity of the combination is one-fourth that of a single condenser. In general, for condensers of any value of capacity is series, the resultant capacity is found by taking the reciprocal of the sum of the reciprocals of the several capacities.

Various types of condensers are used in

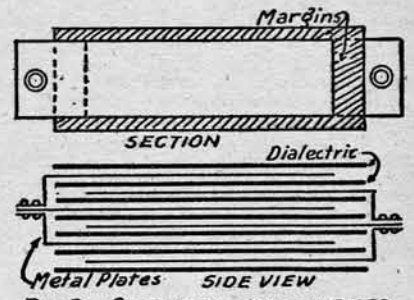


FIG. 5: CONSTRUCTION OF A FIXED CONDENSER (Exaggerated View)

Radio transmitting and receiving systems. Some of these are: High-tension fixed condensers, fixed receiving condensers, variable condensers, antenna series condensers, grid condensers, etc.

Most high-tension condensers are made of brass plates with composition dielectric, formed under pressure. Others have tin foil sheets separated by glass or some other similar insulator. If a high-tension condenser is connected across the spark gap of a Radio-telegraph transmitter, the spark becomes shorter and thicker, a desirable feature.

The variable condenser is a most use-

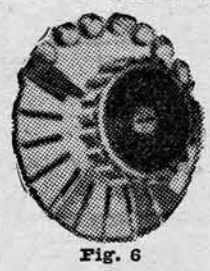


Fig. 6

ful device where sharp tuning and long distance work are desired. It may be connected in various ways with the other apparatus of the receiving set. Fig. 4 shows typical variable air condenser with knob and graduated dial. This type of condenser consists essentially of two sets of plates, one set stationary and the other movable. As the movable set is revolved, the capacity is varied to any desired value within the limits of the condenser.

The fixed condenser, shown in Fig. 5, may be used as a substitute for the variable condenser, but does not permit of any adjustment. There are two series of conductors separated from each other by some dielectric. The metal plates for a fixed condenser may be made of copper, zinc, or tinfoil, while the dielectric used may be paraffined paper, mica or bakelite. A number of metal plates are connected to one side of a circuit, while a like number of plates are connected to the other side. The dielectric or non-conducting material separates two sets of plates.

Numerous antennae have their natural periods above the wave-lengths for which they are to be used. Here, in order to decrease the effective capacity of the antenna, a series condenser is necessary. A condenser to accomplish this efficiently must have small losses and be capable of withstanding a high voltage. A variable condenser is generally used for this purpose. When the condenser is in series, the wavelength is greatly reduced, and fine adjustments may be made by varying the condenser. If the antenna condenser is connected in parallel with the tuning inductance, the wave-length is increased proportionately to the value of capacity used. Fine adjustment of the wavelength is possible by this arrangement.

Fig. 6 shows a phosphor bronze fan switch for cutting capacity in or out when sectional mica condensers are employed instead of a variable condenser. It can be used for varying the antenna series capacity of a transmitting set or for changing the bridging condenser capacity in a vacuum tube receiving set.

Grid leak condensers are usually combined in a unit with the grid leak, with the leakage element easily removable for adjustment to suit any particular type of vacuum tube, or removable entirely without disturbing the condenser. By the removal of the leakage element, the condenser may be used for other purposes where a small fixed capacity is required.

The condenser in Radio transmitting circuits is a real reservoir or storage for electricity. The static pressure created between the plates of the condenser gradually becomes so great that the condenser is no longer able to withstand it and discharges the accumulated energy back

(Continued on Page 13)

Peter J. M. Clute—

FOR several years has contributed technical articles to various periodicals and is well known in electrical engineering circles. A graduate of Union college with a degree of Bachelor of Science in Electrical Engineering, Mr. Clute is now connected with the engineering department of the General Electric company.

Realizing the importance of giving the new Radio fans a comprehensive knowledge of electrical fundamentals necessary to secure a reasonable understanding of Radio, Mr. Clute has prepared a series of articles especially adapted to the novice.

The articles to be published in the RADIO DIGEST in ensuing numbers include:

V. TUNERS AND TUNING.
VI. DETECTORS: CRYSTAL AND VACUUM TUBE
V. THE BATTERIES.
VI. RECEIVERS AND LOUD SPEAKERS
VII. CRYSTAL DETECTOR RECEIVING SETS.
VII. VACUUM TUBE RECEIVING SETS
VIII. AMPLIFIERS.
IX. USEFUL INFORMATION.

Characteristics of Vacuum Tube Amplifiers

By Benjamin F. Miessner

Part VI

Rectifier Distortion and Amplifier Theory

In the preceding installment of this series I discussed the use of the three electrode vacuum tube for rectification of Radio frequency currents and the nature of the phenomena was shown graphically for a train of unmodulated continuous waves such as would represent a dot or dash in Radio telegraphic signalling. When the continuous waves are modulated, as in Radio telephony, the amplitude of the Radio frequency current is varied in accordance with the wave form of the sound waves being transmitted, so that the final current in the telephone, instead of being constant, varies in the same manner as the envelope of the Radio frequency current, with the result that the original sounds are reproduced with more or less fidelity.

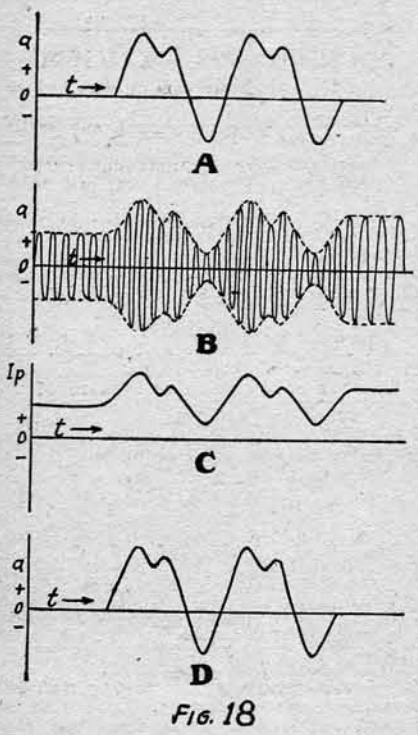


Fig. 18

In Fig. 18, graph A represents the wave form of a sound vibration of three components consisting of a fundamental with its first and second harmonic overtones. A tone of such wave form may be obtained on the E-string of a violin at a frequency of 995 vibrations per second. Graph B shows a continuous wave modulated by this sound wave, and graph C represents the variation in plate current of a receiving tube and telephone, while graph D represents the motion of the telephone diaphragm and the sound wave which it reproduces. It is seen that the transmission of sound by Radiophone involves merely a process of varying the amplitude of a continuous wave transmitting current by apparatus that will transform the sound vibrations into electrical vibrations (microphone) and applying these electrical vibrations of corresponding wave form in the control circuits of the transmitting apparatus. In this way the amplitude of the normally constant transmitting current is modulated or varied in accordance with the wave form of the sound vibrations. This is virtually the same operation as that involved in wire telephony except that the modulated current is alternating instead of direct.

We now understand how the sound waves are transformed into amplitude variations of Radio waves at the transmitter, and how they are again retransformed and reproduced as the original sound waves at the receiver by means of rectifier tubes and telephones.

Causes of Distortion

There is one point in connection with rectifiers which, while very commonly overlooked, should be given special attention. This is the distortion of modulated wave forms produced by rectifying devices. While this is of probably no importance in Radio telegraphy, where exact reproduction of the simple wave form used in telegraphy is unnecessary, it is of great importance in telephony, where exact reproduction of complex wave forms is paramount. While it is true that numerous elements in the chain of circuits and apparatus in a Radiophone system contribute to the general distortion which subtracts from the accuracy of sound reproduction, the receiving rectifier is responsible for no small part of the whole, and certainly requires study and understanding if progress in this direction is expected. In the final analysis the faithfulness and naturalness with which sounds made at a transmitting station are reproduced in a receiver are absolutely and only dependent on the exactness with which the wave forms of the original sounds are reproduced. Among the chief contributing factors in causing changes or distortion in this wave form may be mentioned horns and microphone amplifying circuits and tube characteristics at the transmitter, and rectifiers, amplifying circuits, telephones and loud speaking horns at the receiver. Distortion of wave front caused by objects in the path of the electromagnetic waves themselves has no relation whatever to this acoustical distortion and should not be confused with it; nor has distortion of the form of the Radio frequency carrier waves anything to do with the acoustic distortion as long as the distortion is not great enough completely to obliterate them, and thus destroy their usefulness as a carrying agency for sound wave forms.

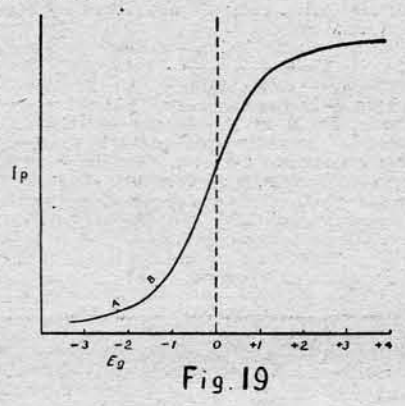


Fig. 19

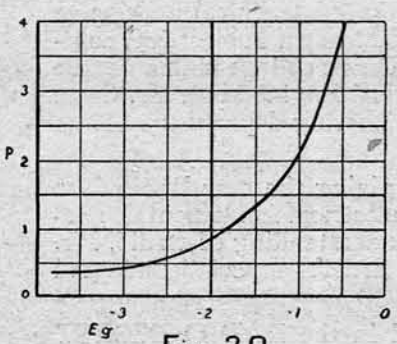


Fig. 20

Let us now go back to our characteristic curve for a three electrode vacuum tube, and investigate its effect on the audio frequency wave form. Fig. 19 shows the entire characteristic over a wide range of grid voltage, and Fig. 20 for closer inspection and analysis, shows a small portion of this curve, including the lower rectifying bend A-B magnified several times. By means of a grid potentiometer the normal operating grid potential is adjusted to 2 volts, as indicated by the heavy vertical ordinate in the figure. This line may be considered as the "zero axis" for the impressed voltage on the tube between filament and grid. Now for the sake of simplicity we will impress upon this tube a high frequency current modulated by a pure sine wave sound, such as that produced by a tuning fork. This is the simplest type of vibration because it contains only one component—that is, it embodies no overtones or other sounds. Such a sound wave form is shown in Fig.

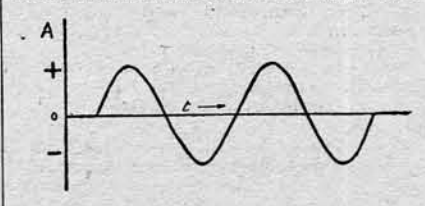


Fig. 21

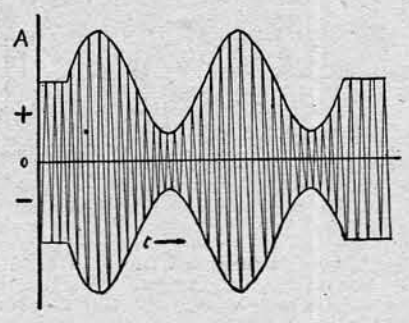


Fig. 22

21, and when used to modulate a continuous wave it appears as indicated in Fig. 22.

When such a modulated voltage wave is impressed along with the normal 2 volts on the rectifying tube, the heavy vertical ordinate of Fig. 20 becomes the (t) or time axis of Fig. 22, so that the actual grid potentials are always negative but vary in accordance with the amplitude of the Radio frequency voltage shown in Fig. 22.

An inspection of Fig. 20 shows that the plate current does not vary in exact proportion to the grid potential, so that a given change in grid potential does not produce the same change in plate current at all points along the curve. This is obviously one important cause of distortion. It will also be observed that the curvature is quite different on the two sides of the normal voltage axis of -2 volts, so that the increase in plate current for positive alteration of the Radio frequency voltage minus the decrease due to the negative alteration, is not a constant amount for a given change at all points along the curve.

If we should take such an impressed voltage curve as that shown in Fig. 22 superimposed upon the normal negative grid voltage of 2 volts, and plot the change in plate current of the vacuum tube point by point along the curve of Fig. 20, we would see just how distortion occurs. We would find that for small variations on both sides of 2 volts—say one-half volt—the increase equals the decrease, so that the net change in plate current would be zero. For a higher variation, however, of say one volt on each side, the increase exceeds the decrease with a consequent slight net slight increase in plate current. For a still greater change—say 1.5 volts, this increase would be far in excess of the decrease and the net increase would be large. The general shape of the wave form in the plate circuit of the tube under such conditions is shown in Fig. 23. The deviation from the improved wave form is shown somewhat exaggerated to emphasize the point under discussion. In this figure the net change in plate current only is shown, representing the superimposed audio frequency current on the normal plate current in the telephone receiver, with the Radio frequency variations smoothed out by the inductive reaction of this circuit.

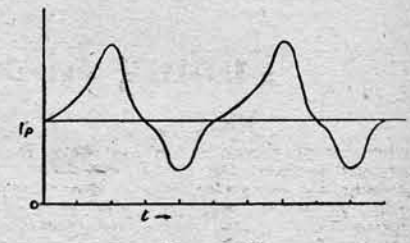


Fig. 23

This curve, while visibly different from the sine curve of the original sound, is even acoustically more different from its original counterpart, for it represents, not the simple sound with only one component vibration, but an entirely different sound with several component parts. The actual difference might be as great as that between the sound of a tuning fork and a cornet sounding at the same fundamental pitch. The fundamental vibration frequency would, of course, be the same, but the change in the shape of its curve is actually equivalent to the introduction of several overtones entirely absent in the original sound. The final result of the distorting influence is therefore a change in the quality of the reproduced sound which makes it different from the original, causing the reproduction to sound "unnatural." Distortion of this type occurs in all processes involving the transformation of complex vibrations from one form into another, as in the telephone, phonograph and Radiophone. It is one of the chief problems which now confront the scientific workers in those fields who constantly endeavor to improve the degree of perfection of the reproduced sound so that it will more nearly and exactly resemble the original.

SUNDAY CONVERTED

(Continued from page 6)

addition, a portable set, which is especially designed for use in a motor car, is owned by the paper. The portable set is capable of both transmitting and receiving.

Early experiments with the portable set taught the operators many new angles to the Radio game. On one occasion, while out in the country experimenting, they found they were without an aerial.

Necessity is the mother of invention. The car was standing near an iron bridge. A wire was strung to the framework of the bridge, another dropped to the water below, and the set was "tuned in" with excellent results.

Use Portable Set to Get News

The first practical use for the portable set came when an athletic meet was held a few months ago at Earlham college. Returns from the various contests were sent in by Radio through the portable set, to the home office, and from this point were relayed out to all parts of the state by the large sending outfit.

"Young America" is interested in Radio and the Palladium is interested in Young America. The young boys of Richmond expect to set up a Y. M. C. A. camp within 30 miles of the city this summer. Radio communication is to be established between this camp and the city through a set to be erected by the boys at the expense of the Palladium. The boys will handle every detail of the operation, and will be able to send and receive messages.

Is Pioneer in Market Broadcasts

The Palladium was the first station in the state and probably in the entire country to transmit Radiophone market reports in co-operation with the United States Bureau of Markets. Every program is made a matter of record and kept on file for the benefit of the Radio inspector.

"What does the Palladium expect to get out of this?" was the question put to the manager recently.

"The paper gets no direct benefit. It is a matter of service to the people," was the answer.

That the service is appreciated is evidenced by the fact that over 300 receiving stations are located in Richmond today, and the demand for Radio apparatus in outlying towns near the city shows that new stations are constantly going into action.

Simple Instructions for the Beginner

By Harry J. Marx

Tuning Apparatus Design

Part I

The present system of making parts in a haphazard manner, assembling them and then expecting the completed set to operate efficiently has become so general that it is not surprising that many, thoroughly disgusted, throw up the sponge and exclaim, "Never again!" It is about time for an article that will describe the exact calculations necessary for tuning apparatus design by means of a practical problem rather than by a detailed explanation of the theory and the derivation of the formulas. In this article such a practical problem is described and its solution worked out in a simple manner, avoiding unnecessary explanation of the theory but describing any variations in solution for different conditions that may exist in the average receiving station.—EDITOR.

Glance over any of the questions and answers as given in this or any other Radio publication, and countless repetitions will be found in questions where the entire source of trouble is due to one point, "The lack of knowledge concerning the wave length of the antenna and tuning units."

Let us start out with the assumption as is usually the case, that the antenna, lead-in and ground are already installed, or as is often the case the installation is restricted to little or no variation. The dimensions then of the receiving tuning unit for a definite range of wavelengths are items of the utmost importance. At this point, one important fact must be considered—you cannot get the same efficiency out of a long range set that you can out of a short one. By that I mean, a set designed for a limited range of from 150 to 600 meters will have much better efficiency than one designed for 150 to 3,000 meters or more. Adding too many turns on the primary and secondary coils and then cutting out these turns for the shorter waves is an error continually made by most amateurs and novices. These unused turns of the tuning unit introduce what is called "end turn losses" which distinctly decrease the efficiency. It might be compared to a water supply system in which there are a number of pipe lines running out from the main line, but ending up in a cap, where the water collects, becomes stagnant and pollutes the main supply.

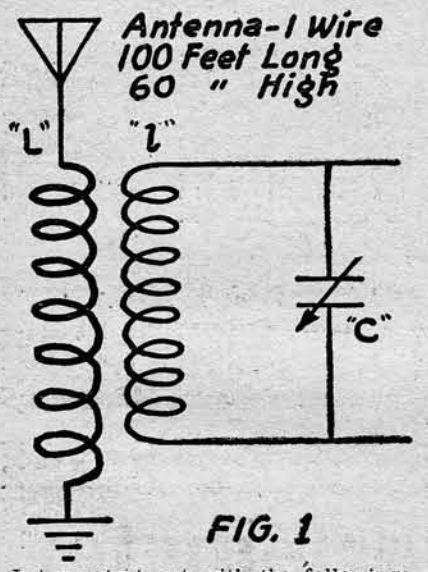


FIG. 1

Let us start out with the following:—The antenna is of the inverted "L" type the flat top being 100 feet long, 60 feet high and composed of a single wire. Let us assume the length of the ground wire, from the ground clamp to the set plus the length of the lead-in from the aerial to the set, is equal to the height of the aerial, 60 feet. It would probably be slightly more if the wires are led around and in through the rooms to the set. Then the total length of the aerial, lead-in and ground wire is 160 feet. To convert this to meters we multiply by 0.3048. This gives us a total length of 48.768 meters. To convert this to the fundamental wavelength, we multiply by 4.2, making the antenna wavelength about 200 meters.

Most broadcasting is sent out on a wavelength of 360 meters. The required inductance of the coil "L" in Figure 1, to raise the wavelength of the primary circut to 360 meters, must be calculated.

In addition the secondary circuit must be designed so the induction of the secondary coil "1" and the capacity of the condenser "C" will give an equivalent wavelength of 360 meters.

Primary Inductance

Referring to table No. 1 we find the inductance and capacities of aerials given for various lengths and heights. This table applies to the inverted "L" type. The inductance of the aerial in this problem then is 62,100 centimeters and the capacity .0004 microfarads.

In order to find the required inductance of the coil "L" the following formula is used:

$$Li = \frac{W^2}{3552\ Ac} - \frac{Ai}{3}$$

where
Li = inductance of the coil "L" in centimeters.
W = desired wavelength.
Ac = capacity of the antenna in microfarads.
Ai = inductance of the antenna in centimeters.

Substitute the formula values in order to increase the wavelength of the set to the usual broadcasting range of 360 meters:

$$Li = \frac{360 \times 360}{3552 \times .0004} - \frac{62{,}100}{3} = 91{,}216 - 20{,}700$$

Li = 70,516 centimeters.
but 1,000 centimeters equal one microhenry, therefore the inductance of the coil "L" should be 70 microhenries.

Secondary Inductance

Having found the required inductance of the coil "L" in the primary circuit attention can be turned to the secondary circuit and find the inductance of the coil "1". The capacity of the condenser "C" need not be very great, in fact it could be dispensed with, but at the same time it has a distinct advantage in tuning, especially in eliminating interference. For a wavelength range up to 600 meters a capacity of .0005 microfarads or less is sufficient.

$$li = \frac{W^2}{3552\ Cc}$$

where
W = desired wavelength as before
Cc = capacity of the condenser "C" in microfarads
li = inductance of the secondary coil "1" in centimeters

substitute the values in the formula:

$$li = \frac{360 \times 360}{3552 \times .0005} = 72{,}972 \text{ centimeters or } 73 \text{ microhenries}$$

The dimensions of the primary and secondary coils are 70 and 73 microhenries respectively. These values are for a wave length of 360 meters. The amateur, however, may desire to increase the range of his set for tuning in wavelengths above these, so sets are usually made with a wavelength range running to 600 meters or more. In this case the maximum wavelength desired is substituted in the calculations instead of 360 meters. Of course, as the range is increased, there is a corresponding loss in efficiency in the lower wavelengths. For this reason it is advisable to design the set for short wavelengths and have another set of coils for the longer wave lengths. Or, as is often done, loading coils can be added to the primary or antenna circuit, increasing the wavelength of the set. When this is done, the actual inductance of the coil required for increasing the range to any desired wavelength can be calculated by use of the formula as used in the first part of the problem.

Loading Coil

Taking for example the problem given an antenna wavelength of 200 meters, this is increased to 360 meters by adding the coil "L", of 70 microhenries inductance. To increase the wavelength to 600 meters by adding a loading coil in the antenna circuit, use the following formula:

$$L'i = \frac{W^2}{3552\ Ac} - \left(\frac{Ai}{3} + Li\right)$$

where
L'i = required inductance of the loading coil in centimeters
W = wavelength required
Ac = capacity of the antenna in microfarads
Ai = inductance of the antenna in centimeters
Li = inductance of the primary coil in centimeters

substituting the proper values:

$$L'i = \frac{600 \times 600}{3552 \times .0004} - \left(\frac{62{,}100}{3} + 70{,}516\right)$$

$$L'i = 253{,}378 - (20{,}700 + 70{,}516) = 162{,}162 \text{ centimeters.}$$

The inductance of the loading coil should be 162 microhenries.

Honeycomb coils are often used as loading coils, because they can be purchased in various sizes and inductances. In the Radio Digest of May 6th, 1922, Issue No. 4, on page 13, is given a table showing the number of turns, inductance and wavelength of honeycomb coils. This table will be convenient in getting the proper coil for either the primary, secondary or for loading.

TERM DEFINITIONS

1,000 centimeters equal one microhenry
1,000 microhenries equal one millihenry
1,000 millihenries equal one henry
1,000,000 centimeters equal one millihenry
1,000,000 microhenries equal one henry
1,000,000,000 centimeters equal one henry
1,000,000 micro-microfarads equal one microfarad
1,000,000 microfarads equal one farad
1,000,000,000,000 microfarads equal one farad

In Part Two the dimensions and details of the coils will be calculated. The above article is not intended as a technical discussion but a simple explanation by which the amateur can calculate the approximate range and wavelength of his station without taking up a detailed technical discussion.

TABLE No. ONE.

HEIGHT IN FEET	HORIZONTAL LENGTH 40		60		80		100		120		140		160		180	
	CAPACITY IN MFDS.	INDUCTANCE IN CMS.	CAPACITY IN MFDS.	INDUCTANCE IN CMS.	CAPACITY IN MFDS.	INDUCTANCE IN CMS.	CAPACITY IN MFDS.	INDUCTANCE IN CMS.	CAPACITY IN MFDS.	INDUCTANCE IN CMS.	CAPACITY IN MFDS	INDUCTANCE IN CMS.	CAPACITY IN MFDS.	INDUCTANCE IN CMS.	CAPACITY IN MFDS.	INDUCTANCE IN CMS.
30	.00019	22400	.00025	28200	.00033	34000	.00039	39800	.00046	45600	.00052	51400	.00058	57200	.00064	63000
40	.00019	28900	.00026	35000	.00033	41100	.00039	47200	.00046	53300	.00052	59400	.00058	65500	.00064	71600
50	.00020	35500	.00027	41900	.00034	48300	.00040	54600	.00046	61000	.00052	67400	.00058	73700	.00064	80100
60	.00021	42200	.00028	48800	.00034	55500	.00040	62100	.00046	68700	.00052	75300	.00058	81900	.00064	88500
70	.00023	48800	.00029	55600	.00035	62400	.00041	69200	.00047	75000	.00053	82800	.00059	89600	.00065	96400
80	.00024	55400	.00030	62400	.00036	69300	.00042	76300	.00048	83300	.00054	90300	.00060	97300	.00066	104200
90	.00026	62200	.00031	69300	.00037	76400	.00043	83500	.00049	90600	.00055	97700	.00061	104800	.00067	111900
100	.00027	69000	.00032	76300	.00038	83500	.00044	90700	.00050	98000	.00056	105200	.00062	112400	.00068	119600

For Inverted L Type Aerial.

RADIO TELEPHONY

(Continued from Page 11)

through the circuit. This discharge current flows through the circuit from one set of plates to the other, thus recharging the condenser in the opposite direction. This charging and recharging operation repeats itself until the charge, becoming weaker with each discharge, spends itself. Thus, it is apparent that the condenser discharges in the form of an oscillating current, which sets up corresponding oscillations or electromagnetic waves in the antenna circuit.

Various types of variable condensers are used some with fixed and hinged movable plates, some with means of varying the distance between fixed and movable plates, and some of the rotary type, such as illustrated in Fig. 4. In the latter type, there is a set of fixed plates and a set of rotatable plates which may be moved in and out of the fixed set, without touching them. This is the most desirable type for tuning a receiving set to the desired incoming wave-length. Maximum capacity is obtained when the plates are entirely in mesh. In most Radio receiving sets the tuning inductance is varied roughly, while the fine adjustments are accomplished through the medium of a variable condenser.

Spider Web Coils

(236) RIK

I am building a regenerative receiving set, and would like some advice on coils. I am using three spider web coils and in the hook-up printed below. The hook-up was originally intended for three tuning coils. Can spider webs be used of the following are their dimensions: 1st (hinged) 24 turns of 22 B and S; 2nd (stationary) 20 turns; 3rd (hinged) 28 turns?

A.—Yes. See page 13 of our fourth issue, Fig. 8. The middle coil is stationary.

Body Capacity

(237) RCH

Can you suggest any better single bulb hook-up other than this?

Is there not always some body induction in connection with the use of Variocouplers and Variometers.

Thank you in advance for any suggestions you might make.

A.—The Honeycombs are best for all around use.

Your hook-up is all right.

There is a hand induction in any set unless the panel is grounded.

Difference in Tubes

(244) FD

I have been getting your magazine or paper RADIO DIGEST since the first time I saw it in the book store and I think it is all there. I want to ask a few questions.

1. Are the Audiotron tubes type C-300 and C-301 the same as Radiotron type CV-200 and VV-201, if not, what is the difference and if the same why do they name them different?

2. Will Thordarson Amplifying Transformers work well with these tubes.

3. Would you give me the inside wiring diagram of the instrument on page 5 of April 29 RADIO DIGEST.

A.—1. They are the same but made by different companies.

2. Yes.

3. We are unable to give the wiring of this set, owing to the fact that manufacturers wish to protect their circuits.

Variometers

(189) CGM

Please tell me if the circuits enclosed will work, if not, what alternations shall I make and are they efficient.

If variometer is wound with fine resistance wire will this increase its wave length and amplifying qualities.

Describe how to make a power transformer suitable for the set enclosed.

Where can I secure such a transformer and what is its cost.

A.— 1. Your hook-ups are O. K.
2. No.
3. You can purchase one at any Radio Supply Store. Instructions on how to make will be given in later issue.

STATION SCHEDULES

(Continued from page 9)

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

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

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

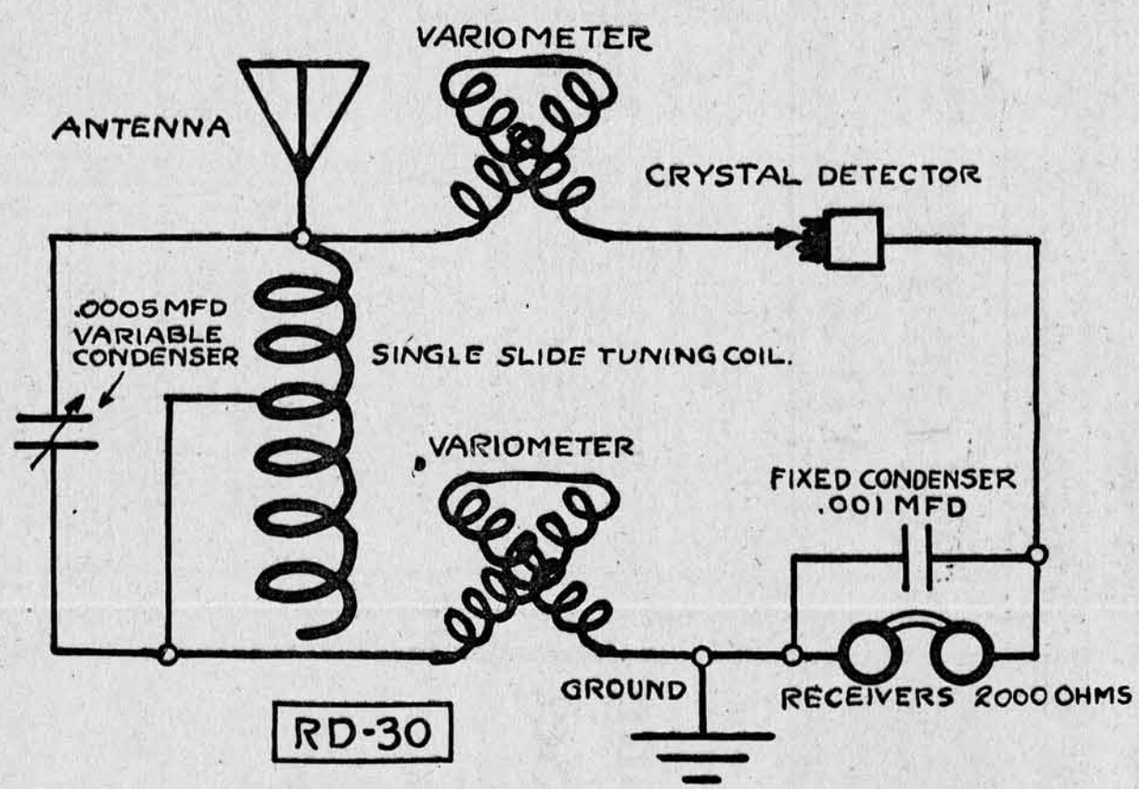
9WD, Denver, Colo. W. D. Pyle. Sat, 8-9:30 pm, concert. Sun, 5:30-7:00 concert. Mountain time.

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

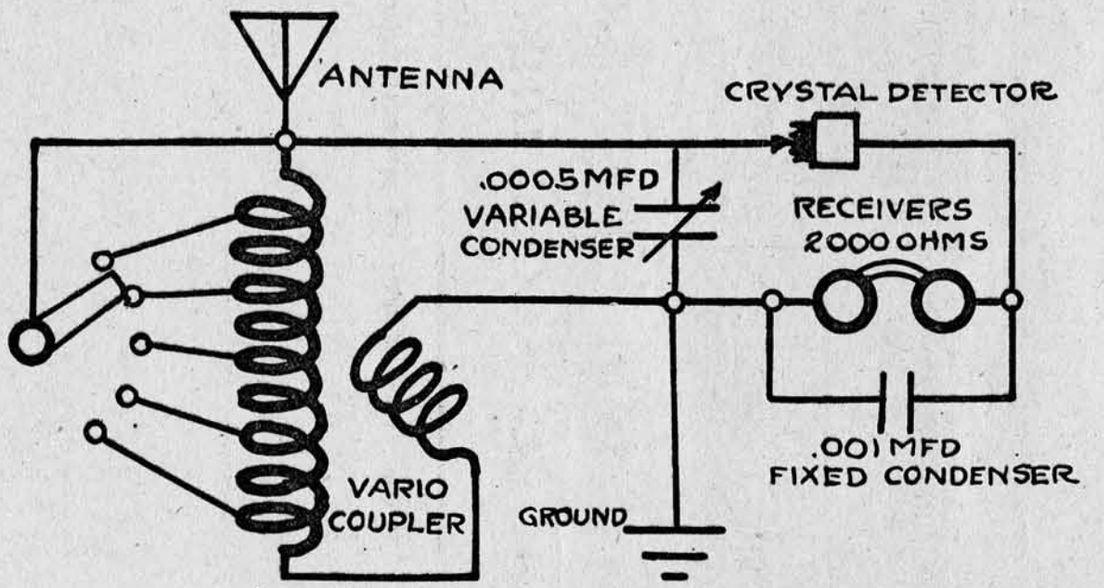
Radio Digest Illustrated

No 9

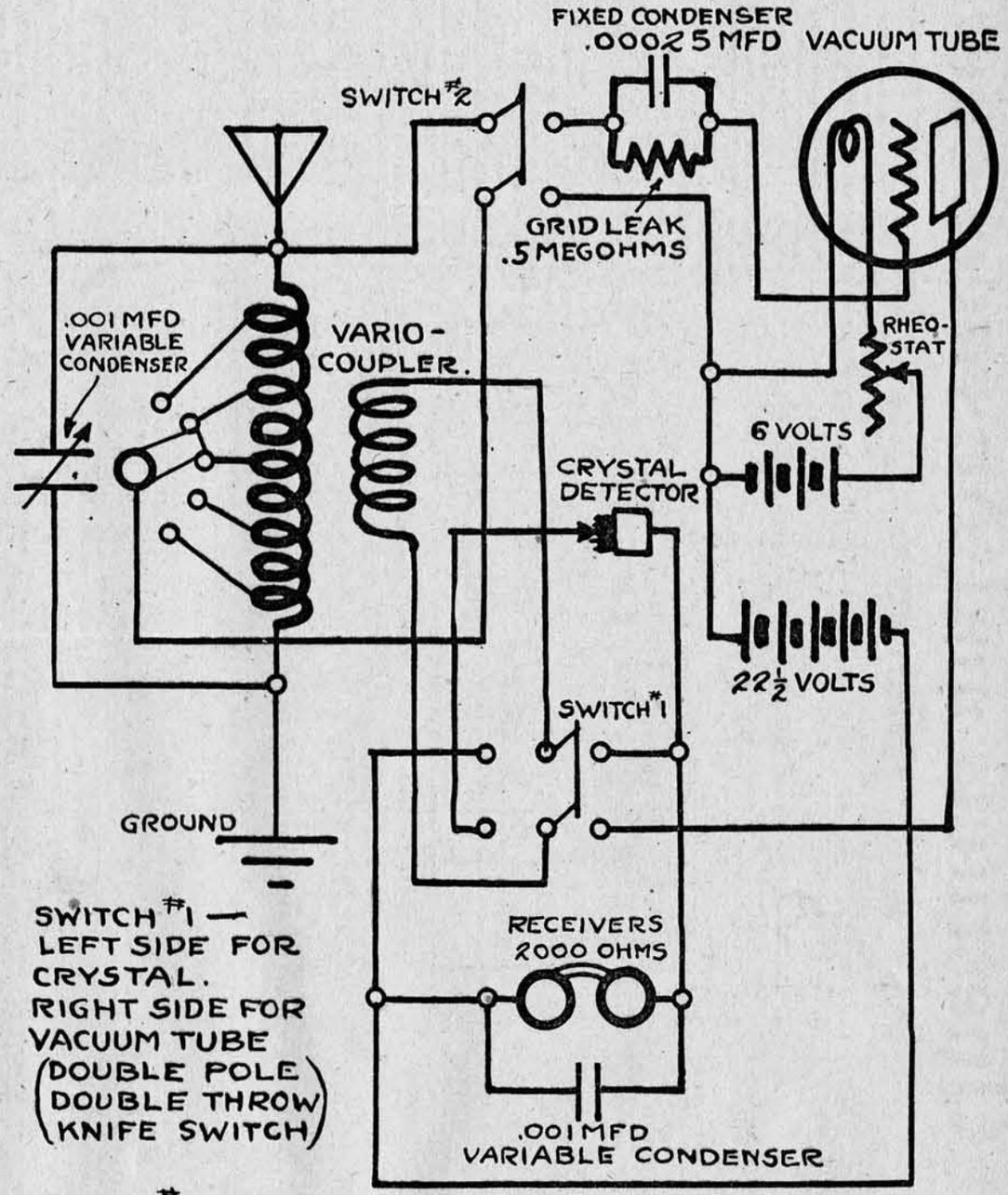
By: Harry J. Marx.



RD-30



RD-31 USING VARIOCOUPLER AS A VARIOMETER.



SWITCH #1 — LEFT SIDE FOR CRYSTAL. RIGHT SIDE FOR VACUUM TUBE (DOUBLE POLE DOUBLE THROW KNIFE SWITCH)

SWITCH #2 — OPEN FOR CRYSTAL. CLOSED FOR VACUUM TUBE (DOUBLE POLE SINGLE THROW KNIFE SWITCH)

RD-32 USING TWO SWITCHES FOR CHANGING FROM CRYSTAL DETECTOR TO VACUUM TUBE.

Questions and Answers

How Big is Your Bankroll?

(167) REG

Having been away at school for some time I am all "behind the times" on Radio dope, so I want to know a "lot." I have just subscribed to the RADIO DIGEST and wish to take advantage of the question department by asking a whole raft of questions.

1. First, is there any legal "objections" to my putting a receiving station here in a gasoline shop to get broadcast?

2. I don't care to put up a conspicuous aerial but I have an opportunity to put up a one wire aerial about two hundred feet long with one end sixty feet high and the other thirty feet high, running north and south over a block of buildings. (There are no tin roofs under this prospective location.)

3. I want to be able to get market reports and concerts from KYW. I will want a vacuum tube outfit and a loud speaker, possibly a Magnavox, with two stages of amplification. Please advise me what my outlay must be and if it isn't too much trouble recommend a hook-up to relieve my ignorance. I will be intensely grateful for any assistance you can render me on the things I have here outlined.

A.—1. No!

2. An aerial 150 feet long including the lead-in and ground wire is enough.

3. Roughly speaking about $100. In issue No. 5, page 14, R D-16, is given a very good hook-up.

Long and Short Wave Range

(181) HES

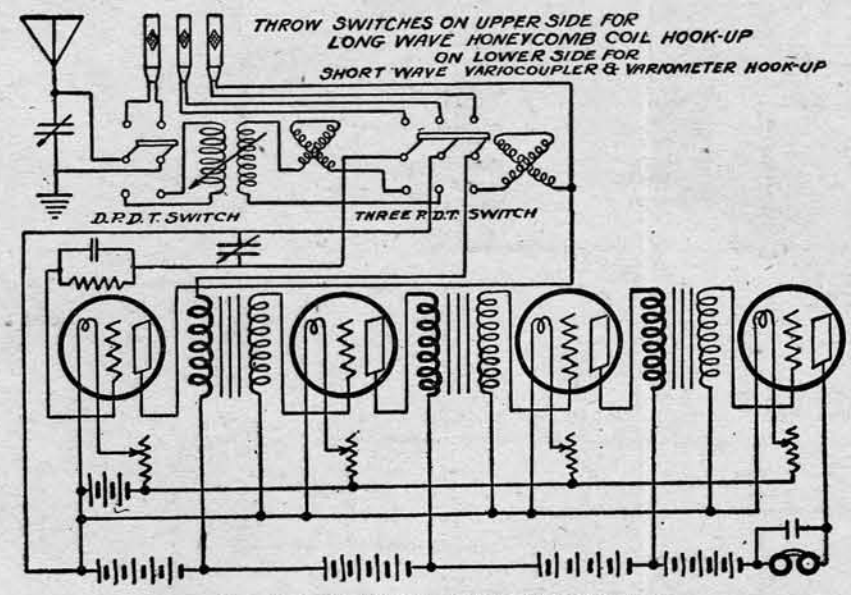
I am beginning the construction of a Radio receiving set, and wonder if you would be good enough to answer a few questions. I wish to use two stages of amplification so that I can listen in on the broadcasted concerts and use a loud speaker. I also want to receive long wave length signals when desired, say up to 2,500 meters.

Most of the V. T. detector sets that I have seen described use the vario-coupler and two variometers. This combination it seems gives a range up to about 600 meters. The commercial loose couplers or receiving transformers claim a range up to 2,500 or 3,000 meters. Now, I would like to ask if one cannot substitute the receiving transformer for the vario-coupler in the V. T. circuit, and obtain as good results as with the 600 meters to 2,500 meters? If this is possible, should the variometers be used? Or would one obtain better results to use the vario-coupler and two variometers for the short wave lengths, and then switch over to the receiving transformer for only the longer wave lengths? Is there any other way in which the wave-length range or a vario-coupler, variometer set can be increased satisfactorily to 2,500 meters?

Would an aerial of one wire 140 feet long give much better results for receiving than an aerial of two wires of 70 feet long each? In case just one wire is used, is it necessary to connect the lead to one end of the wire, or can it be connected to the middle of the span just as well?

A.— The receiving transformer is what you want to use. The only reason the manufacturers are using two variometers and a vario-coupler is that it is compact enough to go into a small cabinet.

One wire would give much better results than two. The lead-in can be connected either at the end or middle.



Q. and A. 249—Long and Short Wave Hook-up

A Good Set Needed

(219) AHH

Will you kindly inform me how far away from Miami, Florida, the nearest broadcasting station is and what type of receiving set I should purchase to listen in on it. I am totally ignorant of Radio and would appreciate your information as to what books I should get to study up on the subject.

I found your very interesting paper on a newsstand in Miami yesterday and am taking the liberty of asking you for information right away.

A.—The nearest broadcasting station to Miami we have on record is in Atlanta, Ga.

You would need a vacuum tube detector and two stages of amplification. Make sure your aerial is clear of all obstructions. The ideal aerial is 150 feet long, including the lead-in and ground wire, and as high as possible.

Refer you to our book-review on books.

"Long and Short Wave Set"

(249)

If possible, please answer my puzzling questions.

My aim is to make a set that will receive messages from 175 to 30,000 meters. It will have honeycomb coils for the long waves, and a vario-coupler and two variometers for the short waves. A three step amplifier and loud speaker will be used. Is it possible that you could send a complete hook up and showing the change switch from the short to long wave receiving?

List of parts of set.

2 Variometers.
1 Vario-coupler;
2 Var. cond. (Prim) (Sec)
4 Bulbs, sockets, rheostats, jacks, B and A Batteries.

About what size and Type aerial should I use for maximum efficiency?

It sure would be good of you to send this information via the enclosed letter.

A.—Hook up Diagram is shown, we do not show any jacks as it would make the diagram very confusing. The 7th Issue of RADIO DIGEST, May 27th, will give you information on the use of jacks.

For aerial, we suggest 100 feet single wire on short waves and 200 feet on long waves.

Two Stages of Radio and Audio

(230) RH

My brother and I intend to put up a receiving station which would be capable of picking up broadcast stations in Chicago, which is one thousand miles from here, and we would like to know what kind of apparatus we would need and how much it would cost, not including a Radio Horn.

We do not know which aerial would be the best of the following three, and would like to have your advice upon it. First to make an aerial one hundred and forty feet long, sixty feet high at one end and between thirty and forty high at the other end, having four wires or having one wire between two hundred and two hundred and fifty feet long and about thirty feet high, or a loop aerial on a sixty foot pole. In case of the loop aerial, does it stay stationary or does it have to be turned when tuning in to certain stations.

A.—A single wire 140 feet long will be all right.

You would need at least a vacuum tube detector and two stages of Radio and audio frequency.

Radio Illustrated

About the only way it was possible to get little Peggy Rice to take a bath was to supply her with a concert by Radio while in the water.
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Anna and Lilly Chow, Chinese maidens are great fans. Radiophones have been installed in their homes in the Chinese quarter, San Francisco.
© International

This Radiophone headgear picks up the vibrations through the vocal cords
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President Harding addressing the chamber of commerce. Sound detectors used to catch his speech and broadcast it by Radio.
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