

Radio Digest

EVERY WEEK

Illustrated

TEN CENTS

TRADE-MARK

Vol. II

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No. 7

WRITES WORDS IN SKY

FAN USES AUTO SET TO FIND CONFLICTS

LOS ANGELES MAN ACTS AS NOISE SLEUTH

Circles Car Toward Signal Center; Brief Search Locates Trouble In Three Cases

LOS ANGELES, CAL.—A local Radio fan has become a professional hunter of sources of interference with broadcasting. His methods are ingenious.

He fitted up his automobile with a small antenna on top of the car, adjusted his headphones, tuned his set to the disturbing signals and started on his way. He circled about, moving always toward the point where the interference seemed most pronounced. Finally he would locate the signals in a comparatively small area and then pursue subsequent investigations until he located the origin of the disturbance.

Finds Troubles

In three experiments he traced the trouble to a faulty transformer on the electric-power wire, to a high-tension wire which had rubbed against the branch of a tree, and to a small boy's attempt to build himself an antenna.

The public service company was glad to know of his discoveries and remedy them in the first two cases and the small boy was duly penitent. Now he has a regular aerial.

When the story was related at a meeting of Radio fans it was brought out that the use of a loop antenna, or rather two loops, would simplify the search for interference.

German Post Office to Send News by Airwave

BERLIN, GERMANY.—From long and systematic experiments the German post office has come to the conclusion that Radio telegraph is the simplest and cheapest means of distributing news. The post office has entered into an agreement with a news agency for the circulation of market prices of stocks and prices of material.

Subscribers to the service pay 4,000 marks per annum to the post office for installation and maintenance and a subscription for the news service to the press agency. Reception of news services which are not subscribed for is partially prevented by changing the figures which have to be decoded by the subscribers entitled to the particular service.

JUST THINK OF THE MAIL MAN'S LABORS!

PITTSBURGH, PA.—A well known authority on accounting and federal taxation recently gave a talk over KDKA, Westinghouse station at East Pittsburgh, and not thinking of the range of that powerful station, offered to answer any questions by mail. Within the next few days he received 2,500 requests for information.

WILL RADIO HARNESS NIAGARA?



TEACH KIDS TO BUILD SETS EACH SATURDAY

Birmingham Age-Herald Gives Boys Weekly Instruction

BIRMINGHAM, ALA.—A feature of special interest to youthful operators is the Birmingham Age-Herald's Radio day each Saturday. Several hundred boys are taught now to make simple sets each week. Jack Turner, Radio editor of the Age-Herald, has charge of the demonstration. He also answers the many questions asked by the boys. A contest is also held each Saturday and a valuable receiving set is given away to the prize winner. The Saturday demonstration with the Radio page run on Sunday is making many new subscribers for the Age-Herald.

PARIS FORECASTS MAY BE RELAYED BY BELL

Eiffel Tower to Send Weather Reports to Farmers

PARIS, FRANCE.—The Eiffel Tower Radio station at Paris is preparing to send out telegraphic weather reports and forecasts three times daily. A suggestion has been made that receiving sets be installed at central points in the various country communes and that the information thus received be signaled to the farmers by a code of sound signals from the church bells. For example, no signal if no change in the weather is forecast; 3 strokes of the bell if rain is expected; 6 strokes for frost, and 10 strokes for wind or hail storms.

TYPEWRITER RADIOGRAMS THROUGH AIR

Navy Announces Successful New Airplane Communication System

Is Step Far in Advance

Will Revolutionize Warfare in Clouds—No Radio Knowledge Needed for Operation

WASHINGTON—Typewriting in an airplane flying high in the clouds and simultaneously having Radio apparatus at a ground station miles away reproduce the message in typewritten form, is the latest accomplishment of the Navy Department. Navy officials declare the new achievement is "a means of communication far in advance of Radio telegraph and telephone systems now in use."

The device has been named the "Radio teletype." It resembles the commercial typewriter, in that a keyboard having the letters of the alphabet and other symbols on it arranged for hand operation. Wire line teletypes have been in use for nearly ten years.

Coöperating with the Radio Laboratory of the Bureau, experts of the Navy successfully tested the operation of the teletype by Radio a few months ago, and succeeded in printing messages from a distance of nine miles. The Radio circuit was established between the Bureau of Standards near Chevy Chase and the Naval Air Station at Anacostia, a picture of which is shown.

Plane Experiment Successful

Recent experiments have established the fact that teletype messages printed on a machine installed in an airplane and transmitted by Radio can be recorded on a typewriter in a ground station. Future experiments will undertake the reversal of this operation; the sending machine being on the ground and the receiving apparatus installed in a plane in flight. Great interest is manifest by Naval experts as the new method will permit the

(Continued on page 2)

BELGIUM GETS FIRST WIDE-WORLD STATION

BRUGES, BELGIUM.—Work is in progress on the first large Belgian Radio station for international traffic. Up to the present service has been limited to reception from high-power stations of other countries and distribution to points in Europe via land wire. The circuit was formerly available only to one way traffic.

WRITES WORDS IN SKY

(Continued from page 1)

sending and receipt of duplicate orders of record, eliminating errors and a knowledge of code, besides saving time of re-writing.

The practical tests made assure future commercial uses in aerial news reporting, when a correspondent covering an aquatic event, marine engagement, or sea maneuvers can send his copy straight to the desk. Another value, if aerial passenger lines are extended, would be the receipt and dispatch of typewritten telegrams, stock reports, news dispatches, etc. ready for delivery.

How System Works

The sending instrument is mounted in a standard type of Navy plane. It resembles, in general, the commercial typewriter in that a key board having letters of the alphabet and other conventional symbols on it is arranged so that it may be operated by hand. Each key is connected to the Radio installation in the plane and when a letter is struck on the key board, a Radio impulse is sent out from the antenna of the plane and is received at a station on the ground. The similarity to the typewriter is completed in the equipment of the receiving end of the device. When, for example, the letter A is struck on the key board in the air, the Radio energy released travels to the recording instrument and selectively energizes the type letter A, causing it to be reproduced on paper carried in the receiver.

Will Reverse Operation

As the tests are carried on at present, the transmitting instrument of the teletype is mounted in the plane and the receiver is located on the ground at the station, but, experts who are carrying on the work point out that a reversal of this operation, where the recording instrument is carried in the plane and messages are sent out to it from ground stations, is development merely involving detail. As applied to the Navy, the Radio teletype will be a great improvement over methods now in use for communication between

Ether Waves Demonstrate Efficiency When Irish Rebels Seize Ten Cables

Trans-Atlantic Radio Circuit Given Real Test in Emergency—Afraid Rebels Will Destroy Cables—Radio Corporation's Share of Oversea Messages Shows Big Increase

WASHINGTON.—"An ill wind" may blow Radio communication "some good." In fact, it is very likely that the seizure of ten trans-Atlantic cables by the Irish irregulars, reported by the Associated Press, leaving but seven to carry all the Old World news and dispatches, may give Radio communication the opportunity it needs to show what it can do, especially in an emergency. And to date it is reported that the Radio Corporation of America is clearing all its Trans-Atlantic messages filed between Great Britain and North America without delay.

Officials of the corporation in Washington say they welcome the opportunity to handle the increased traffic and feel that after two and a half years' operation they can handle their share at least. Ordinarily, the corporation carries between twenty

and twenty-five percent of the trans-Atlantic traffic, but now it may get about seventy percent.

Afraid Rebels Will Destroy Cables

The five commercial cables seized in Ireland terminate in Waterville, the four Western Union at Valentia, and the British cable at Ballinskelligs. The trouble seems to be that if the Government forces attempt to regain the stations, the rebels will destroy them, as was the case with the Marconi station at Clifden which operated to Louisburg, Nova Scotia, Canada. The three remaining cables direct to Penzance, England, became overloaded at once and the only Radio circuit in operation, that of Carnarvon, Wales, is busy night and day.

Radio Corporation of America officials admit, however, that the Carnarvon sta-

Typewriting in a plane flying among the clouds with Radio apparatus duplicating the typewritten message miles away on the ground, is a feat recently accomplished by the Navy Department. The photo shows a message reeling off from the receiving set at the Navy Air Station, Antacostia, D. C. © P. & A.



ships and aircraft. With the printed message reeled off on the receiver, much of the chance for error will be eliminated. This will be a marked step in advance, in that it will allow transmission of explicit directions to scouting and combat planes in flight by the commander-in-chief of the fleet and will enable scouts and other types of planes to convey accurate and detailed information to the high command.

The Radio teletype is said by naval experts to be subject to the same static disturbances which are encountered in the Radiophone and Radio telegraph. Static interference is an element to be reckoned with in all phases of Radio and never has been eliminated entirely. The Navy Department, it is said, has been engaged in research work looking to the elimination of static longer than any other Government Department, and while results have been attained which have reduced interference from this source to about half; it never has been removed completely.

Dr. Max Thorek Tells by Radio of Breast Cancer

CHICAGO.—Dr. Max Thorek, famous surgeon and cancer specialist, recently made a special broadcast here at Station WBU on the subject, "The Prevalence of Cancer of the Breast." Dr. Thorek is chief surgeon and founder of the American Hospital, Chicago, which is one of the three theatrical hospitals in the United States. WBU is the municipal broadcasting station of the City of Chicago.

License Six Broadcasters

CHICAGO.—Six limited commercial broadcasting stations were licensed for public service by the Department of Commerce from July 7 to 12. They are: WJAC Capper Publications, Topeka, Kan.; WAJT Kelley-Vawter Jewelry Co., Marshall, Mo.; KFBH Thomas Musical Co., Marshfield, Ore.; WLAJ Waco Electrical Supply Co., Waco, Tex.; WAJU Yankton College, Yankton, S. D.; WJAS Pittsburgh Radio Supply House, Pittsburgh, Pa.

WASHINGTON.—The Egyptian Department of State Railways, Telegraph and Telephones has announced that commercial Radio service is open to the public from the station at Abou Zabal.

RECEIVING RECORDS? SEND THEM IN—

The complete list of receiving record holders appears only once each month. The next complete list will appear in the September 23 issue of RADIO DIGEST. The last complete list appeared August 19. Amateurs who have beaten old records or made new ones will have their names listed each week. Makers of new records or amateurs who have broken old records during the past week are:

Station, Mills Record, and by Whom Heard.

- DN4-925—A. H. Klein, Beaver Dam, Wis.
- KDN-2,200—F. C. Woodford and E. J. Poyser, Canton, O.
- KDFM-115—H. S. Rahiser, Pittsburgh, Pa.
- KFAF-525—M. Johnson, Atchison, Kan.
- KFC-3,600—G. Boucher, Harrisville, R. I.
- KYG-3,000—A. J. Barron, Johnson City, Tenn.
- WAAC-1,100—A. H. Klein, Beaver Dam, Wis.
- WAAP-900—C. D. Mason, Cleveland, O.
- WAAY-435—H. E. Davis, Omro, O.
- WBAH-675—F. C. Woodford and E. J. Poyser, Canton, O.
- WBAZ-1,000—J. & B. Radio Co., Avoca, Ia.
- WCAU-375—C. D. Mason, Cleveland, O.
- WCAV-750—F. C. Woodford and E. J. Poyser, Canton, O.
- Wis.
- WDAP-1,935—F. W. Sullivan, Roxbury, Mass.
- WDAX-300—S. C. Cushman, St. Paul, Minn.
- WEAH-800—H. S. Juday, Eldorado, O.
- WGAL-550—F. W. Sullivan, Roxbury, Mass.
- WHA-950—Wm. Douglass, Guthrie, Okla.
- WHAF-820—M. Johnson, Atchison, Kan.
- WHAM-300—R. U. Waite, Vineland, N. J.
- WHAS-1,060—F. W. Sullivan, Roxbury, Mass.
- WIAH-120—J. & B. Radio Co., Avoca, Ia.
- WJAD-1,100—A. H. Klein, Beaver Dam, Wis.
- WJAX-375—A. J. Barron, Johnson City, Tenn.
- WMB-875—K. McKee, Cincinnati, O.
- WOK-795—H. S. Rahiser, Pittsburgh, Pa.
- WPI-230—R. U. Waite, Vineland, N. J.
- WSL-240—R. U. Waite, Vineland, N. J.
- 2XY-525—A. J. Barron, Johnson City, Tenn.

WASHINGTON.—Reuter's Trade Service states that the Radio telephone circuit between Copenhagen and Bornholm was recently opened to the public.

tion will have to handle both Canadian and United States dispatches, although stations on this continent can relay messages between United States and Canadian points. The Radio system is more flexible than cable communication, they point out, and when one station is loaded, part of its work can be transferred to another. High speed transmission will enable the Radio stations to carry great numbers of messages in periods free from interference, and practically no delay is anticipated.

Four Other Cables Remain

The only other means of communication remaining between the old and new worlds are the three French cables which land at Brest, and one commercial cable to the Azores and Lisbon. The latter usually serves the Mediterranean. Some of these cables are reported to be in poor shape.

Radio stations in Europe and England are used for sending and receiving from specific sections. For example, the new station at Ongar, England serves the Continent and Europe, while that at Carnarvon, in Wales, operates to Canada and the United States. The British Postal Radio circuit near Oxford handles Egyptian traffic.

It would seem that the Radio Corporation of America can handle the American end of the trans-Atlantic traffic with little trouble. The stations at Marion, Mass., Tuckerton and New Brunswick, N. J., and Port Jefferson, L. I., will send, while the receiving station at Riverhead, L. I., will do the receiving from Carnarvon, Bordeaux, Stavanger, Norway; and Nauen and Ellvesse, Germany.

French Amateurs Form Club

HAVRE, FRANCE.—Owing to governmental restrictions, the development of amateur Radio clubs in France has been so retarded that up to date there have been few in existence outside of Paris. The Radio Club of France has recently established its first branch office at Versailles, and its local representative has opened offices at No. 44 Rue des Abeilles and in the grounds of the French National Colonial Exposition.

The program of the club provides for lectures, exhibitions, and advice to amateur radio operators and to commercial operators as well, the idea being to foster the development of the Radio art.

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Looking Ahead

Everyday Analogies for Radio. A continuation of the series by Letson Balliet is soon to start.

Useful Information will be the last of the series by Peter J. M. Clute. This series of articles will be followed by a series written by H. M. Towne, who for a number of years has been employed in the laboratories of the General Electric Company.

How Music Is Broadcast. Have you wondered what goes on inside the Broadcast Station? Watch the future issues of RADIO DIGEST for this elucidating explanation.

Panel Units for Your Receiving Sets. Two additional panels of the standard type. The best way for an amateur to build up his set is by standard panels.

Broadcasting Directory. Gets better and larger each week. The only convenient reference to aid you in finding a station heard.

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RADIO "LIGHTHOUSE" ON SCOTLAND COAST

DESIGNED ON MARCONI DIRECTED WAVE BASIS

System Reported, After Tests, to Be as Accurate as Airwave Compass

LONDON, ENGLAND.—The first "lighthouse" in Scotland has been erected off the east coast on the island of Inchkeith. Its operation during the experimental period indicates that it will remove one of the last terrors from navigation.

Its design is based on the principle of reflected waves outlined recently by Guglielmo Marconi before the Institute of Radio Engineers at New York. The exception is in the reflector which revolves in the same manner as the reflector of an ordinary lighthouse.

The system will act as a warning to ships in foggy weather when they are in a dangerous water. In normal times it is as accurate as the Radio compass in giving a ship its bearing. The system is described in paper read by C. S. Franklin, before the Wireless Society of London.

"The general idea is that a transmitter and reflector revolving will act as a kind of Radio lighthouse. It is not intended at present for long ranges, but rather that revolving reflectors should be erected in position, similar to those at present occupied by fog signals, and be capable of similar ranges so as to give the position to ships during fog when within about ten miles of the danger point.

Short Wave Used

"An experimental revolving reflector was erected on Inchkeith, and tests were made to the steamship Pharos with a 4-meter wave. Using a spark transmitter, a reflector of 8 meters aperture and a single valve receiver on the ship, a working range of seven nautical miles was obtained. The reflector made a complete revolution once every two minutes, and a distinctive signal was sent every half-point of the compass. It was found that this enabled the bearing of the transmitter to be determined within 1/4-point of the compass, or within 2.3 degrees.

"These results were good, but it was desired to know the effect of putting the transmitter lower down at the point of the island where ships would pass quite near. A new and larger reflector was designed, and erection has just been completed.

Method of Receiving Bearings.

"The best method of giving the direction to a ship by means of such a revolving beam required consideration. The method being adopted is, the author thinks, the most practical one. When listening in a receiver to a moderately sharp revolving beam the signals are heard only for a very short time. Taking the case of such a beam, as produced by the 4.28 meter wave; supposing it makes a complete revolution in one minute, then at four miles with the receiver at maximum sensitiveness signals will be heard for seven seconds every minute. Near the limit of range signals will be heard for only about four seconds. The exact time of maximum signals is not easy to determine by ear, but the times of starting and vanishing are easy to determine, as the rate of rise and fall of the signals is extremely rapid. The time half way between these two times gives with great exactness the moment when the beam is pointing to the ship.

Use Stop Watch

"It would be quite possible to send a general broadcast signal when the beam passes through true north; then by arranging for the beam to revolve at a perfectly uniform rate, the bearing on the ship could easily be determined by means of a stop watch. This method is probably the most accurate, but has some disadvantages. It entails accurate timing mechanism at the transmitter, the use of waves, and three, or perhaps four, re-

(Continued on Page 4)

LIBRARY MEETS BUGS' DEMAND FOR BOOKS

BIRMINGHAM, ALA.—Radio bugs here are swallowing up all the reading matter that they can obtain on their favorite subject. As a result of the run on the public library, Lloyd Josselyn, director, has established a special Radio department with scores of books on the shelves. It is now the most used part of the library according to Director Josselyn.

CANADA LIFTS BAN ON RECEIVING LICENSES

OTTAWA, CANADA.—The Naval Department of Canada recently announced that all national restrictions on Radio receiving licenses were canceled and that anyone, regardless of nationality, may obtain a license. These are issued by Canadian postoffices, who are invested with the power of issuing them. Every receiving station must be licensed.

SHIP DOCTORS TALK ON CASES BY RADIO

NEW SYSTEM MAKES SEA CONSULTATION EASY

Steamship Line Establishes Medical Service to Give Advice to All Vessels

BOSTON, MASS.—Taking precedence over all but SOS messages, a new system of medical service and consultation for ships at sea has been established by an American steamship company. While primarily designed to assist vessels not carrying medical officers, this service is free to the ships of all the nations. It has been worked out by George S. Davis, general manager of the telegraph department of the United Fruit Company, whose steamships all are equipped with Radio systems. Announcement has just been made of the service by Andrew W. Preston, president of the company.

"This means," said Mr. Preston, "that the captain of any steamship requiring medical assistance may Radio to one of our hospital or passenger ships the details of a case of illness or accident on his vessel and receive, without charge, as far this company is concerned, experienced medical advice.

"While the service is mainly for ships not carrying doctors, it is also at the disposal of vessels whose medical officers desire the benefit of consultation with other physicians. For instance, in the case of an obscure malady or one where the patient's symptoms may indicate complications, a ship's doctor may call our hospital staffs and medical men into consultation to add their experience to his own."

Has Many Hospitals

The United Fruit Company and its subsidiaries maintain hospitals and Radio stations in Panama, Costa Rica, Colombia, Guatemala and Honduras. All of the passenger steamers as well carry physicians. In addition, Radio stations are maintained in New Orleans and Burrwood, La., Fort Morgan, Ala., and on Swan Island in the Caribbean Sea. The company's instructions state that radiograms requesting advice should be signed by the captain of the ship and should give briefly but clearly the symptoms of the person afflicted.

Such Radiograms are to be addressed "Unifruitco" and sent to the company's hospitals at Santa Marta, Colombia; Port Limon, Costa Rica; Almirante, Panama; Toia, Honduras; Puerto Castilla, Honduras, or Puerto Barrios, Guatemala. They may be transmitted also to the company's steamships, being addressed to "Ship's Doctor," followed by the name of the ship. It is requested that when sending medical advice Radiograms, operators check them (number of words) and charge them "Dh. Medico."

Invents Set Requiring No Grounds or Aerial

NEW YORK.—A new achievement in Radio apparatus, the electronaire, without antenna or ground wires, or outside connections of any sort, yet receiving messages sent by Radio telephone, has been perfected by David Grimes of the research department of the American Telephone and Telegraph Company.

The instrument was recently tested while placed in the tonneau of an automobile on a ferry boat in the middle of a river and performed as in a room.

To emphasize the entire freedom of his invention from "directional effects," Grimes drove his car around a number of sharp curves, but the messages were received uninterruptedly.

The electronaire employs what is termed a "receptor" for picking up Radio waves. This overcomes the necessity for using any outside wires. Details of Mr. Grime's "receptor" have not been announced.

DANCES A LA INDIAN TO RADIO



Poaches Jackson, Indian film star, does a dance of her people, using ether wave music © U. & U.

Postal Experts Claim Aerial Antenna Passe

WASHINGTON.—Experiments have convinced postoffice experts that the day of aerial antenna for Radio receiving has passed. According to Superintendent J. C. Edgerton of the Radio section, post office department has been using "large vertical outside multiple turn loops," "underground horizontal loops" and "underground antennae," and has had much success in eliminating static interference.

"The horizontal buried loop has been very successful," Superintendent Edgerton announced, "when well insulated and buried in water or very damp earth."

Japs Build Station on Strait

NAGASAKI, JAPAN.—Telephone communication by Radio will be opened across the Chosen Strait in the early part of this month. The stations at Fukuoka and Fusan contain the necessary equipment and it is expected that the shipping of Kiushu and Chosen will use the service.

Movie Shows Station Workings

LOUISVILLE, KY.—Through the agency of a movie reel the people here and throughout Kentucky are this week being shown how things are done at station WHAS. This reel is to be sent all over the state.

THE ANTENNA BROTHERS

Spir L. and Lew P.

A Bad Pair of Receivers



NEARLY ALL OCEAN RADIO WAVES IN USE

TRANS-ATLANTIC LENGTHS SCARCE, SAYS EXPERT

E. T. W. Alexander Warns of Interference Due to Crowding Number of Stations

STOCKHOLM, SWEDEN.—"Apply for your wave length now, or you will be left out in the cold," was the friendly advice given to Sweden by E. T. W. Alexanderson, of New York, chief engineer of the Radio Corporation of America, while making a brief business visit to Sweden, his native land.

The Radio Corporation has entered its bid for delivery of apparatus for the new high-power Radio station which Sweden is now building on its west coast.

In an interview with the Stockholm press Mr. Alexanderson explained that only an extremely limited number of trans-Atlantic Radio stations could operate successfully at one time without serious interference.

Few Wave Lengths Left

He said that various countries already had reserved most of the wave lengths suitable for trans-Atlantic communication, and only a few were left. The wave lengths best suited for such transmission are between 10,000 and 20,000 meters. The wave lengths between 11,500 and 17,000 meters have been reserved, while Poland has applied for the 18,000-meter length.

Mr. Alexanderson declared that, in his opinion, Radio traffic should be monopolized by the various governments of the world. Otherwise, he said, the confusion in the air will become so great that all Radio service may ultimately be rendered impossible.

The awarding of wave lengths to trans-Atlantic stations is now made by an international commission, whose next session probably will be held in London this year.

Tests for Alabama Static

BIRMINGHAM, ALA.—Col. L. B. Musgrove, capitalist of Jasper, Ala., and trustee of the University of Alabama, is making a series of Radio tests to determine static conditions of the atmosphere throughout Alabama. This work is being done for the university. The latter is planning to install a broadcasting station at Tuscaloosa together with receiving sets at various public and high schools over the state to be used by the university for educational work in connection with the extension department.

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Radio Power Transmission

By Charles P. Steinmetz

THE SUCCESSFUL development of Radio communication by telegraph and telephone, raises the question of the possibility or impossibility of Radio power transmission.

In some respects, Radio power transmission exists today, for the message which you receive by Radio, has been carried by the power of the electro-magnetic wave from the sending to the receiving station. However, while the sending station sends out electro-magnetic waves of a power of several kilowatts or even hundreds of kilowatts, this power scatters in all directions, and it may be only a fraction of a milliwatt which we receive, that is, less than a millionth of the power sent out. But this small power is sufficient, when amplified, to give us the message.

The problem of power transmission essentially differs from that of the transmission for communication, that in power transmission most, or at least a large part of the power sent out by the generating station must arrive at the receiving station, to make it economical to transmit the power.

Much Successful Work Done

Hence, the problem of Radio power transmission is that of directing the Radio waves so closely that a large part of their power remains together so as to be picked up by the receiving station. Much successful work has been done in directing Radio waves, and for instance our Transatlantic stations send out most of their power Eastwards. But still even as directed the power scatters over the coasts of Europe from Norway to Spain, so that it is impossible to pick up an appreciable part of it. The limits of impossibility of concentrating a beam of Radio waves may be illustrated by comparison with a beam of light. Light is an electric-magnetic wave, differing from the Radio wave merely by having a wave length many million times shorter. While usually the light scatters in all directions, like the Radio wave, we can direct it in a concentrated beam by the searchlight.

Scattering Effect of Searchlight.

But there is inevitably a scattering of the light in the searchlight beam, and when the beam starts perhaps with a square yard section at the searchlight mirror, at 10 miles distance it has at the very best scattered to a diameter of 2000 feet, and at 100 miles distance the beams cover a section of 16 square miles.

If it were a beam of Radio power, it would thus require at 100 miles distance a receiving station covering 16 square miles—about four miles wide and what is still more difficult, four miles high, to pick up a large part of the power. The cause of this scattering is two-fold. First, the inevitable imperfections of any apparatus. No matter how perfect a reflector, there are slight imperfections, and at 100 miles distance, they seriously count. Furthermore, even with an absolutely perfect reflector, the beam of light would stay together only if the light came from a mathematical point. As it must however come from a small area, this causes an inevitable scattering, which at best gives an angle of scattering of about two degrees. This is about 100 times as much as would be permissible to economically transmit power a hundred miles by a direct Radio beam.

Probability is Small

Thus the probability of power transmission by directed Radio is very small, except perhaps in very special cases, the distances are moderate and the efficiency of transmission of secondary importance.

The second possibility of Radio power transmission—at least theoretically—is by resonant vibrations or standing waves. Suppose we had a very large sending station sending out electro-magnetic waves not of hundreds, but of hundred thousands or millions of kilowatts, and suppose we could find a wave length, where the absorption in the passage of the wave through space is sufficiently small so as to be negligible compared with the amount of power. Assuming first there were no receiving stations. Then

Carter Radio Co.
209 S. STATE STREET
CHICAGO
CARTER TU-WAY PLUG takes TWO head sets at same time; takes ALL types of cord tip terminals. Price \$1.50 each.
If Your Jobber Is Unable to Supply, Write Us

RADIO MAILING LISTS
6900 Retail Radio Dealers covering the United States, by states, price per thousand . . . \$ 7.50
838 Radio Manufacturers per list 10.00
1022 Radio Supply Jobbers per " 10.00
260 Owners of Radio Stations per " 4.00
14000 Radio Amateurs and Managers of Radio Stations per M. 7.50
These are neatly typewritten and ready to send you on receipt of remittance covering the amount. Guaranteed 95% correct.
Trade Circula Addressing Co., 166 W. Adams St., Chicago, Ill

the waves issuing from the sending station would circle the globe and return to the sending station, and if the wave length is adjusted so that the return wave coincided with the outgoing wave, it would return its power, and little power would be required from the sending station to maintain such a system of high power standing waves, only enough to supply the losses—just as little power is required in an electric wire transmission system, to maintain the voltage wave, as long as no current is taken off.

Power Receiving Station

Suppose now we erect a second station, tuned for the same wave length as the sending station. It would resonate with the standing electromagnetic wave issuing from the sending station, thereby stop its passage by absorbing its energy. It would, as we may say, punch a hole in the standing wave sheet coming from the sending station. Power would then flow into this hole; the sending station would begin to send out additional power to maintain the wave sheet, and this power would be received by the receiving station.

This would give a real Radio power transmission. Any receiving station of suitable design would then be able to pick up power from the universal power supply carried by the standing wave sheet covering the earth.

Several Sending Stations

Also, several sending stations may send out power. These may either have different wave lengths, then would not interfere, and the receiving station could be tuned to receive power from any of the generating stations. Or—what would be preferable—all the generating stations would be tuned to the same wave length, that is, the same frequency. Then they would have to be synchronized and operate in synchronism, just as different electric generating stations on the same transmission line are operated in synchronism.

Theoretically, this is an interesting speculation, but whether it could ever become a possibility, would depend on the question, whether a Radio wave of such length could be found, as to make the losses of power by absorption, etc. economically permissible, and whether stations for such wave length and power would be economically feasible. Furthermore, it would have to be an international development. Therefore, even if such Radio transmission by a stationary electromagnetic wave sheet were possible, its realization at best is rather distant, so that the present outlook for Radio power transmission is very remote.

RADIO LIGHTHOUSE

(Continued from page 3)

celvers on the ship, as well as the use of a stop watch.

"For the short wave two receivers are required, one at each end of the bridge or one fore and one aft. This is necessary to avoid screening by the ship itself. If the broadcast wave for giving the time when the beam passes true north is another short wave, then two more receivers would be required.

Substitute Code Letters

"The method provisionally adopted avoids accurate timing mechanism. On the base of the revolving reflector contact-segments are arranged so that a definite signal is transmitted every half or quarter point of the compass. A distinctive letter is sent every two points and short signs mark the intermediate points and half points. When listening in at the receiver a few short signs are heard and one or two letters. If the letters T, I, O, I, T, I are heard, the half-way position is between South and S. ½ West, and the bearing to the transmitter will be S. ¼ W.

"The apparatus proposed is of a very reliable nature. The spark transmitters are very robust and last for years without attention. The receivers are simple valve rectifiers with fixed adjustments except for a "backing off" potentiometer for dealing with powerful signals at close range. The attenuation of these waves over sea is so strong that a little experience enables distance to be judged by strength of signals, and this can be measured by means of the potentiometer. The only qualification necessary for a person determining the bearing is the ability to read a few code signals."

Complete Two British Stations
WASHINGTON, D. C.—The British annual Colonial report for Gambia notes the completion of Radio telegraph and telephone stations in that colony at Bathurst and at McCarthy Island, 176 miles distant. These stations are intended for internal communication, as the colony has no organized telegraphic wire systems.

COPENHAGEN, DENMARK.—Iceberg warnings are sent out daily from the Danish government Radio station at Blaavand, giving reports of the position and movement of bergs in Danish territorial waters.

CINCINNATI TO HAVE SHOW OCTOBER 7-14

RADIO EXHIBITS TO REVIEW IMPROVEMENTS

Management Will Offer Valuable Prizes for Best Receiving Sets Built by Amateurs

CINCINNATI, O.—Arrangements have just been completed for the Cincinnati Electrical and Radio Exposition which will take place October 7 to October 14, inclusive, at Music Hall here.

In addition to the Radio entertainments and discussions there will also be given demonstrations and informative talks upon the use of electrical household labor-saving appliances by domestic experts. The Radio section of the exposition will embrace exhibits of the many improvements and developments perfected in recent months and taking place at a season of the year just after radio communication has suffered somewhat by the impediment of "summer static," the inventions and discoveries that have minimized that handicap will receive particular attention and attract special interest.

The management has arranged to attract and encourage the amateurs of this section by offering valuable prizes for the best home-made receiving sets made by pupils of the grade and high schools of the city and vicinity.

A noteworthy series of demonstrations will be given in both Radio sending and receiving. The management has arranged to broadcast concerts from one of the annexes, receiving and amplifying them in the auditorium so that auditors and spectators may visit both the sending and the receiving stations and visualize and hear Radio communication from both ends.

January to See 2nd Annual Radio Show in Windy City

CHICAGO.—The second National Radio Exposition will be held here in January, according to Milo E. Westbrooke, exposition manager. Mr. Westbrooke states that in plans of advertising he is preparing a directory telling where to buy Radio sets, parts and supplies. This will be mailed to a large list of Radio dealers throughout the United States.

Cleveland Exposition Postponed

CLEVELAND, O.—The Cleveland Radio Exposition has been indefinitely postponed. The period for which it was first scheduled was August 26 to September 4. The Electrical League of this city may sponsor the exhibition later.

SAN FRANCISCO.—During the great Shriners' parade held here several weeks ago reporters sent in their stories verbally by means of a Radio sending outfit on an automobile truck.

"ALL-AMERICAN"
Amplifying Transformers
Two years of successful use all over the world guarantees permanent satisfaction. Radio and Audio Frequency.
SEND FOR CIRCULARS
RAULAND MANUFACTURING CO.
35 South Dearborn Street Chicago

DEPEND ON CRAMER RADIO



SPECIAL
FOR 30 DAYS THIS \$80 RECEIVER for ONLY \$45
The CH5 receiver needs no introduction. Judged by any standard it is without equal anywhere. Simple in control; handsome in appearance; super-efficient in operation. Includes in its 150 to 3,000 meter range, amateur, commercial and Navy waves, special land stations, ship stations and Arlington "time." Employs latest inventions. Especially efficient for radiophona concert reception. Guaranteed in writing for one year. Regular price \$80—and worth it! **SPECIAL PRICE Only \$45.**
ORDER ONE NOW!
Send cash only—no C. O. D.'s. Only one sold to a customer.
W. R. CRAMER CO., Dept. 1, Omaha, Neb.
"PIONEER RADIO MANUFACTURERS"

FORESEES RADIO AS POLICE AID

Captain A. H. Munday Holds Great Hope for Future of Airphones

Fire Laddies to Benefit

Predicts Installation of Sets for News Reporters and as Kiddies Amusement

By Captain A. H. Munday.

What is to be the future of Radio?

This is one of the most arresting questions of the present day and one that is in a way neglected because Radio "bugs" and "fans" all over the world are altogether too interested with present day Radio pleasures and experiments to even give the question a passing thought. Radio enthusiasts sprung up over-night, as it were. Ever since that time they have been kept far too busy absorbing the latest improvements and reading Radio literature to think of the future. To many the future may prove a pleasure deferred, and one that will prove to be far more attractive than present day affairs in the Radio realm.

Law Enforcement Aspects

One of the future uses of the Radio will be one of the most useful in helping to enforce the regulations of the law. Even at the present time, the various heads of the police departments throughout the cities in the United States and Canada are making exhaustive inquiries. It will not be long before every policeman walking a beat will be equipped with a receiving and transmitting set. The aerial wires will be concealed beneath his tunic and the ground wires will run down his leg to an iron heel.

It has been suggested that a buzzer, controlled by the Radio receiving circuits, be attached to his sleeve. A buzz will then attract his attention and inform him that he is wanted at headquarters. The other instruments will be compact and probably packed in a pocket of his tunic or in a small pouch onto his belt. In this way the officer of the law will be where he is wanted. At least there will be no good reason for his absence, and he will be ready at a second's notice to report where wanted. If, for an example, there is a "free-for-all," a hundred or so "Radio constables" can be informed instantly where to go and their sturdy forms will loom out of every corner. This will all happen before the offenders can do any serious damage.

Canoeing Made More Comfortable

Another future popular use, and one that is at present an innovation, is the application of Radio outfits to canoes. While paddling many miles from shore enthusiasts will be able to listen in on band concerts and the like.

The distinction of being one of the first persons in Canada to use a canoe Radio goes to a Walter Wood of Toronto. A few weeks ago he equipped his canoe and while paddling on the river Humber in the environs of Toronto he heard a complete concert. Mr. Wood is well known both in the United States and Canada as "3EI." He did not, of course, equip the Germaine for protection but as a means of entertainment. Drifting down the Humber every evening Mr. Wood picks up broadcast programs from Buffalo, Pittsburgh, Schenectady, N. Y., Cleveland and Detroit with perfect clearness and surprising ease.

The apparatus installed consists of an A battery, B battery (110 volt), two pairs of phones, Magnavox, a Jewett (Canadian) detector and a two step audio fre-

quency amplifier coupled to a regenerative detector.

Aerial and Ground

The ground used is ten feet of heavy copper wire dropped over the side of the canoe. The aerial is a collapsible spiral copper helix, with a natural wave length of about 150 meters. The Germaine's antenna is one of the best suited for this purpose, with a possible exception of the loop aerial coupled to several more stages of amplification.

Physician Finds Set Useful

Another feature of the new age will be the Radio doctor. At least one prominent physician has found other waves of use in his profession. As he is speeding about on his regular visits he keeps the receivers on his ears. His wife—an efficient operator—gives him the latest reports and calls. It is not unusual for the doctor to be reading a newspaper while being driven when suddenly the call will come: "Doctor Wilson, Doctor Wilson—Doctor Wilson" there is a short pause and then: "Accident on Bright Street—accident on Bright Street—little girl with broken leg—little girl run over by automobile truck—has broken leg" or "Urgent call—urgent call from Mrs. Emmitt—Mrs. Emmitt seriously ill—another attack." The doctor then orders the driver to change his course and speed to the house or the street where his services are required.

He can also send messages to his house from time to time to order various medicines to be sent to his various patients and also, in special cases, to summon a nurse to be sent to a certain residence. Many a man and woman may possibly owe their lives to Radio in the future via the doctor and his Radio car.

Such a car will also be valuable to the business man who is obliged to make long journeys from his home office. It is not uncommon to-day for business men to have a haunting fear that while absent from the office some question of vital importance may arise which needs an immediate answer. With a Radio set installed in his car he need no longer fear the results because any question could immediately be given his attention without delaying his journey.

Firemen Can Determine False Alarms

In case of fire departments, Radio will also render a valuable service. The engine, rushing to answer an alarm, will be recalled when the alarm is found to be false. Again arriving at the fire, further help is found necessary, the firemen will send a call for aid in a tiny fraction of a second.

Compact sets are going to be in great demand this coming winter and specialists are at present turning their attention in this direction. Sets in fountain pens, pencil cases and razor boxes will be ingenious affairs. One of the latest sets is a neat little device which resembles a book. On each cover is mounted a "pancake" coil. The distance between the coils can be varied by opening or closing the book. Very efficient tuning is the result. The detector is contained in a small tube resembling the case of a clinical thermometer. The former fits into the binding.

Newspapers Plan Sets for Reporters

One of the leading newspapers is at present considering equipping the lady reporters with small garter sets. Attached to the garter will be a short wire on a spring that will be fastened to the sole of the reporter's foot. Another wire, considerably longer, will be extended to her hat frame. This will make an admirable antenna system. The receiver will be carried in a vanity case and can be secured in a second when required. By means of this set the reporter while away from the office, will be able to receive instructions from the news editor.

In an important way the child fans are going to be the ones to foster these new

spheres of use. Judging by the great interest at present shown by the children, great strides will be made. There is undoubtedly a great future for Radio. The more the subject is considered the bigger it appears.

Riga Reports New Phone Station Rigged in Moscow

WASHINGTON.—Recent advices received from Riga state that a new phone broadcasting station, located on the Kursk Railway station in Moscow, was opened by the People's Commissariat of Post and Telegraphs. The station was built by the Nizhni-Novgorod laboratory of the Government, and is designed to broadcast messages and press news sent out by the Government.

Australian Official Gets Outline of British Plans

MELBOURNE, AUSTRALIA.—Commonwealth Prime Minister Hughes has received from the Secretary of State for the Colonies an outline of the Imperial Government's Radio proposals as expounded in the House of Commons. All doubts are now removed as to the efficiency of the high-power stations to communicate over such vast distances.

Draft Radio Bill in Argentina

BUENOS AIRES, ARGENTINA.—No laws have yet been passed to govern Radio telephony in Argentina, but a bill is being drafted for presentation to the next Congress. No regulations prevent the sale of sets. The latter are being manufactured to some extent locally, but of inferior quality and sell at from 200 to 700 pesos.

CONDENSED

By Dielectric

It wasn't so long ago when any of us could sit down and write a list of things for which Radio was being used, but to-day, to write such a list would prohibit our doing anything else. The signal announcing new stuff are coming in so fast it takes a McElroy to get 'em.

If any of you fans travel much by train, you'll appreciate having receiving sets aboard. For instance, a loud speaker in the diner gives you music with your meals, something you could never have before. Those interested—intimately—in stock reports should be careful in choosing their dining hour. Better to listen in at the set in the parlor car. You may leave a perfectly good meal unfinished otherwise. Everything considered, a Radio equipped train makes for good companionship.

Sir Oliver Lodge must have discovered some of his "sprites" dwelling among the clouds and intends making use of them. At least I overheard that much of the gossip. You see parts of the country are very dry, while others parts are distinctly wet. (I'm speaking of water—rain water.) Now Sir Oliver intends broadcasting to the spirits when rain is needed, also supplying them with the necessary electrical current to produce it. In the East all is damped; farther West, it has been one huge dry-cell.

I hesitate to gossip about some things in Radio, heard through our non-selective receiving set. It's not because of any fear of inspectors, at all, but simply that what is repeated may be out of date when it reaches you. They tell us of a new stunt and before signing off, it's "as old as the hills." There's Dr. Plank, for example. I had just recovered my surprise upon learning that Radio had been used instead of a general anesthetic, in operating on a young lady in Philadelphia, when this noted Chicago surgeon makes use of the Radio scalpel to remove cancer. Perhaps by now another M. D. has installed one of those microscopic receiving sets in the head of a deaf man.

Since department stores have been broadcasting, numerous married men wear that worried look. Music and lectures are all right, but when it comes to wifery robbing the hope chest (where the money is kept for new tubes, etc.) to buy those gowns she hears about, then it's time something was done. Well, let me tell you he-fans something. Our wives bought gowns before the first broadcast station was thought of. Besides, if they enjoy listening in, those open circuit socks will be darned a blame sight quicker to the strains of sweet music coming from the loud speaker.

The late Dr. Alexander Graham Bell, inventor of the telephone, was responsible for the knowledge that an arc light acts as sort of a detector unit. Passing under one not long ago, I noticed a swarm of insects crowding around it and thought they were attracted by the light. Now I understand that these little "bugs" were there to enjoy their evening's ether concert.

Transmitting to our Senators in Washington may seem a hopeless task sometimes. They don't always try to get our signals. Senator Edge, of New Jersey, kept his tubes burning long enough recently to receive a message from several Radio clubs in his state protesting against an alleged monopoly in manufacturing Radio materials. We fans need to loud speak our thoughts on matters which concern our hobby. Why not broadcast to our rectifiers in the Senate? They'll eventually get us through the interference. Senator Edge's action may result in burning out some gassy bulbs before anything is done, but it will pay to keep the C. W. flying.

Ether waves—Steinmetz to the contrary—sure did set "Pussyfoot" Johnson to oscillating while sailing to Europe recently. He's not what you would call a sympathetic galena on the subject of high voltage alcohol. However, "Pussyfoot's" admission before sailing of a lenient attitude toward beer and wine resulted in a Radio message of congratulation from a WET association. He made the ether buzz with his reply. No, he's still a very sensitive crystal on the subject.

Another of Marconi's statements while visiting us, to the effect that Radio might some day be used in detecting the condition of ignition systems on autos, leads me to a new hope. If he will only devise a scheme of announcing when the gas in the tank is fading, I'll be very much obliged.

We are signing off for this week.
—Dielectric.

While the aerial on the canoe is as yet an innovation, Capt. Munday declares that it will not be long until this will be among the most popular styles of receiving sets. And he also assures us that the enthusiasm already shown by children—witness the picture to the right—in ether waves promises great strides in the development of the science to be made by the rising generation.



MODIFY PLANS FOR RADIO GLOBE CHAIN

ENGLISH OFFICIALS ERECT DIRECT TRAFFIC PLANT

Decide to Discard Step-by-Step Scheme for Circling Earth; Cut Out Four Smaller Plants

LONDON, ENGLAND.—Important modifications have been made in the scheme for linking the Mother Country and the overseas dominions in one continuous chain of wireless communication. For some time to come the chain will lack some of the smaller links. The stations that have been temporarily cut out are Suez Canal; Singapore; Hong Kong and East Africa.

Instead of proceeding by geographical steps of about 2,000 miles each to Australia, South Africa and India, the government has decided to establish direct communications, and for this purpose a great new Radio station will be erected capable of developing 240 kilowatts of high frequency power, or twice the quantity it was contemplated would be employed, while the scheme was in its inception. This new station will be one of the largest in the world. With the five stations in operation, England, Egypt, India, South Africa and Australia—a service will be maintained capable of handling ten million words a year. When the relay stations are added, it is expected that between twenty and thirty million words a year will be handled.

Probably the new station will be near Bourn, on the southwestern boundary of Lincolnshire. A new receiving station will also be constructed at Banbury, where there is already a receiving station in connection with the Leaflet-Cairo service, which, however, will proceed independently of the new service.

THREATENS CITY RULE OF ANTENNA ERECTION

Aerials Near Power Wires Cause Trouble in Louisville

LOUISVILLE, KY.—It is thought that some plan of municipal regulation of the installation and operation of Radio receiving sets will result from a conference held last week by the Board of Public Safety with the electric and building departments of this city. The aim of the conference was to formulate some measures to regulate antenna installation. Trouble arises from people erecting antenna wires close to or in touch with various power wires in the city. Persons even attach them to telephone poles. The practice may result in bad accidents as well as disturbance to other wires. Radio dealers have sought to caution buyers of receiving sets and to give instructions about precaution which should be exercised in making installation. However, enough trouble has developed to call for preliminary steps looking forward to municipal regulation of installations.

Czecho-Slovakia Develops Transmission of Airwaves

WARSAW, POLAND.—The Ministry of Post and Telegraph of Czecho-Slovakia has carefully studied all the latest developments in Radio. It has sent many engineers to foreign countries to study operating systems.

When weather conditions are favorable a large station will be built at Podebrady, Bohemia, where the natural features are ideal. A central and subsidiary Radio system may soon be established.

The main station will be equipped with high frequency alternators (Letour Bethend type), producing 50 kilowatts in the antenna. The station will be able to produce 50 kilowatts of additional energy. Two towers, approximately 500 feet in height, will be erected. It is estimated that the absolute range of the station will be over 2,500 miles.

Report New French Station Set for Service with U. S.

PARIS, FRANCE.—It is officially announced that the new French Radio station at Sainte Assise, in the Department of Seine-et-Marne, is now open for service with the United States. The service which the Centre Radio-electrique started means a tremendous impetus to commerce by Radio across the Atlantic. The French government has ceased to control Radio in France and private initiative is to take the place of governmental administration.

Plane to Amazon Carries Set
PHILADELPHIA, PA.—A plane bound for the Amazon is equipped with Radio so that it will keep in touch with the world even when at points remote from civilization. Drinking water will be carried in thermos bottles. The distance to be covered is 8,000 miles.

13,700 Meter Waves Used at Cavite Station

U. S. Sets Lengths to Avoid Clash with Jap Signals

SAN FRANCISCO.—After considerable difficulty in reaching a wave length which does not interfere with the transmitting of the British and Japanese Radio stations on the Pacific, the United States Naval Communication Service has determined upon a wave length of 13,700 for eastbound messages from the naval station at Cavite.

A two weeks' test between Cavite and San Francisco showed that with this wave length the signals from the Japanese stations sending from Iwaki did not interfere, as was previously the case. Originally the Cavite station sent Eastern messages on 14,200, but that interfered with the English stations, and 13,900 was tried out with interference from Iwaki. To-day, however, NPO comes through to San Francisco on 13,700. Westbound messages from San Francisco and San Diego are not sent direct to Cavite, but relayed through Pearl Harbor.

BEATS NEWSPAPERS ON STATE ELECTION NEWS

Birmingham Station Broadcasts Returns as Dailies Tabulate

BIRMINGHAM, ALA.—"Beating the newspapers to it" might describe the feat of the Alabama Power company on last Tuesday night when it broadcasted the returns of the state primary election in which a governor and other officials were nominated. While the newspapers were busy tabulating returns, Station WSY of the power company was placing in the ears of its listeners the figures. These came in by telephone to the broadcasting station. Thus people in their homes who had Radio sets were notified of the election returns hours before they received their morning paper. The service was rated as the most valuable one yet attempted by airphone as everybody was interested in the closely contested election.

UNDERWRITERS MAKE RULES MORE LENIENT

Change Requirements for Wire in Ground Connection

NEW YORK.—The requirements of the Board of Underwriters are becoming more lenient. Their latest modifications seem eminently reasonable.

A few months ago a No. 4 wire was required for the ground connection, installed in a very particular fashion. Later a No. 8 wire was acceptable, and now a No. 14 copper wire or a No. 17 copper-clad steel is allowed for the ground connection. This same ground connection may be used as the ground wire of the set.

All Parts for the ARMSTRONG Super-Regenerative CIRCUIT

Prices Reasonable : Send for Circular

Kramer Radio Company
4713 Sheridan Rd., Chicago, Ill.

WESTERN ELEC. TUBES

Made for Signal Corps, U. S. Army

VT1 .. \$8.00

Ultra Sensitive Detector Tube

VT2 .. \$12.00

Enormously Powerful Amplifier for All Sets, Especially Super-Regeneratives. Require 6 Volt Fil. Current.

All Tubes Tested

For Perfect Operation in Receiving Sets. Carefully Packed for Mail Shipment. Orders Shipped Same Day.

25% Cash With Order, Balance C. O. D.

Dealers write for discounts

NATIONAL RADIO Co.
6 N. Wells St. Chicago, Ill.

Book Reviews

Fowler's Practical Radio Text Book. A text book that tells you what you want to know about Radio. It explains Radio in plain language and it will help to get better results from your set. Price, \$1.25.

Radio First Aid. Illustrated with working drawings and complete data as to the necessary equipment and cost of constructing from the simplest to the most modern Radio outfit at home. Price, \$1.

How to Retail Radio. A new book telling of tested plans and methods and policies for the dealer in Radio. Financing, location, store equipment and arrangement. Price, \$2.00.

Elements of Radio Telephony. By William C. Ballard, Jr., M. E. A reliable, authoritative discussion, in simple form, of the essential principles of Radio telephony and their application. The use of mathematics has been almost entirely avoided. Price, \$1.50.

Radio for the Amateur. By A. H. Packer and R. R. Haugh. The underlying principles of Radio thoroughly explained in simple language and understandable illustrations. This book will teach you how to construct and operate a receiving set successfully. Price, \$1.50.

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. Postage stamps in payment for books not accepted. Send money order or check. Book Department, Radio Digest Illustrated, 123 W. Madison St., Chicago, Ill.

Establish Airwave Fog Signal

WASHINGTON.—A Radio fog-signal station has been established at Cape Finisterre in latitude 42° 52' 56" N., longitude 9° 18' 20" W. The signal consists of a musical note of 500 vibrations per second, transmitted on a 1,000-meter wave every 7.5 seconds, sound 0.5 second, silent 7 seconds.

RADIO MANUAL. Everything the beginner should know. How to build and operate an inexpensive receiving set. Sixty-four pages, thirty illustrations. Twenty cents. Post paid. RAYDIO PUBLISHING COMPANY, CAXTON BUILDING, CLEVELAND, OHIO.—Adv.

Eiffel Tower Station Transmits in German

Service Builds Up French-Teuton Friendship

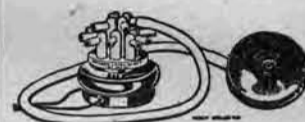
Radio, like art, knows no country. The statesmen, the press, and the "man on the street" in France are as insistent now as on the day the armistice was signed that revenge shall be had on Germany. But, quietly and unobtrusively, Radio has been working towards the creation of a friendly spirit between the two countries.

Prove it yourself. Listen in any day after 11:00 A. M. Central Standard time, and hear FL (Eiffel Tower, Paris), transmitting press news in the German language.

The wave length is 6,500 meters.

★ Radio Bugs! ★ Try This on Your Cat's Whisker

To the tune of Yankee Doodle



Price \$10

Gregg's Listen In set, is a marvel, you bet, through which the waves come abuzzin'.

Attach to the phone you now use alone, and the program is heard by a dozen.

Yes, a dozen hear the news, a dozen hear it dandy. Everyone should have Gregg's Set, because it is so handy.

The family should get Gregg's Listen In set. Does for all, even uncle and cousin. No more all alone. Does one use the phone, the set sends it out to a dozen.

Write for Catalogue

Gregg Company
Room 505, 35 South Dearborn Street
CHICAGO

CROSLLEY RECEIVER MODEL XX Highly Polished Mahogany Cabinet \$100

CROSLLEY
Better-Cost Less

BEAUTIFUL Yes!

And in Addition to That
It is Equipped with a Crosley Four Tube Receiving Set

The Crosley Receiver Model XX is the last word in Radio Instrument design. This model is practically our Model X Receiver built into a highly polished mahogany upright cabinet. Beautiful in design and staunch in structure. The lower compartment is for batteries, charger, battery leads, etc., eliminating all the miscellaneous what-nots that are usually to be seen around a Wireless Telephone Receiving Set. The middle compartment contains loud speaking amplifying horn for use with pair of head phones. This Model is a four tube set, consisting of one stage of Tuned Radio Frequency Amplification, Detector and two stages of Audio Frequency Amplification. Like all other products of the Crosley Manufacturing Company, this unit is non-regenerative and thereby more easily tuned. Furthermore, it stays tuned. During these summer months, receivers in Cincinnati have heard all the large broadcasting stations, such as Kansas City, Chicago, Atlanta, Detroit, Indianapolis, Schenectady, Newark and others, with our four tube sets. No experience is required to operate at its maximum efficiency as it is the personification of simplicity. Music received on this instrument will be heard throughout a large room and often throughout an entire house. Price, without Tubes, Batteries or Phones, \$100.00.



Other sets from \$25.00 up. Radio parts at lowest prices. Write for new illustrated catalog.

Dealers Everywhere
If your Dealer Cannot Supply You, Write Us.

CROSLLEY MANUFACTURING COMPANY
DEPT. R. D. I. 5
CINCINNATI, OHIO

The Radiophonist's Mart

ALL RADIO enthusiasts do not appreciate that the final delicate tuning of their Radio telephone receiver can best be done with the filament rheostat. This condition is perhaps due to the faulty construction and limitations of many filament rheostats now on the market. The proper balance of reactance, resonance, inductance and resistance can only be perfected after adjustment of the other devices in the circuit to their maximum effect by a fine and smooth control of the filament current. Clearness of tone and audibility come from the close setting of the filament current.

Attempts to tune with the wire coil rheostats result in an unpleasant noise produced while the knob is turned. This noise is distracting when working for increase in audibility of a faint signal. It will even drown out the signal. The result of this disagreeable condition is that Radio operators do not attempt to tune with the filament rheostat as should be done, and the pleasure of clear and undistorted tones is not experienced.

With the Bradleystat, manufactured by Allen-Bradley Company of Milwaukee, Wis., this objection is overcome. There



Continuously Variable Rheostat

is absolutely no foreign noise produced when it is used. The incoming sound, music voice or code, can be listened to attentively and the tuning accomplished without distortion. Furthermore, due to the fineness of current control, a degree of clearness and audibility is obtained which is impossible with any other rheostat.

Sliding contacts, loose contacts, or corroded metallic contacts produce an unpleasant "frying" noise.

There are no sliding contacts in this type of rheostat nor is there mechanical friction to cause noises foreign to the vacuum tube. The resistance is made of carbon. It cannot corrode. All parts are under pressure when the current is flowing so that they cannot be loose.

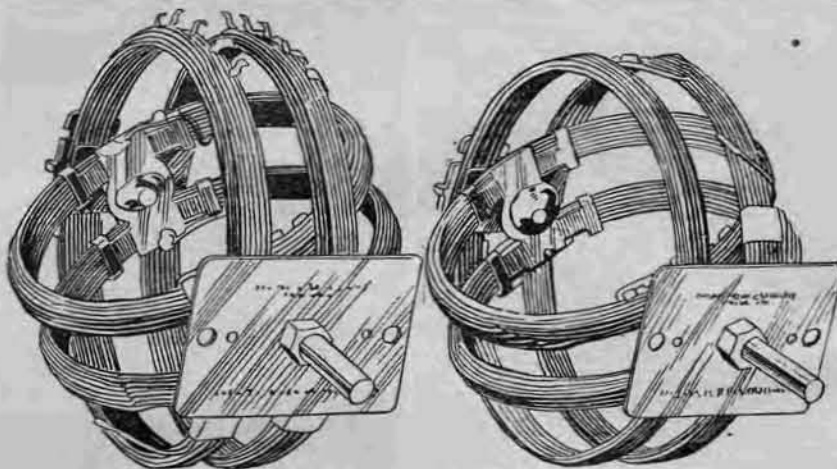
The range in resistance is such as to give the finest of filament current control. In the "off" position, with the knob turned to the left, the filament circuit is open. An internal switch opens the circuit when the pressure on the discs is released and prevents leakage of current from the battery. From the point where the circuit is established to the maximum brilliancy of the filament the change in current is absolutely gradual—positively without sudden changes. Any degree of brilliancy can easily be obtained.

In the full "on" position the resistance is so low that there is only about two-hundredths of an ampere difference between the current flowing and that which would flow with the filament connected direct to the battery terminals. This is true even when the battery is fully discharged.

The Bradleystat can be universally applied to 1/2 and 1-ampere detector and amplifier tubes and to the 5-watt power sending tubes. It may also be used with two amplifier tubes in parallel with satisfactory results.

THE VARIOMETERS and variocouplers shown in the illustration are a new development in construction and are manufactured by the Thompson Levering Company, Inc., of Philadelphia, Pa. These instruments, which serve to vary the inductance and wave length value of any circuit in which they may be used, consist of a set of fixed windings, and a set of movable windings, the latter being rotated within the former, similar to the

Inductances Have Skeleton Windings



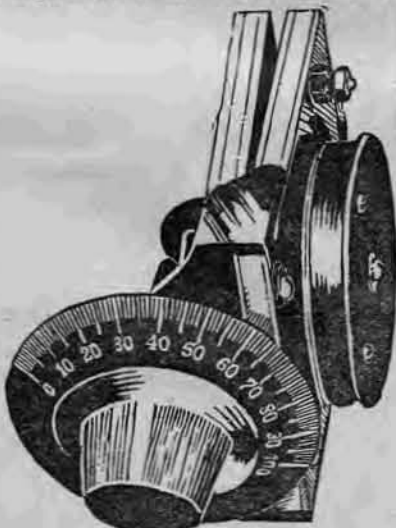
usual construction. When both sets of coils carry the current flow in the same direction, the variometer has a maximum inductance or wave length. When the coils are turned around so that the current flow in both sets of coils is in opposite directions, the coils are said to be "bucking" each other, and the inductance and wave length value are a minimum.

These instruments are "bank wound." The windings are made self-supporting. It is well known that any solid material is inferior to air as a surrounding medium on account of the capacity, effect and losses entailed. The only solid material in the construction are small clips to hold and enable the coils to rotate. For this reason the losses are less than those resulting from the usual type of windings.

The manufacturers recommend these coils for use in the new Armstrong super-regenerative circuit inasmuch as their values fulfill exactly those required for that circuit.

RADIO FREQUENCY transformers have been introduced very generously on the market in all types and forms. Numerous handicaps, however, still must be contended with in transformer type coupling for Radio frequency amplification. For this reason, the Crosley unit, a reactance and capacity form of coupling presents considerable attraction to the amateur who is assembling his entire set.

Most efforts along the lines of Radio frequency amplification have been confined to the use of an untuned Radio frequency transformer, working efficiently over a very narrow band of wave lengths. The unit shown, works efficiently over a band of wave lengths from 200 to almost 600 meters. This is accomplished by the use of a Crosley variable condenser operating in conjunction with fixed inductance, both having extremely low resistance, and consequently the interaction between the



Tuned R. F. Transformer

capacity effect of the condenser and the inductance, as well as external body capacity effects are reduced to a minimum. This permits easy tuning not to be had with any other type of variable control of a tuned Radio frequency amplifying unit. In actual practice this works out by making the combination of the receiver and the unit very simple and easy to tune.

When this unit is used in connection with the detector unit, an amplifier tube is used in the detector and the grid leak, condenser combination is bridged or short circuited. The detector tube is then placed in the Radio frequency unit, thus this new unit contains the Radio frequency tuner and the detector tube and its control.

THE AUDIO frequency transformer manufactured by the General Radio Company, of Cambridge, Mass., known as type 231A presents many interesting features to the amateur.

The remarkable results obtained in long distance Radio communication in recent years have been due largely to amplification made possible by the use of vacuum tubes. The experimenter has been at a decided disadvantage, due to his inability to get suitable vacuum tubes. Fortunately, this difficulty has been adjusted and satisfactory tubes are available.

In order to get the maximum of results from these tubes as amplifiers, they must be used with correctly designed amplifying transformers. The type 231A transformer specially meets this situation. The primary receives the maximum amount of energy and delivers it undistorted in wave form and at the correct potential to the grid of the amplifying tube.

The core construction is such that there is little tendency for the setting up of external fields, with the resultant howling in the audio frequency circuit. The distributed capacity of the secondary is low, so that the maximum potential is obtained on the grid of the tube.

The primary has a direct current resistance of 1,100 ohms, an alternating current resistance at 1,000 cycles of 11,000 ohms, and a reactance at this frequency of 66,000 ohms. These figures for the secondary are 5,500, 130,000 and 700,000 ohms respectively.

In order to obtain the best results from an amplifying transformer, certain precautions should be observed. Since what is wanted is the production of the maximum potential, or rather change of potential on the grid of the amplifying tube, it is best to connect the grid to the outside terminal of the secondary of the transformer. This is because the outer portion of the secondary has smaller capacity to ground than the inner portion, due to the proximity of the latter to the primary winding which is connected to the filament and other low potential parts of the circuit. The capacity effect increases with frequency and, therefore, reduces the intensity of high notes proportionately more than low ones, thus tending to cause distortion. Howling, or oscillation at audio frequencies, is caused by coupling (either electrostatic or magnetic) of the amplifier grid to some other part of the circuit, and is more troublesome with two or more stages of amplification than with one. If the electrostatic and magnetic couplings are made to oppose each other, the tendency to oscillate is minimized, and when a transformer is connected into a circuit it is worth while to reverse the leads to the primary to see which connection is better. In some cases,



Low Capacity A. F. Transformer

the oscillations are above audibility, but the strength of signals is reduced, nevertheless.

In an oscillating detector circuit the capacity of the telephone cords (which is of the order of 75 micro-microfarads) is often sufficient to by-pass the Radio fre-

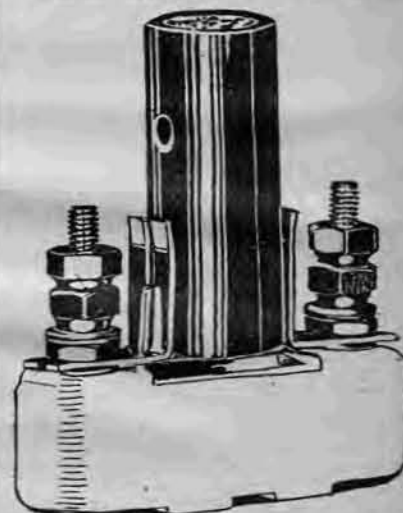
quency current around the high inductance of the phones, but when the primary of an amplifying transformer is substituted for the phones, it should be shunted with a condenser of a few hundred micro-microfarads or more.

Aside from its excellent electrical characteristics, this transformer is well designed mechanically. It is compact, and by means of the four projecting feet, each with a screw hole, may be mounted in any position. The core and coil are finished in black, while the brackets and binding posts are nicked. Particular attention is called to the accessibility of both the binding posts and the mounting brackets.

THE CONSTANT fear of lightning deters many from participating in the pleasure of Radio reception. The vacuum lightning arrester shown in the illustration is manufactured by the Apex Electrical Specialty Company, and is known as the Jacobus vacuum aerial protector.

The "National Electrical Code," rule 86—"C" says: "In Radio stations used for receiving only, the ground switch may be replaced by a similarly mounted and grounded short gap (1/4-inch or less) or vacuum lightning arrester."

Jacobus protectors have been designed to replace the expensive ground switches



Vacuum Type Lightning Arrester

for receiving stations in Radio work. Since lightning always follows the path of least resistance, all unnecessary resistance from the tube has been eliminated. The degree of vacuum is such that the tube will discharge without any time lag whatever. The lead wires in the protector are of extra heavy amperage carrying capacity, and will discharge several hundred amperes to ground momentarily without affecting the operating characteristics in the least. The megohm resistance is over 30,000 when new and dry.

Through the employment of incandescent lamp principles, as well as the elimination of shoulders and strains in the tube, the possibility of lost vacuum has been removed. The life of the protector is not affected by the discharge of lightning or static over it and it is not necessary to replace a tube after each time it functions.

The tube is enclosed in a neat black fiber case, which in turn is mounted on a porcelain mounting block, such as is shown. The entire unit measures 3 1/4 inches long, 3 1/2 inches high and one inch wide.

One terminal or binding post of the protector is connected to the aerial ahead of the instrument. The opposite terminal or binding post goes to ground connection.

The protector is simplicity itself to install. There are a number of ways of connecting it. Whatever hook-up is used, the main essential to keep in mind is that the protective circuit must be the most direct route to an approved ground and one presenting the least resistance.

The weather will eventually destroy the insulation on any device. That is why the telephone companies always install their protective devices inside. If convenient, therefore, fasten the protector on the window sill inside or at the nearest place to the window.

There is now absolutely no necessity for a ground switch. One may be used if desired, but it cannot take the place of the protective device. The protector automatically conducts all of the heaviest static and discharges instantly to the ground.

Cheap Panel Materials

Instead of paying high prices for panel board materials let the amateur and professional Radio experimenter make use of discarded disk talking machine records. The material of these disk records is an excellent insulator and they are very easily cut to the shape and size desired.—Dr. Dan J. Cable, Pittsburgh, Pa.

Radiophone Broadcasting Stations

Corrected Every Week.

CONTENTS AND HOW BEST TO USE—

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

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

Station Schedules

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

CFCA, Toronto, Canada. 400 only. 500 mi. Toronto Star. Daily ex Sun, 7-7:30 pm, baseball, stocks, concert. Tues, Fri, 8:30-9:30 pm, concert, address, Eastern.

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

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

CHBC, Calgary, Canada. 410 also. 1,000 mi. W. W. Grant Radio Ltd. (Morning Alberta). Daily, 8:45-10 pm, news, stock quotations, music. Mountain.

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

CHCC, Calgary, Canada. 400 only. 200 mi. Western Radio Co. (Calgary Herald). Daily ex Sun, 3:30-4:30 pm, music, news, baseball; 7:45-8:45, music, etc. Sun, 7:45-8:45 pm, church service. Mountain.

CHVC, Toronto, Canada. 410 only. 200 mi. Metropolitan Motors Co. Daily ex Sat and Sun, 6-6:30 pm, news, concert. Eastern.

CJCA, Edmonton, Canada. 450 only. 500 mi. Edmonton Journal Ltd. Daily ex Sun, every evening, music, bedtime story, news, weather, markets, etc. Pacific.

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

CJTB, Windsor, Canada. 410 only. 300 mi. Manitoba Free Press. Daily ex Sun, 10-10:30 am, news; 12-1 pm, reports. Mon, Thurs, 8-10 pm, concert. Tues, 7-8 pm, music. Fri, 5:30-6:45 pm, music. Sun, 5 pm, every other week starting August 20. Central.

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

DD5, Denver, Colo. 340 only. 1,500 mi. Fitzsimmons General Hospital. Daily ex Sun, 8:15 pm, weather, news, concert. Thurs, 8:15-9:30 pm, special concert, speech. Mountain.

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

KDN, San Francisco, Cal. 455 also. 550 mi. Leo J. Meyerz Co. Daily ex Sun, 11-12 am, 1-2 pm, 4:30-5:30, concert; 7-7:15, weather; 8:30-9, concert. Sat, nothing after 5:30 pm. Sun, 10-11 am, sacred concert. Pacific.

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

KDYL, Salt Lake City, U. 485 also. 300 mi. Salt Lake Telegram. Daily ex Sun, 7-8 pm, music, baseball, news, weather; 9-9:30 (occasionally), Sun, 2-3 pm, church service. Mountain.

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

KOYX, Honolulu, Hawaii. 750 mi. Star-Bulletin. Daily ex Sun, 12:15-1:15 pm, stocks, markets, business news; 6:30-7:30, concert, lecture. Sun, 11-12 am, church service; 4-6 pm, concert, lecture. Honolulu.

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

KDZM, Fresno, Calif. 50 mi. The Herald-Boford Co. Daily ex Sun, 4-5 pm, news, sports, music. Mon, Wed, Thurs, Sat, Sun, 7-8 pm, music. Tues, 8-9 pm, music. Fri, 8-8:30 pm, music. Sun, 10-11 am, sqm. program. Pacific.

KDZZ, Denver, Colo. 500 mi. Wm. D. Pyle. Mon, Wed, 8:15-9:30 pm, concert. Mountain.

KDZZ, Everett, Wash. 100 mi. Kinney Bros. & Siple. Daily ex Sun, 2:30-3:30 pm, 8-9:30, Pacific.

KFAC, Glendale, Cal. 455 also. 150 mi. Daily News. Mon, Wed, Fri, 3-3:15 pm, baseball, news. Mon, Thurs, 8-9 pm, concert. Sat, 7-8 pm, dance music. Pacific.

KFAD, Phoenix, Ariz. 485 also. 100 mi. Mon, Wed, Fri, 8-9:15 pm, concert, weather, stocks, markets. Sun, morning, church service. Mountain.

KFAE, Pullman, Wash. 300 mi. State College of Wash. Program irregular.

KFAF, Denver, Colo. 1,000 mi. Western Radio Corp. Daily, evenings, music, news, sermons, etc.

KFBD, Hanford, Calif. 100 mi. Calif. Radio Lab. Daily ex Sun, 3-4 pm, 8-9, Sun, 5-6 pm. Pacific.

KFBE, San Luis Obispo, Calif. 50 mi. Cline's Elec. Shop. Daily ex Sun, 4-5 pm. Tues, Fri, 7-8 pm. Sun, 10-11 am. Pacific.

KFC, Seattle, Wash. 100 mi. Northern Radio & Electric Co. Daily, eight hours, miscellaneous. Pacific.

KFI, Los Angeles, Calif. 200 mi. 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.

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

KFZ, Spokane, Wash. 300 mi. Doerr Mitchell Elec. Co. Daily ex Sun, 7:30-9:30 pm, concerts and voice. Pacific.

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

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

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

KGG, Portland, Ore. 500 mi. Hallock & Watson Radio Service. Daily ex Sun, 4:30-5 and 7-7:30 pm, baseball scores, markets, news. Sat, 9:10 pm, instruction. Sun, 4:30-6 pm. Pacific.

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

KGO, Altadena, Calif. 300 mi. Altadena Radio Lab. Daily, 1 pm, 5-7. Pacific.

KGW, Portland, Ore. 200 mi. Ship Owners Radio Service. 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.

KGU, Honolulu, Hawaii. 485 also. 150 mi. The Honolulu Advertiser. Daily, 7:30-9 pm. Tues, Thurs, Sat, special program. 150th meridian. (Three hours later than Pacific).

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

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

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

KIO, Los Angeles, Calif. 100 mi. Standard Radio Co. Barlet Barlet. Daily ex Sun, 11:30-12 noon. Mon, 10-11 am. Wed, 9-10 am. Sun, 1-2 pm, 5-6. Pacific.

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

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

KJS, Los Angeles, Calif. 100 mi. Bible Inst. of Los Angeles. Tues, Wed, 12-12:30 pm, sacred music, lecture. Sun, 11:30-12:30 pm, sacred music, sermon. Pacific.

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

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

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

KLS, Oakland, Cal. 150 mi. Warner Bros. Daily, 12-1 pm, concert. Sun, 7-9 pm, concert. Pacific.

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

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

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

KNI, Roswell, N. M. 300 mi. Roswell Public Service Co. Daily ex Sun, 7-9 pm, weather, financial markets, news. Mountain.

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

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

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

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

KON, Los Angeles, Calif. 200 mi. Holzwarner Inc. Daily ex Sun, 4-5 pm and 8:15-9, concert, news. Sun, 10-11 am, 4-5 pm and 8:15-9, church service. Pacific.

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

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

KQW, San Jose, Cal. 200 mi. Chas. D. Herrold. Daily, 1-1:30 pm, Wed, 8:15-9 pm, concert. Pacific.

KR, Portland, Ore. 100 mi. Stubbins Elec. Co. Daily, 1-2 pm, 5-7, miscellaneous. Pacific.

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

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

KSF, San Francisco, Cal. 500 mi. The Emporium. Daily ex Sun, 10-11 am, concert, news; 2-3 pm, concert, educational talk. Sun, 2-3 pm, concert and educational talk. Pacific.

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

KTW, Seattle, Wash. 200 mi. First Presbyterian Church. Sun, 11-11 pm, 7:30-10, church service. Pacific.

KUO, San Francisco, Cal. 1,500 mi. San Francisco Examiner. Daily ex Sun, 3-3:30 pm and 5:30-6:45, news, etc. Sun, 5-6 pm, news, etc. Pacific.

KUV, Los Angeles, Calif. 300 mi. Coast Radio Co. Daily ex Sun, 4-4:45 pm, lecture, concert. Mon, 8-9 pm, lecture, concert. Thurs, 8-9 pm, concert. Pacific.

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

KWG, Stockton, Cal. 1,500 mi. Portable Wireless Telephone Co. Daily ex Sun, 4-5 pm, news, concert, markets. Tues and Fri, 8-9 pm, concert. Sun, 2-3 pm, concert. Pacific.

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

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

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

KYV, Chicago, Ill. 485 also. 800 mi. 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 daylight saving.

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

KZM, Oakland, Cal. 200 mi. Preston D. Allen. Daily ex Sun, 7:15-7:30 pm, news. Tues, 7:30-8:15 pm, 6:45-7 pm, news. Wed, 7:30-8:15 pm, concert. Sat, 8:15-9 pm, news. Sun, 11-12:15 pm, church service; 3-4 pm, concert. Pacific.

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

WAJ, Boston, Mass. 50 mi. Eastern Radio Inst. Mon, Wed, Fri, 8-9 pm, concert. Eastern.

WAK, Hialeah, Fla. 485 also. 200 mi. Gimbel Bros. Daily ex Sun, 10 am, markets, weather; 11, markets; 12-12 pm, markets; 1:25, closing markets; 2, and every hr. after, concert, test; 7, weather; 7:15, baseball; 7:30, concert. Central.

WAAD, Charleston, W. Va. 40 mi. Radio Service Co. Daily ex Sun, 6:45-7:45 pm, music, news, weather, baseball. Eastern.

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

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

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

WAAY, Youngstown, O. 300 mi. Yohrling Rayner Music Co. Tues, Thurs, Sat, 5:45 pm, baseball, news; 7:30, music; 8-9, address, music. Eastern.

WAAZ, Emporia, Kan. 250 mi. 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.

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

WBAB, Syracuse, N. Y. 1,000 mi. 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.

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

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

WBAJ, Toledo, O. 450 also. 500 mi. Marshall-Gerken Co. Tues, Thurs, Sat, 6-7:30 pm, news, bedtime story. 8:00 pm, concert. Eastern.

WBAM, New Orleans, La. 100 mi. I. B. Remynson. Daily ex Sun, 10-11 pm, real estate bulletins, lecture, concert. Central.

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

WBAP, Fort Worth, Tex. 485 also. 100 mi. Star Telegram. Daily ex Sun, 8:45-9 am, opening markets; 11-11:30, weather, markets; 1:30-2 pm, closing markets; 3:45-4, news, road conditions; 5:15-5:30, police; 6:30-7:45, baseball, police news; 9:30-10, music. Sun, 11-12:15 pm, church service; 2-2:30 pm, sermonette; 3:30-4, concert; 6:45-7 baseball. Central.

WBAQ, South Bend, Ind. 100 mi. Myron L. Harmon. Daily, 5:30-6 pm, news, concert; 8 pm, concert, news, police reports. Sun, 3:30 pm, church services. Central.

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

WBAX, Wilkes-Barre, Pa. 200 mi. John H. Stenger, Jr. Thurs nights of week, not regular.

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

WBL, Anthony, Kan. 300 mi. T. & H. Radio Co. Daily ex Sun, 8:50 am, 9:50, 10:50 and 1:15 pm. Kansas City grain markets; 1:15, roads, local markets; 7-8, concert, etc. Sun, 4-5, concert. Central.

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

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

WBAB, Newburgh, N. Y. 100 mi. Newburgh Daily News. Daily ex Sun, on half hour 12:30-8:30 pm, news, sports, concert; 10:30-11 pm, concert, feature. Eastern, daylight saving.

WCAC, Fort Smith, Ark. 500 mi. John Fink Jewelry Co. Fri, Sun, 8-10 pm, music, talks, sermon. Central.

WCAH, Columbus, O. 300 mi. Enteklin Elec. Co. Tues, Fri, 7-8 pm, concert, bedtime stories. Sat, 3-4 pm, lecture, music. Central.

WCAK, Houston, Tex. 200 mi. A. P. Daniel. Daily ex Sun, 7-7:15 pm, news, etc. Wed, Sat, 8-9 pm, concert. Sun, 3-4 pm, concert. Central.

WCL, North Platte, Neb. 200 mi. St. Olaf College. Fri, 9:15-10 pm, concert, lecture, news. Sun, 3:30-9:30 pm, chapel, music. Eastern.

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

WCAT, Rapid City, S. D. 385 only. 100 mi. S. D. State School of Mines. Daily ex Sun, 9:30 am, weather, 3-3 pm, stock warnings. Central.

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

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

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

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

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

WDH, El Paso, Tex. 500 mi. Mine & Smelter Supply Co. Tues, Thurs, Sat, 7:30-8:30 pm, concert. Mountain.

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

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

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

WDAQ, Brownsville, Pa. 200 mi. Hartman-Riker Elec. & Mach. Co. Daily ex Sun, 10:30-10:50 am, music; 12:50-1:10 pm, music, news, weather; 5:05-5:30 pm, news, Thurs, Fri, 9:15-10 pm, concert. Sun, 5 pm, chapel, Eastern.

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

WDAW, Atlanta, Ga. 485 also. 500 mi. Georgia Ry. & Power Co. Daily ex Sun, 6-7 pm; 9-9:55. Sun, 3:30-4:30 pm. Central.

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

WDAY, Fargo, N. D. 485 also. 100 mi. Fargo Radio Service Co. Daily ex Sun, 12:15 pm, weather; 7-7:30, news, music. Mon, Wed, Fri, 9-10 pm, concert, etc. Sun, 12:15 pm, weather. Central.

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

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

WEAB, Fort Dodge, Ia. 250 mi. Standard Radio Equip. Co. Daily, 7:30-8:30 pm, music, news. Sun, 10-11 am, church service. Central.

WEAD, Atwood, Kan. 485 also. 150 mi. N. W. Kansas Radio Supply Co. Daily ex Sun, 11-11:30 am, markets, music; 12, markets; 1:45 pm, markets; on half hour 3:15 to 5:45, news, baseball. Tues, Wed, Thurs, Sat, 7:30-9, concert. Sun, 11 am, church service; 3 pm, sacred music; 7:30, church service. Central.

WEAH, Wichita, Kan. 485 also. 500 mi. Lander Radio Co. Daily ex Sat and Sun, markets at 8:40 am, 9:40, 10:40, 11:40, 12:30 pm, 3:15, Wed, Sat, 8-9 pm, concert. Sat, markets at 8:40 am, 9:40, 10:40, 11:40. Sun, 3-9 pm irregular, concert. Central.

WEAK, St. Joseph, Mo. 100 mi. J. B. Abernoble. Daily, 12-1 pm, St. Joseph live stock markets; 7:30-8:45, concert. Central.

WEAM, North Plainfield, N. J. 75 mi. Borough of N. Plainfield. Daily, 7:30-8 pm, music, police news, etc. Eastern, daylight saving.

WEAN, Providence, R. I. 100 mi. Shepard Company. Daily ex Sun, 3-5 pm, music; 6-8, bedtime stories, baseball, weather, music. Mon, Wed, 8-10 pm, concert. Eastern, daylight saving.

WEAP, Mobile, Ala. 485 also. 50 mi. Mobile Radio Co. Daily, 4-5 pm, 7-8:55. Central.

WEAS, Washington, D. C. 100 mi. The Hecht Co. Daily ex Sun, 3-4 pm, music, retail news. Wed, 7-8 pm, concert. Fri, 7:30-8:30 pm, concert. Eastern.

WEAV, Rushville, Nebr. 200 mi. Sheridan Elec. Service Co. Wed, Fri, Sun, 8-9 pm, concert, news, etc. Mountain.

WEAZ, Waterloo, Ia. 100 mi. A. C. Sweetman. Mon, Thurs, Sat, 7-8 pm, news, concert, lecture. Central.

WEW, St. Louis, Mo. 485 only. 100 mi. 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.

WEW, Wichita, Kan. 485 also. 500 mi. Casradio 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.

WFAA, Dallas, Tex. 485 also. 250 mi. News-Journal. Daily ex Sun, 12:30-1 pm, weather, talk; 2-2:30, baseball, markets, news; 3:30-3:45, markets, news; 6:45-7, baseball final; 8-8:30, concert. Sun, 2-2:30 pm, chapel; 6:30-6:45, sacred concert; 9:30-10, baseball, weather. Central.

WFAC, Superior, Wis. 100 mi. Superior Radio Co. Daily, 7:30-9 pm. Central.

WFAD, Salina, Kan. 100 mi. Watson Weldon Motor Supply Co. Daily ex Sun, 8:45 am, 10:45, 11:45, 1:15 pm, markets; 4, news. Tues, Thurs, Fri, 8 pm, concert. Sun, 11 am, church service; 8 pm, concert. Central.

WFAG, Waterford, N. Y. 340 only. 300 mi. Radio Engineering Lab. Wed, Sat, 7:45-10 pm, concert. Sun, 2-4 pm, church service. Eastern.

WFAM, St. Cloud, Minn. 485 also. 100 mi. Granite City Elec. Co. Daily ex Sun, 3:30-4:00 pm, markets; 7:30-9, entertainment. Central.

WFAN, Hutchinson, Minn. 485 also. 500 mi. Hutchinson Electric Service Co. Daily ex Sun, 1 pm, markets etc. Central.

WFAP, Peoria, Ill. 300 mi. Brown's Business College. Daily ex Sun, 10:30 am, weather; 12-12:15 pm, music; 1:45-1:55, markets; 4:30-4:50, business lecture; 7:45-8:55, baseball, news, concert. Sun, 11 am, church service. Central.

WFAT, Sioux Falls, S. D. 300 mi. Argus Leader. Daily ex Sun, 7:30-8 pm, baseball, concert. Tues, Thurs, special concert, 8-9 pm. Sun, 7:30-8 pm, concert. Central.

WFAV, Lincoln, Nebr. 485 also. 300 mi. Univ. of Nebr. Daily ex Sun, 10-10 am, weather, markets. Sat, 9:00 pm, concert. Central.

WFAZ, Binghamton, N. Y. 50 mi. A. L. Kent. No fixed schedule.

WFI, Philadelphia, Penn. 350 mi. Strawbridge & Clothier. Daily ex Sun, 1:15 pm, news; 3:30-4:30, concert; 6:30-6, baseball. Mon, Fri, 6:30-7 pm, Radio music. Wed, Fri, Sat, 7:30-8:30 pm, concert. Fri, Sat, (alternate weeks) 7:30 pm, concert at 8:30 pm. Sun, 4 pm, church service. Eastern, daylight saving.

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

WGAB, Houston, Tex. 485 and 600 also. 250 mi. QRV Radio Co. Daily ex Sun, 8:30-9:30 am, police, news; 12:30-1:30 pm, music, readings; 4-5, baseball, news. Mon, Wed, Fri, 8 pm on concert. Eastern.

WGAD, Escondido, Puerto Rico. 200 mi. Spanish-American School of Radio Telegraphy. Irregular, 7:30-11:30 pm, entertainment. 60th Meridian.

WGAL, Lancaster, Pa. 35 mi. Lancaster Elec. Supply & Construction Co. Mon, Wed, Fri, 7-8 pm, concert, lecture. Sun, 3-3:30 pm, church service. Eastern.

WGAM, Orangeburg, S. C. 150 mi. Orangeburg Radio Equipment Co. Daily ex Sun, 10 am, markets, weather; 11:55, time; 4 pm, Radio talk, markets, baseball; 6, music, lecture; 10, time, weather, entertainment. Sun, 11 am, church service; 11:55, time; 10 pm, time, weather, music. Eastern.

WGAQ, Shreveport, La. 500 mi. Glenwood Radio Corp. Daily ex Sun, 7:45-8 pm, news, baseball, music. Sun, 11 am, 7:30 pm, sermon. Central.

WGAT, Lincoln, Nebr. 100 mi. Am. Legion, Dept. of Nebr. Mon, Wed, 9 pm, announcements. Fri, 9-10 pm, patriotic program, concert. Sun, 3-5 pm, sermon. Central.

WGAS, Chicago, Ill. 300 mi. Ray-Di-Co. Organization, Inc. Daily ex Sun, 9-9:20 am, 11:15-11:30, 11:55-12, 12:15-12:30 pm, 1:30-1:45, 2:45-3, 4-4:15, 4:30-4:45, 5-6. Wed, Fri, 10-11 pm. Central, daylight saving.

WGAY, Madison, Wis. 100 mi. North Western Radio Co. Daily ex Sun, 9-10 am, financial news; 11:30, news, opening markets; 4 pm, news, closing markets. Sun, 12-12:12 pm, concert. Sat, 7:30-8:30 pm, concert. Sun, 12-12:12 pm, church service. Central.

WGAZ, South Bend, Ind. 100 mi. South Bend Tribune. Daily ex Sun, 9-9:30 am, home hints, menus; 2-3 pm, news, music; 7-8, news, music. Central.

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

WGI, Medford Hillside, Mass. 500 mi. Am. Radio & Research Corp. Daily ex Sun, 8:25 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 pm, church service; 8:45 am, sacred concert. Special features week nights, 7:30-9 pm. Eastern.

WGL, Philadelphia, Pa. 200 mi. P. F. J. Howlett. Tues, Thurs, Sat, 7:45-11:30 pm, concert. Eastern.

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

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

WHA, Madison, Wis. 485 also. 600

WIAC, Omaha, Neb., 485 also, 500 mi. Journal-Stockman Co. Daily ex Sun, 7:45 am, markets; 9:10, markets; 10:15, weather, markets; 12, markets; 1:59 pm, weather, markets; 3:50, markets. Central.

WIAN, Allentown, Pa., 100 mi. Chronicle-News. Schedule irregular.

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

WIAC, University Place, Neb., 485 also, 150 mi. Nbr. Wesleyan Univ. Daily ex Sat and Sun, 12 m, weather; 4 pm, markets, concert. Central.

WIAE, San Antonio, Tex., 200 mi. Texas Radio Syndicate. Daily ex Sun, 4-5 pm, Mtu, Thurs, Sat, 9:30-10:15 pm, Mon, Wed, Fri, 8:30-9:30 pm, Sun, 7:30-8:30 pm, Central.

WJD, Granville, O., 100 mi. Dennison University, Daily, 5-8 pm, concert, lecture. Central.

WJH, Washington, D. C., 250 mi. White & Boyer Co. Tues, 7:30-10 pm, concert, address, lecture, Eastern.

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

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

WJZ, Newark, N. J., 1,500 mi. Westinghouse Elec. & Mfg. Co. Daily ex Sun, 15 minutes hourly from 9 am to 6 pm; 12-12:30 pm; 7:10-15 pm. Miscellaneous program of highly varied nature. Sun, 5:10-15 pm, misc, Eastern, daylight saving.

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

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

WLK, Indianapolis, Ind., 300 mi. F. F. Hamilton. (Indianapolis News.) Daily ex Sun, 11-11:30 am, music, weather; 12-12:30 pm, music; 2-2:30, music; 3-3:30, music; 5, baseball; 10, weather. Tues, Thurs, Sun, 8:30-10 pm, Special, Sun, 2-4 pm, church services; 10, weather. Central.

WLW, Cincinnati, O., 2,000 mi. Crosby Mfg. Co. Daily ex Sun, 1 pm, market letters; 1:30, weather; 2:30, N. Y. stocks; 2-3, music. Central.

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

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

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

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

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

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

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

WOH, Indianapolis, Ind., 1,000 mi. Hatfield Elec. Co. (Indianapolis Star.) Daily ex Sun, 10-11 am, music; 10:15, financial, markets; 1-2 pm, music; 1:20, markets; 4-5 pm, music; 4:15, police notes; 4:50, baseball. Mon, Wed, Sat, 8:30-10 pm, Concert. Central.

WOI, Ames, Ia., 300 mi. Iowa State College. Daily, 9:30 am, 12:40 pm, weather. Central.

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

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

WOR, Newark, N. J., 150 mi. L. Bamberger & Co. Daily ex Sun, 20 minutes on half hour from 10:30 am to 6:30 pm, miscellaneous. Eastern, daylight saving.

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

WPA, Fort Worth, Tex., 485 also, 500 mi. Fort Worth Record. Daily ex Sun, 11:30 am, 2:30-3 pm, 6-6:15, 7:15-7:30; 8-9:30, Sun, 3-3:30 pm, 6:30, Central.

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

WPI, Philadelphia, Pa., 30 mi. St. Joseph's College. Daily ex Sun, 2-3 pm, 3:30, sports, news. Sun, 10:45-12 noon, 7:45-8:30 pm, church service. Eastern.

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

WPO, Memphis, Tenn., 300 mi. United Equipment Co. (News-Scimitar.) Daily, 7-9 pm, concert, news. Central.

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

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

WRM, Urbana, Ill., 410 also, 200 mi. Univ. of Ill. Thurs, 8:30-8:55 pm, 9:05 on, news, concert, lecture. Special concerts irregular. Central.

WRP, Camden, N. J., 300 mi. Eastern Inst. of Radio Teleg. Daily ex Sat and Sun, 10-10:45 pm, instruction. Eastern, daylight saving.

WRR, Dallas, Tex., 485 also, 200 mi. City of Dallas. Daily ex Sun, 12-12:30 pm, weather; 3-3:30, baseball, markets, news; 7-7:15, police news; 8:30-9, music. Sun, 11 am, church service; 7-8 pm, police news, church service. Central.

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

WSB, Atlanta, Ga., 485 also, 1,000 mi. Atlanta Journal. Daily ex Sun, 12-1 pm, concert for industrial employees; 2:30, weather, markets; 4-4:30, theater concert; 4:30, markets; 5-6, baseball, markets, music, bedtime stories; 7-8, concert, etc.; 10:45-11:15, music. Sun, 11 am, 5 pm, church service. Central.

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

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

WSY, Birmingham, Ala., 150 mi. Alabama Power Co. Daily ex Sun, 2:30 pm, markets, stocks; 8, concert. Sun, 8 pm, chapel. Central.

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

WTK, Paris, Tex., 300 mi. Paris Radio Elec. Co. Daily ex Sun, 10 am to 5 pm, 7-11 pm, miscellaneous. Sun, 11 am to 3 pm, Central.

WTP, Bay City, Mich., 75 mi. Ra-Do Corp. Daily ex Sun, 1-2 pm, 6:30-7:30, 10-11, concert, baseball, markets. Sun, 1-2 pm, 6:30-7:30, 9-11, Eastern.

WWI, Dearborn, Mich., 300 mi. Ford Motor Co. Wed, 10-11 pm, Eastern.

WWJ, Detroit, Mich., 485 also, 1,000 mi. Detroit News. Daily ex Sun, 9:30-10:30 am, hints to housewives, concert, weather; 10:55, time signals; 12:05-12:45 pm, concert; 3:30-4:15, markets, weather; 5-6, news, baseball. Week of July 19 and every other week, 7-8:30 pm, concert, lecture, fill in weeks, 8:30-10 pm, concert, lecture. Sun, July 9, wk etc., 9:30 am-2:30 pm, church services and special; 4-5 pm, special. Sun, fill in wk, 2-4 pm, special; 6-10, church services and special. Eastern.

WWX, Washington, D. C., 1,100 only, 600 mi. Post Office Dept. Daily ex Sun, 10 am, weather; 10:30, markets; 5 pm, 7:30, 8, markets; 9:50, weather. Eastern.

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

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

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

State, City, Call

Alabama:
Birmingham, WIAQ, WSY
Mobile, WEAP
Montgomery, WGH

Arizona:
Phoenix, KDYW, KFAD
Tucson, KDZA

Arkansas:
Fort Smith, WCAC
Little Rock, WCAV,
WEAX, WSV
Pine Bluff, WOK

California:
Altadena, KGO
Bakersfield, KDZB, KYI
Berkeley, KQI, KRE
El Monte, KUY
Eureka, KNI
Fresno, KDZH, KMJ
Glendale, KFAC
Gridley, KFU
Hanford, KFED
Hollywood, KFAR, KGC
Long Beach, KSS
Los Altos, KLP
Los Angeles, KDZD,
KDZF, KDZP, KFL,
KHJ, KJC, KJS, KNN,
KNR, KNV, KNX, KOG,
KON, KQL, KUS, KWB,
KXS, KYJ, KZI
Modesto, KOQ, KXD
Monterey, KLN
Oakland, KLS, KLV, KZM,
KZY
Pasadena, KDYR, KLB
Pomona, KGF
Redley, KMC
Redwood City, KDYN
Sacramento, KVQ
San Diego, KDPT, KDYM,
KDYO, KFBC, KYF
San Francisco, AGI, KDN,
KDZG, KDZV, KDZX,
KPO, KSL, KUO
San Jose, KFAQ, KQW,
KSC
San Luis Obispo, KFBE
Santa Ana, KFAV
Stockton, KJQ, KWG
Sunnyvale, KJJ
Venice, KFAV

Colorado:
Boulder, KFAJ
Colorado Springs, KHD
Denver, DD5, KDYY,
KDZU, KLZ, KOA

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

Delaware:
Wilmington, WHAV

District of Columbia:
Washington, WDM,
WEAS, WHAQ, WIL,
WIAY, WJH, WMU,
WPN, WWX, 3YN

Florida:
Jacksonville, WCAN,
WDAL
Miami, WFAW, WYAZ
Pensacola, WGAN
Tampa, WDAE, WEAT,
WHAW

Georgia:
Atlanta, WAAS, WDAW,
WSB, 4CD
College Park, WDAJ
Fort Smith, WGAR
Savannah, WGAU, WHAO

Idaho:
Boise City, KFAU
Lewiston, KFBA
Moscow, KFAN

Illinois:
Chicago, KYW, WAAF,
WBU, WDAP, WGAZ,
WGU
Decatur, WBAO, WCAP,
WHAP
Peoria, WBAE, WFAF,
WJAN
Quincy, WCAW, WCAZ
Rockford, WIAB, WJAM
Springfield, WDAC
Tuscola, WDC
Urbana, WRM

Indiana:
Anderson, WMA
Fort Wayne, WFAZ
Huntington, WHAY
Indianapolis, WLK, WOH
Marion, WIAQ
Richmond, WOZ
South Bend, WBAQ, WGAZ
Terre Haute, WEAC
West Lafayette, WBAZ

Iowa:
Ames, WOI
Burlington, WIAS
Cedar Rapids, WJAM,
WKAA
Centerville, WDAX
Davenport, WHAI, WOC
Des Moines, WGF
Fort Dodge, WEAB
Iowa City, WHAA
Le Mars, WIAU
Newton, WIAH
Shenandoah, WGAJ
Sioux City, WEAU, WHAE
Vinton, WIAE
Waterloo, WEAZ, WHAC

Kansas:
Anthony, WBL
Atwood, WEAD
Eldorado, WAH
Emporia, WAAZ
Independence, WFAZ
Lindsborg, WDAJ
Manhattan, WTG
Salina, WFAJ
Topeka, WJAQ

State, City, Call

Wichita, WAAP, WEAH,
WEY, WHAN

Kentucky:
Louisville, WHAS, 9ARU
Paducah, WIAR

Louisiana:
New Orleans, WAAB,
WAAC, WBAM, WCAQ,
WGV, WIAF, WWL
Shreveport, WAAG,
WDAN, WGAQ

Maine:
Auburn, WMB
Portland, WJAL
Sanford, WFAZ

Maryland:
Baltimore, WCAO, WEAR,
WKC

Massachusetts:
Boston, WAET, WFAU
Holyoke, WHAX
Medford Hills, WGI
New Bedford, WDAU
Springfield, WEZ, WIAP
Worcester, WCN, WDAS,
WDAT

Michigan:
Bay City, WTP
Dearborn, WWI
Detroit, KOP, WCX, WWJ
East Lansing, WHW
Flint, WEEA
Lansing, WHAL
Saginaw, WIAW

Minnesota:
Duluth, WJAP
Hutchinson, WFAN
Minneapolis, WAAL,
WBAD, WBAH, WCAS,
WCE, WLB
Redfield, WCAL
St. Cloud, WFAM
St. Paul, WAAH

Mississippi:
Corinth, WHAU

Missouri:
Brentwood, WFAK
Cameron, WFAQ
Columbia, WAAN
Jefferson City, WOS
Joplin, WHAH, WJAC
Kansas City, WDAF,
WHB, WOQ, WPE
Marshall, WAJT
St. Joseph, WEAZ
St. Louis, KSD, WAAE,
WCK, WEB, WEW
Springfield, WIAI
Tarkio, WIAT

Montana:
Butte, KFAP, KFBB
Great Falls, KDYS
Havre, KFBB

Nebraska:
Lincoln, WCAJ, WFAV,
WGAT, WIAX, WJAB,
WKAC
Norfolk, WJAG
Omaha, WAAW, WIAK,
WOU, WOV
Rushville, WEAV

Nevada:
Reno, KDZK, KFAS, KOJ

New Hampshire:
Berlin, WEAQ

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

New Mexico:
Roswell, KNJ
State College, KOB

New York:
Albany, WNJ
Binghamton, WFAZ,
WIAV
Brooklyn, WGAC
Buffalo, WGR, WWT
Canton, WCAD
Ithaca, WEAI
Newburgh, WCAB
New York, KDOW, WBAY,
WDM, WDT, WVP,
WWZ
Poughkeepsie, WFAF
Rochester, WHAM, WHQ
Ridgewood, WHN
Schenectady, WGY, WRL
Syracuse, WBAB, WDAI,
WFAZ
Tarrytown, WRW
Troy, WHAZ
Utica, WSL
Waterford, WFAZ

North Carolina:
Asheville, WFAJ
Charlotte, WBT

North Dakota:
Fargo, WDAY

Ohio:
Akron, WOE
Athens, WAAV
Canton, WWB
Cincinnati, WAAD,
WHAG, WIZ, WLW,
WMH
Cleveland, KDPM, WHK
Columbus, WBAV, WEAQ
Dayton, WAI, WFO,
WJAJ
Defiance, WCAQ
Fairfield, WL-2
Granville, WJD
Hamilton, WBAU, WRK
Lebanon, WFG
Marletta, WBAW
Norwood, WIAL

State, City, Call

Portsmouth, WDAB
Stockdale, WJAK
Toledo, WBAJ, WHU,
WJK
Wooster, WGAU
Youngstown, WAAZ, WMC
Zanesville, WPL

Oklahoma:
Muskege, WDAV
Oklahoma City, WKY,
5XT
Tulsa, WGAF
Yale, WHAT

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

Pennsylvania:
Allentown, WIAN
Bridgeport, WBAG
Brownsville, WDAQ
Clearfield, WPI
Erie, WJT, WSW
Harrisburg, WBAK
Lancaster, WGAL
McKeesport, WIK
Philadelphia, WCAU,
WDAR, WFI, WGAU,
WGL, WIP, WOO
Pittsburgh, KDKA, KQV,
WAAZ, WCAE, WHAF,
WJAS
Villanova, WCAM
Wilkes-Barre, WBAX

Rhode Island:
Edgewood, WEAG
East Providence, WKAD
Pawtucket, 10J, 1XAD
Providence, WEAN, WJAR

South Carolina:
Charleston, WFAZ
Orangeburg, WGAM

South Dakota:
Rapid City, WCAT
Sioux Falls, WFAT
Yankton, WAJU

Tennessee:
Memphis, WKN, WFO
Nashville, WDAZ

Texas:
Amarillo, WDAG
Austin, WCM
Dallas, WDAO, WFAA,
WRR
El Paso, WDAH
Fort Worth, WBAP, WPA
Galveston, WHAB, WIAC
Houston, WCAK, WEAV,
WEV, WFAL, WGAB
Paris, WTK
Port Arthur, WCAH
San Antonio, WCAR,
WJAE
Waco, WJAD, WLAJ
Wichita Falls, WKAF

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

Vermont:
Burlington, WCAZ

Virginia:
Norfolk, WSN
Richmond, WBAZ

Washington:
Aberdeen, KNT
Bellingham, KDZR
Centralia, KDZM
Everett, KDZJ
Lacey, KGY
Pullman, KFAE
Seattle, KDZE, KDZT,
KFC, KHQ, KJR, KTW,
KZC
Spokane, KFZ, KOE
Tacoma, KFBB, KGB,
KMO
Wenatchee, KDZI, KZV,
Yakima, KFY, KQT

West Virginia:
Bluefield, WHAJ
Charleston, WAAO
Clarksburg, WHAK
Huntington, WAAR
Morgantown, WHD

Wisconsin:
Madison, WGAY, WHA
Milwaukee, WAAK,
WCAZ, WHAD, WIAO
Neenah, WIAJ
Superior, WFAZ
Waupaca, WIAA

Hawaii:
Honolulu, KDYX, KGU

Porto Rico:
Ensenada, WGAD

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




Federal INSTRUMENTS

- ARE SUPERIOR -

The Federal CRYSTAL RECEIVER

is a highly efficient instrument for the reception of RADIO Programs in a clear, soft, pleasant tone—when used within a radius of 30 MILES of a broadcasting station.

WITH THE ADDITION OF THE

Federal JUNIOR AMPLIFIER No. 20

The receiving range is increased to

100 MILES

THE

Federal JUNIOR AMPLIFIER No. 20

is equipped with Two of the famous

No. 226-W Voice Frequency Amplifying Transformers

No. 226-W Voice Frequency Amplifying Transformer

THESE INSTRUMENTS are exceedingly simple to operate—No knobs and Dials—merely operate control arms until reception is loudest.

THIS TRANSFORMER was used in ARMY and NAVY radio equipment throughout the war and has been used continuously in commercial equipment.

Federal Telephone & Telegraph Company

BUFFALO, N. Y.

CHICAGO BRANCH OFFICE: 805 STEGER BUILDING, CHICAGO, ILL.

Keeps Storage Battery Charged

Storage batteries must be kept charged, for when discharged below certain limits no receiving set will operate. Remember that a detector unit draws a little over 1 ampere, and that each amplifying unit also draws a little over 1 ampere. Therefore, a 6-volt, 60-ampere storage battery with a detector and 1 amplifying unit can only operate about 30 hours, and a detector and 2 amplifying units about 20 hours, without recharging. Failure to note this frequently completely shuts off reception of messages.—William Hunt, Denver, Colo.

An Envelope Condenser

A variable condenser that can be made in a few minutes when time may be of great value, may be constructed out of a piece of cardboard and a thick envelope. Wrap two layers of tin foil around the envelope fastening a binding post through the closed end of the envelope and the tin foil. Wrap a similar amount of tin foil around a piece of cardboard cut to slide into the envelope with a binding post connection on one end. Sliding the cardboard in and out of the envelope will make a variable condenser of it.—Fred Martin, Indianapolis, Ind.

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Radio as Life Protection

Ether Waves Do Much to Eliminate Accidents

ONE OF the finest things that Radio has done for mankind is the protection of human life. Ships at sea can now be guided safely through a heavy fog. On land the automatic control of railroad trains is now being given trials. The old system of control soon may be superseded by Radio. Conductors who have charge of train loads of humans can keep in continuous touch with every station. Possibilities are that they can communicate with other trains on the same line and thus avoid accidents due to the failure of wired signal systems.

How Far Is East from West?

Only a Fraction of a Second to Transmit News

FOR YEARS the sparsely-settled communities in the West have depended on the large cities in the East for their news. This came, at first, in the way of weekly newspaper, later by the daily, then by wire telegraph and telephone. The American public is not inclined to spend much time in waiting nowadays, but what they want, they want immediately, and news is one of their first wants. The Radiophone is a means of getting that commodity to those who desire it quickly while it is news. It has brought the Capitol and all its absorbing national activities from the banks of the Potomac to the Pacific Coast in less than one-ninetieth of a second. The navy realizing the importance of Radio has installed ten stations along the Alaskan Coast which stand ready to take up the work of the Pacific cable the moment it breaks down, thus assuring communication with the Far East and Alaska.

Aside from the stations at St. George, St. Paul, Dutch Harbor, Kodiak, Seward, Cordova, Juneau and Ketchikan, the navy has established two Radio compass stations practically within the Arctic Circle. This chain is in touch with all trans-pacific stations and despite apparent isolation, it is an important factor in West Coast communication service.

These stations, ice-bound most of the year, are at present waiting for spares and essentials for the coming winter. Supplies and extra parts are on the way on board the ship Gold Star, the navy's Radio repair ship. This ship, named for the mothers of the men lost in the war, is equipped with sufficient material to do anything from repairing a crystal detector to erecting a new station.

East is not nearly so far from the West as it was in the day of Custer!

World's Best Artists at Your Door

Personal Attendance Not Necessary for Grand Opera

DO YOU remember when you experienced the first thrills of such a thing as a circus? Go back and trace over the years from boyhood to manhood. See if you can recall the thrills that have accompanied each venture into a new thing. See if you can remember each one and how it left impressions with you for the years that have followed.

Many of us who live in beautiful country places hundreds of miles from the large cities do not have the opportunity to see or attend some of the better kinds of entertainment. Grand opera does not travel in circus tents and again, we do not remain boys all our lives. We wish for entertainment suitable to our age. When we grow a few years we desire a change from the circus to a different form of entertainment. There is a time in life when nothing seems to strike us better than good music. This form of entertainment is not to be found in all small country places. Here is where the Radiophone enters. It brings that kind of entertainment to the person who cannot possibly or conveniently take a 500-mile trip.

Radio broadcasting may bring the world's best artists to the homes of every person no matter where they may live. If all plans work out as anticipated, persons living in outlying districts of the country can share the pleasures of those in metropolitan districts where talent is more available. In fact these plans will permit the Radio enthusiast to listen in on the world's best singer or most famous lecturer, whether he be in Paris, London, New York or Shanghai.

From the station where the best singer or lecturer can be obtained the voice will be sent out to other broadcasting stations not only on the same continent but across the seas. Each broadcasting station will transmit simultaneously the voice it picks up from the central station. All this will be done for the benefit of the Radio listener.

Ye Ed Asks 'imself

Question.—Briefly describe the theory of a tuner as used in Radio reception.

*Answer.—*The use of the word tuner in Radio reception has for some reason or other been given two or three applications. In general it may be said that a tuner as used in Radio reception is an instrument consisting of a coil. This coil is composed of a number of turns, depending upon the wave length desired.

The inductance of this coil is varied by adjusting the number of turns of wire or by means of anyone of several adjustments. By manipulating these adjustments an instrument of this kind is put into resonance. This resonance adjusting device of the set or system is called a tuner, and its principal function is the adjustment of the receiving set to the desired wave length.

Question.—What is meant by "umbrella type" of aerial?

*Answer.—*An umbrella type of aerial is composed of a pole with a number of wires radiating from the top to a circular area.

Question.—What is the difference between the operation of a tickler and a tuner?

*Answer.—*As a general rule it may be stated that a tickler is a coil which is inductively related to primary or secondary of tuner and which is wired only into the plate circuit of a tube. The function of this tickler is to feed back into the plate circuit. This operation, of course, increases the strength of the signal to be received and its operation as a whole is called regeneration.

Question.—Describe the difference between variometers and variocouplers.

*Answer.—*A variometer is composed of two coils which interweave on the same axis without external connections to other coils.

A variocoupler is composed of two coils which, while interweaving on the same axis, has one of the coils tapped. These taps are connected to a switch.

Question.—What is meant by the expression "blue glow" in a vacuum tube?

*Answer.—*The expression "blue glow" denotes an actual condition in a tube. This particular glow of blue is readily distinguished from the ordinary light furnished by the tube under its proper operation. Blue glow in a lamp generally occurs when the auxilliary, or B battery, is increased to an excessive voltage. This glow is caused by a complex ionization of remaining gases and does not help the tube. In fact, it has been found disastrous to many tubes.

Question.—Is an electron considered an atom or is part of an atom considered an electron?

*Answer.—*In scientific parlance an atom was formerly considered the smallest thing known to science. Investigation of an atom under electrical operation, however, has shown that atoms are composed of electrons. Electrically it may be said that an electron is a negative charge of current and is generally believed at this time to be an indivisible particle of matter. The continuous flow or explosion under great heat of electrons in large numbers brings about what is known as the electron flow. In Radio telephony these electrons are produced in a vacuum tube by heating the filament of such a tube to that point where the electrons are discharged and migrate from filament to plate.

Question.—What method is used in sending out so-called naval observatory time by Radio?

*Answer.—*Naval observatory signals are sent out as time signals twice a day; namely, at noon and at 10 p. m., Eastern Standard Time. This Naval Observatory is located at Arlington, Va., and operates on a wave length of twenty-five hundred meters. These signals, however, may be relayed by other naval Radio stations. The first signal is sent out five minutes before the hour at the rate of one tick a second for twenty-nine seconds, omitting the thirtieth tick. Continuous ticks are then sent out to the fifty-fifth tick and omitting then to the sixtieth. This process is repeated until the last minute before the hour. The last minute of the hour is composed of twenty-nine ticks, omitting the thirtieth and then continuing to the fiftieth and omitting the remainder of the minute. The hour is denoted by a short dash.

When such signals are relayed, however, by local broadcast stations they are reduced to wave lengths of 360 meters. Since the ordinary receiving set is generally designed for a range of 275 to 800 meters, it is impossible to read the naval observatory time signals without the use of loading coils.

Question.—What prevents the interference of a broadcasting program sent out simultaneously with other similar programs within the receiving range of both transmission sets?

*Answer.—*There is no means of preventing interference when such a condition arises. The strength, however, of one broadcasting station may be greater than that of another within the same receiving range. A condition of this kind exists between the Chicago and Detroit transmitting stations due to the slight difference in actual time between the two cities it was necessary to increase the power of the KYW of Chicago station to such a point that the weak currents from the Detroit station WWJ would be drowned out in Chicago, even though the wave length used by both stations was 360 meters.

It will thus be seen that within the area of two such cities the distance to the desired station will determine the amount of selectivity in the operation of the set. The selectivity of such a set will, of course, depend entirely upon its construction.

W. N. Furthman.

RADIO INDI-GEST

Sounds Fishy to Us

Radio is being used successfully in fishing. A noise like a worm is broadcast, bringing the fish to the surface.—Tacoma (Wash.) Ledger.

And Detectors That Detect

"Movies that move" is an ad in a Tacoma paper. When the police are equipped, it may be "Radio that raids."

May Be Bill Had a Set

When Shakespeare wrote, "Thou wilt not trust the air with secrets," the Radio had not been invented.—Birmingham Age-Herald.

Nor Do They Store Storage Batteries



Green Clerk: "Naw! You can't have a battery charged here. We do a strictly cash business."

Not If You Watch the Actress

"One of our worthy readers," states the New York World, "asks us the following questions: 'At what frequency does an actress shimmy on the stage, and will I be able to hear Newark on the Hudson Tube?'"

A Modern Lullaby

Elsie Duncan Yale

Oh, hushaby, my baby, in your cozy little bed,
A Radio receiver is adjusted to your head;
So cuddle down so "comfy," like a birdie in the nest—
A station miles and miles away will lull you off to rest.

Oh, hushaby, my baby; close your sleep eyes of blue;
A lovely bedtime story someone's telling now to you;
So drift away to dreamland—mother doesn't linger near,
For broadcast in the twilight tender lullabies you hear.

Oh, hushaby, my baby, for you have the wave length right;
The wireless gently whispers as you nestle down to-night.

Oh, you don't need me waiting while the shadows softly creep,
For KDKA kindly lulls my little one to sleep!

—Ladies' Home Journal.

If You Don't Like Lilies

Says "Radio Mitch": Don't think because you are a Radio bug that you are any relation to a lightning bug. Get off the phones when it begins to thunder.

How to Make a Kitchenette Radio



When your vacuum tube detector is burned out, the grid may be used in the kitchen for tickling griddle cakes, and the plate will come in handy to serve them on.

But Don't Send Any Storks!

Dr. W. S. Irwin, one of the first ship surgeons to perform an amputation by Radio, recently arrived in New York harbor on board ship. As he descended the gang plank a man made his way to him and grasped his hand. He gazed in astonishment as the man poured forth a volume of verbal gratitude.

"I'm sorry, my man," the physician said finally, "but I don't seem to remember you. I don't believe I ever saw you. There must be a mistake."

"You never did see me, doctor," exclaimed the man, "but I've been hoping for years for the chance to thank you. I'm the man whose leg you amputated by Radio ten years ago."—New York Evening Mail.

His Wife Buys Waves

First Bug: "Why is a married man like an efficient spark gap?"

Second Bug: "Well, I've heard that it is because he's quenched."

Radio Telephony for Amateurs and Beginners

Part XII—Useful Information. Section I—Radio Terms and Symbols

By Peter J. M. Clute

To Explain—

The following article by Peter J. M. Clute is a continuation of his series. The last article will be:

XII. Useful Information—Section II.

IN THE preceding discussions, we have employed a number of symbols and terms commonly encountered in Radio work to effectively set forth the ideas and principles underlying Radio communication. This series has undertaken to give the novice a comprehensive knowledge of electrical fundamentals necessary to secure a reasonable understanding of Radio telephony.

Certain definite symbols, which have become conventional through common usage have been adopted to indicate the various pieces of apparatus. The accompanying chart gives the various symbols used to show the apparatus in the wiring diagrams previously given. Specific information concerning the arrangement and connections of Radio apparatus can best be given by the use of these conventional symbols. A little attention given to the study of these symbols will enable the novice to readily become proficient in reading the various Radio wiring diagrams. Interpretation of the symbols is practically self-evident and by properly selecting and connecting the apparatus, any simple or intricate receiving circuit may be represented.

In addition to special symbols, there is a large collection of distinctive terms used in technical Radio discussions. The most common terms employed and their meanings are given below:

"A" Battery: Also called **Filament Battery.** A low-voltage storage battery for supplying current for heating the filaments of vacuum tubes.

Aerial: Also called **Antenna.** A system of elevated wires, strung as high as possible and above all surrounding objects. Its purpose is to radiate or intercept the electromagnetic waves, according as the station is transmitting or receiving.

Alternating Current: Abbreviation, A. C. Current which constantly changes in direction at regular intervals. Thus, a 25-cycle alternating current reverses in direction 25 times a second.

Alternator: An electrical generator for producing alternating currents.

Ammeter: An instrument connected in series in a circuit, for measuring electric current intensity in amperes in the circuit.

Ampere: The standard electrical unit of flow of current. The current which a potential of one volt can send through a circuit having one ohm resistance.

Amplifier: A device which augments or builds up the feeble oscillations received. Amplifiers are used to increase the strength and tone of the received signals.

Amplification, Audio Frequency: Amplification used to build up the audible frequency current coming from the detector, so as to obtain maximum audibility.

Amplification, Radio Frequency: Amplification used for building up the intercepted Radio energy before impressing it upon the detector.

Amplitude: The vertical height of the wave or oscillation from trough to crest. In continuous wave transmission, there is generated a perfectly uniform wave of constant amplitude. The damped wave train does not have the amplitude of its oscillations constant—the waves gradually fall lower and lower in amplitude until completely damped out.

Antenna: See aerial.

Audio Frequencies: Oscillations whose frequency is below 10,000 cycles per second. Such frequencies correspond to vibrations normally audible to the ear.

"B" Battery: Also called **Plate Battery.** A high voltage dry or storage battery for supplying plate current for the vacuum tube.

Buzzer: An electromagnetic signal device for testing crystal detector adjustment.

Capacity: Abbreviation C. The capacity of a condenser is the quantity of charge required to make until difference of potential between its plates. The unit of capacity is that of a condenser, in which a unit charging current will be maintained by increasing the potential at unit rate. The capacity of a condenser, where a charging current of one ampere is sustained by an E. M. F. increasing at the rate of one volt per second, is de-

finied as a "farad." This unit is so large that ordinary condensers are rated in "microfarads" or millionths of a farad.

Capacity Reactance: The opposition offered by capacity to alternating current flow. Capacity reactance is expressed in ohms.

Choke Coil: A coil so wound as to have great self-induction or choking effect (impedance) when introduced in an alternating current circuit.

Circuit: Any path (open, closed or oscillating) in which electric current can flow.

Clamp, Ground: A metallic strap for grounding a circuit to a pipe.

Close Coupling: Close coupling is effected when the primary and secondary windings of a receiving transformer are very close together. The closer the coupling, the greater the energy transfer and the greater the mutual inductance.

Condenser: A contrivance in which two conducting surfaces are separated by

possess the valuable property of converting the Radio frequency oscillations received by the antenna into uni-directional pulsating currents so that with the aid of telephone receivers the incoming signals are rendered audible to the ear.

Detector: Any device, such as crystal or an audion, which converts the high-frequency oscillations of the antenna circuit into pulsating direct currents.

Dielectric Constant: 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.

Direct Current: Abbreviation D. C. A uni-directional current, that is, one that always flows in the same direction. Such a current may vary in intensity but must always flow the same way. Direct currents may be continuous pulsating or constant.

Earth: See ground.

Frequency: The number of waves that passes a given point in a second, or, in other words, the number of complete cycles the wave goes through in one second. See also **Alternating Current.**

Gap, Spark: Two metal rods so supported that their sparking distance can be closely adjusted.

Grid: An electrode of the vacuum tube. A fine mesh metallic screen, interposed between filament and plate, so as to regulate flow of electrons between them.

Grid Leak: A high, non-inductive, resistance, connected across the grid condenser, to present a leakage path so that the potential of the grid in respect to a terminal of the filament may be maintained at some desired value. The grid leak is sometimes connected between the grid and the filament.

Ground: Also called **Earth.** A connection with earth or water. Used as one side of a Radio system, forming a sort of condenser effect with the antenna wires.

Henry: The unit of inductance. A circuit has an inductance of one henry when a current changing at the rate of one ampere per second induces an E. M. F. of one volt in the circuit.

Hertzian Waves: Electromagnetic waves, named after their discoverer, the German

Honeycomb Coil: Coil constructed of solid wire, the winding being such as to approximate a bank winding in one direction. The coil is cellular in type, the turns of one layer crossing the preceding layer always at an angle, thus making the distributed capacity a minimum.

Hydrometer: An instrument for measuring the specific gravity of the electrolyte of the storage battery. The condition of the battery may thus be tested.

Impedance: That quantity which represents the combined resisting effects (to a current flowing in a circuit) of the ohmic resistance and the reactance or opposition due to the counter E. M. F.'s of self-induction and permittance. Impedance is expressed in ohms.

Inductance: Abbreviation, L. The ability of an electric circuit to produce an E. M. F. by electromagnetic induction, when the current in the circuit changes or varies. The "henry" is the unit of inductance. As this unit is large, the "millihenry," or one-thousandth of a henry, is most frequently used.

Insulator: Material that has such high resistance that it is non-conducting as far as electricity is concerned.

Jack, Telephone: A device used with a plug to connect meter or phones in circuit.

Kilowatt: Abbreviation, KW. One thousand watts. A large unit for measuring electrical power. See **Watt.**

"L"-Type Aerial: A flat-topped aerial from which the "lead-in" wires are led from one end of the antenna system.

"Lead-in": Wire or wires leading from the antenna system to the receiver or transmitting apparatus.

Lightning: Electrical discharge due to great difference of potential between clouds and earth.

Lightning Arrester: A protective device placed in the antenna-ground circuit for lightning protection.

"Loading" Coil: An inductance coil connected in the antenna circuit, when it is desired to receive greater than the natural wave-length of the receiving antenna.

Loop Antenna: An aerial constructed on a frame, wound with a number of turns of wire, used for receiving. The loop is sometimes used as an indoor aerial instead of using the standard aerial and ground. It has the advantage of reducing interference and static disturbances to a minimum.

Loose Coupler: See **Coupler** and **Coupling.**

Loud Speaker: A reproducing device, generally in the shape of a horn, which emits Radio signals or sounds loud enough to be heard without a head set. Amplification is essential to the of a loud speaker.

Megohm: One million ohms.

Meter: The unit of length in the metric system. A meter corresponds to 39.37 inches.


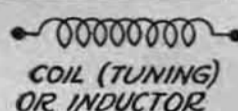
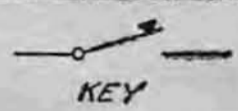
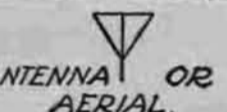
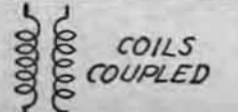
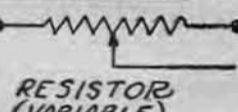
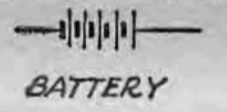
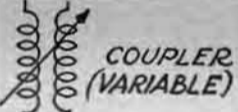

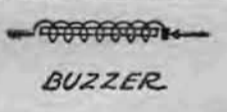


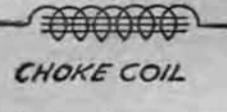


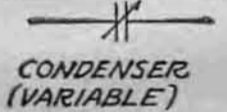
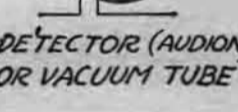

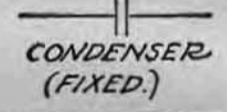
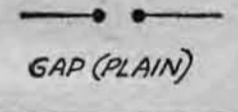

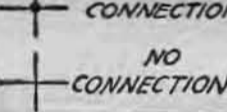
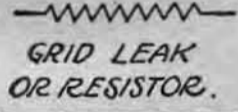
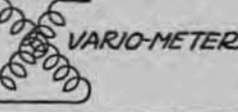
Microfarad: Abbreviation, mfd. One millionth part of a farad. See **Farad.**

Milliampere: One thousandth of an ampere. See **Ampere.**

Ohm: The unit of resistance. The resistance offered to the passage of one ampere when impelled by one volt.

Ohm's Law: A method of expressing the relationship existing between the E. M. F., current and resistance, and practically the basis of most electrical computations. It is expressed as follows: Current flow equals the electromotive force divided by the resistance.

Oscillations: High frequency alternating currents. "Radio frequency oscillations" is an arbitrary designation for current

 AMMETER	 COIL (TUNING) OR INDUCTOR	 KEY
 ANTENNA OR AERIAL	 COILS COUPLED	 RESISTOR (VARIABLE)
 BATTERY	 COUPLER (VARIABLE)	 SPST. SPDT. DPST. DPDT.
 BUZZER	 DETECTOR (CRYSTAL)	 PHONES (RECEIVING)
 CHOKE COIL	 DETECTOR (AUDION) OR VACUUM TUBE	 TRANSFORMER
 CONDENSER (VARIABLE)	 GAP (PLAIN)	 VARIOMETER
 CONNECTION	 GRID LEAK OR RESISTOR.	 CONTACT (SLIDING)
 NO CONNECTION.	 GROUND	 V.M. VOLTMETER.

a thin non-conducting medium, which has sufficient dielectric strength to prevent discharge between them. So-called because it can take a heavy charge at a small potential.

Continuous Waves: Abbreviation C. W. Electromagnetic waves having constant amplitude, which travel through the ether without losing their form. Also called "Undamped Waves."

Coulomb: The quantity of electricity or the charge transmitted in one second by a current of one ampere.

Counterpoise: A system of wires, suspended beneath the antenna and used in place of the usual ground connection. Insulated from the earth and used where a ground connection is not available or possible.

Coupler: A device for transference of the energy of Radio oscillations from one circuit to the other. The loose coupler and variocoupler are representative types. In a coupler, the primary is connected in the antenna-ground circuit and the secondary in the detector or closed circuit.

Coupling: The operation of transferring Radio energy from one circuit to another. Coupling may be close or loose, depending on the relative closeness of the primary and secondary windings.

Crystal Detector: Certain minerals and crystals inserted in a receiving circuit

Electron: A minute, but very active, particle or corpuscle of negative electricity. The smallest object known to science. All matter is composed of electrons.

Electromotive Force: Abbreviation, E. M. F. Also called voltage, electrical pressure, or potential. The force that causes electricity to flow. The unit of E. M. F. is the volt.

Ether: A hypothetical medium of extreme tenuity and elasticity, believed by scientists to be diffused not only throughout all space but among the molecules of which solid bodies are composed and to be the medium of transmission of heat, light and electromagnetism.

Farad: The unit of capacity. Represents the capacity of a condenser, which will hold a charge of one coulomb when the potential difference between plates is one volt.

Feed-Back Circuit: See regenerative circuit.

Filament: One electrode of a vacuum tube. A fine wire loop brought out through and sealed in the glass bulb. When heated to a high temperature, the filament emits negative electrons.

Filament Battery: See "A" Battery.
Flat-Top Aerial: A system of elevated wires supported parallel to the ground. See also **L-Type** and **T-Type Aerial.**

(Continued on page 12)

Hand Drill Used for Winding Coils

Drill with Revolution Counter Records Turns

If there is much winding to do, the use of some mechanical means will be fully appreciated. The writer has repeatedly used a hand drill for winding various inductance transformer coils, with most satisfactory results. A drill having a chuck of $\frac{3}{8}$ inch capacity is preferred be-

WORKSHOP KINKS? EARN A DOLLAR—

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

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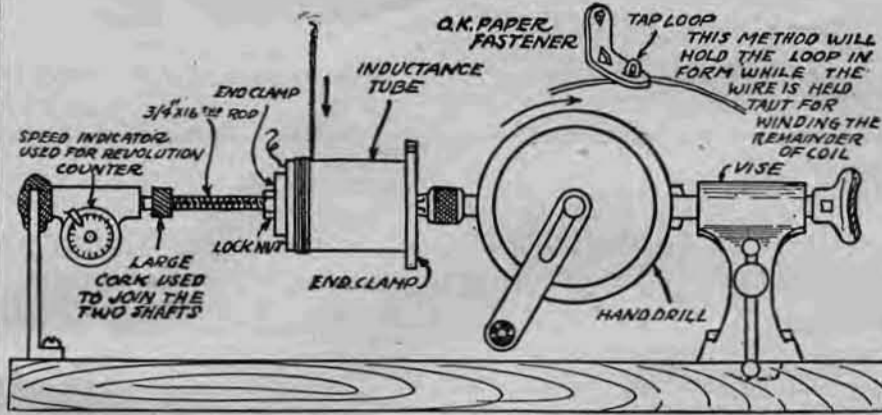
cause a tool of this size will be sufficiently strong to insure plenty of tension in the wire during the winding process.

Obtain a piece of cold rolled round stock, $\frac{3}{8}$ inch in diameter and long enough to accommodate the tubes selected for inductance. This rod should be threaded within 2 inches of its length and a nut provided to fit the threads. The standard die for this size of rod is $\frac{3}{8}$ in. by 16 threads.

Make two end clamps of wood $\frac{1}{2}$ inch thick and 2 inches wide, and long enough to project over the outside diameter of the tube to be wound. End clamps made after this fashion will enable the operator to work on the inside of the tube and secure the ends of the rod in the drill and after securing the drill body in a vise or clamping it to the bench, pass the end clamps and tube over the rod and tighten the clamp nut. It will be necessary for the operator to center of true the tube before the lock nut is securely tightened.

As a safety device, a simple ratchet can be made and attached to the drill drive gear to prevent unwinding, should the operator accidentally release the handle. In winding audio-frequency transformer

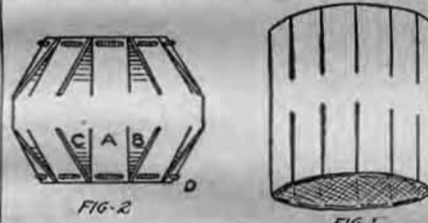
CORE OF COIL TURNED EASILY



coils a speed indicator or revolution counter can be attached to the end of the shaft so that the operator may proceed with the work without the constant thought of counting the number of turns. In winding coils, the writer has found it is best to support the spool of wire from above and to use a cotton or kid glove to guide the wire onto the tube.—H. E. Jameson, Milwaukee, Wis.

An Inexpensive Rotor Ball

Instead of paying from forty to seventy-five cents for a rotor ball, it is a simple matter to make one at home out of an ordinary tube such as the carton in



which ice cream is retailed. Measure off a length slightly longer than the diameter of the tube and cut it off. Mark a band from $\frac{3}{8}$ to $\frac{1}{2}$ inch in the center for the shaft connections and divide the remainder equally on each side into twelve parts as shown in Fig. 1. Slits are cut on these dividing lines to the marks of the center band.

Referring to Fig. 2, the parts B and C are bent down until their points touch, and A is glued on top of them, the pieces being held until the glue sets by a spring clothespin. The rest of the tabs are bent and glued in the same manner all the way around each side as shown. After all the tabs are glued down, holes are punched and a string D is woven in and out around the rotor close to each end as shown. This string forms a little shoulder which keeps the wire from slipping off while the ball is being wound, and then the string may be left permanently. After putting the string in place, the whole thing should be shellacked inside and out. This will make a firm and satisfactory rotor ball.—Albert E. Jones.

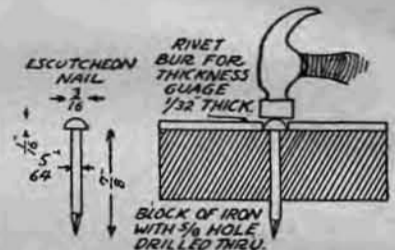
Preventing Interference

The best results are not always obtained by the new fan who is often enduring the unnecessary discomfort caused by signals from other stations interfering. Much interference may be eliminated by proper adjustment of the receiving circuits and apparatus.

If employing in the receiving circuit a vario-coupler or loose coupler with a coupling scale marked "maximum," "minimum," the pointer should be placed as near "minimum" as possible and the primary and circuits carefully tuned again after thus changing the coupling. Radiophone stations are best received with loose coupling, which also aids in reducing interference from other stations.

Escutcheon Nails Make Contacts for Switches

Escutcheon nails will make good switch contacts for the home-made variometer. In order to have a smooth head for an even contact, each nail was prepared in the following manner. A piece of annealed steel was procured 1-32 inch thick, and a hole drilled in it the size of the head of the nail. The steel was then hardened. Another smooth surfaced block of iron or steel was procured and a hole drilled in it the size of the body of the nail. The illustration shows the assembly of the steel parts with the nail in place ready for a blow from a hammer. When the head is hammered down level with the surface of the gauge steel, it will have a flat top and just 1-32 inch thick. To work the nails easily and to prevent the head from cracking it is best to anneal each one by heating them red and cool-



ing in water. The nails are run through holes drilled in the panel. The leads are soldered to the nail ends.—O. W. Feldman, St. Louis, Mo.

Positions of Aerials

Aside from its directional qualities there is no definite rule or rules governing the position in which an aerial must be placed. It may be straight up and down or horizontal. The only essential thing is that it shall be well insulated.

TERMS AND SYMBOLS

(Continued from page 11)

whose frequency exceeds 10,000 cycles per second. Audio-frequency oscillations are those whose frequency is below this margin.

Plate: An electrode of the vacuum tube. A sheet metal plate, positively charged, to which electrons are attracted.

Plate Battery: See "B" Battery.

Potential: Also called voltage, electrical pressures or electromotive force. The force that causes current to flow in a circuit.

Radiation: The sending of energy through the ether in the form of electromagnetic waves.

Radio Frequencies: Oscillations whose frequency is above 10,000 cycles per second. Such frequencies correspond to vibrations not normally audible.

Reactance: The opposition offered to the flow of alternating currents due to the counter E. M. F. of self-induction. Reactance is expressed in ohms. See **Impedance.**

Receivers, Telephone: The agency which actually conveys the Radio signals to the ears. Radio receivers are more sensitive than ordinary ones.

Rectifier: Any device which converts alternating currents into direct currents. A detector acts as a rectifier of high-frequency oscillations. See **Detector.**

Regenerative Circuit: Also called, "feed-back" circuit. A circuit in which regeneration is produced by "feeding-back" oscillating energy from the plate to the grid circuit. Types of this circuit are the "tickler" circuit and the "tuned plate" circuit.

Resistance: The unit of resistance is the ohm. Electrical resistance is the opposition which is offered by electrical conductors to the flow of current. No material is a perfect conductor, hence, all materials have resistance.

Resonance: A circuit is in resonance when it is in tune with another circuit. Two circuits of Radio-frequency are in electrical resonance if they are so adjusted that the products of the inductance and capacity in both circuits are equal in value. See **Tuning.**

Rheostat: A resistor so arranged that its effective resistance can, within its range, be varied at will.

Self-Amplification: A characteristic of

a vacuum tube in a regenerative circuit. The "feeding-back" of energy from the plate circuit into the grid circuit. This regenerative effect produces an increased value of plate current, which results in much louder signals.

Signals, Radio: Electromagnetic waves sent through the ether in the form of messages or speech.

Storage Battery: A battery which when being charged transforms the electrical energy imparted to it into chemical energy which is stored in the cell. When the cell is placed in a circuit through which current can be forced by the E. M. F. of the cell, the stored chemical energy is reconverted into electrical energy. The unit of capacity of any storage cell is the "ampere-hour," and the capacity is usually based on the normal or 8-hour discharge rate. See "A" Battery.

Static: Natural electrical disturbances in the ether.

Symbols: Conventional representations adopted to indicate the various parts of apparatus.

"T"-Type Aerial: A flat-topped aerial in which the "lead-in" or vertical wires are connected to the center of the antenna system.

"Tickler" Coil: A coil placed in series with the plate circuit of a vacuum tube and mounted so as to be in inductive relation to the secondary winding of the receiving circuit. The "tickler" is used in regenerative circuits for transferring energy from the plate to the grid circuit.

Transformer: A device, operated by virtue of the principle of mutual induction, whereby energy transfer from one circuit to another is accomplished. The voltage induced in the secondary may be of any value, according to the ratio of primary to secondary turns.

Transmitter: A device or apparatus for sending out electromagnetic oscillations in the form of signals or speech.

Tuning: The operation of adjusting the receiving equipment to be in "electrical resonance" with the transmitting station it is desired to hear. See also **Resonance.**

Umbrella Type Antenna: Essentially a vertical conductor from the top of which other conductors slope downward like the ribs of an umbrella. This type of aerial is used in some of the large transmitting stations.

"Undamped" Waves: See **Continuous Waves.**

Vacuum Tube: Also called a thermionic tube. Consists of three electrodes securely sealed in a glass bulb, which latter is then exhausted to a vacuum. One electrode the "filament," when heated, gives off electrons; the "plate," positively charged, attracts these electrons; and the "grid," placed between the filament and plate, is used to control the flow of electrons. Vacuum tubes can be employed for the generation, detection or amplification of high-frequency oscillations.

Variable Condenser: A condenser having essentially 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.

Variocoupler: See **Coupler.**

Variometer: A continuously variable inductance, consisting essentially of two coils in series, one being placed inside the other, the plane of the inside coil being rotatable about a diameter. The self-inductance of a variometer depends upon the relative position of the two coils.

Velocity: The velocity of transmission of all ether waves is the same, namely, 300,000,000 meters, or 186,000 miles a second.

Volt: The unit of electromotive force. The force required to send one ampere of current through ohm resistance.

Voltmeter: An instrument for measuring differences of potential, and giving the readings directly in volts.

Watt: The electrical unit of power. The power to do work when one ampere passes through one ohm resistance under a pressure of one volt. 746 watts equals one horsepower (H. P.) See **Kilowatt.**

Wave-Length: The distance between the crests of two successive waves. Wave-length may be determined by dividing the velocity of the electromagnetic waves by the frequency of the oscillations. The unit which has been universally adopted to measure wave-lengths is the "meter," the unit length in the metric system. The meter corresponds to 39.37 inches.

Wave-Length, Natural: The natural or fundamental frequency obtained with any antenna system without introducing other elements.

The above abbreviated list does not cover all the terms, technical and otherwise, that confront the beginner in Radio. The most common ones only are given.

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Simple Instructions for the Beginner

By Harry J. Marx

Construction of Spider Web Coils

THE USE of spider web coils for the tuning unit in receiving sets has been very popular with the amateurs in the past. Even now the novices are still making this type of coil because of its simplicity and low cost for home construction.

Spider web coils lend themselves readily to either two or three circuit hook-ups. The windings can be tapped if desired. The coils are usually loose coupled by

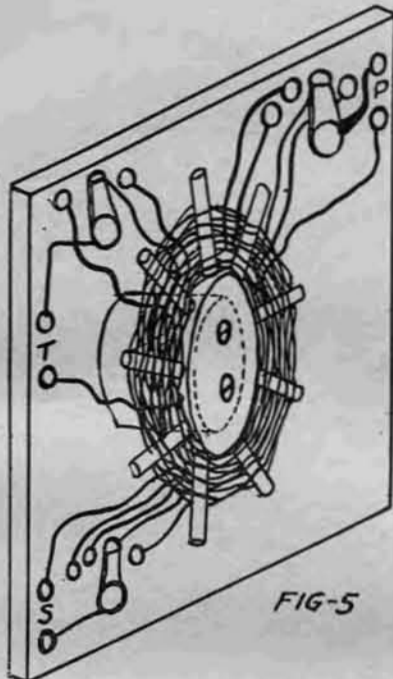
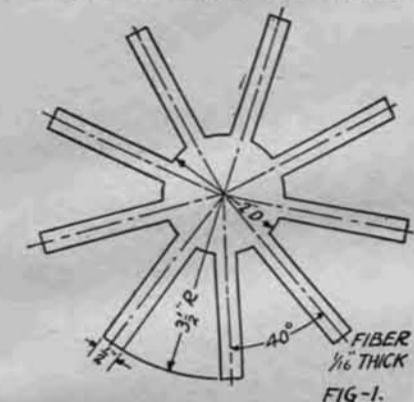
The form should be made of smooth cardboard, bristol board, or best of all, 1/16-inch sheet fiber. The use of phonograph

each leg is what supports the successive layers, one on top of the other as illustrated in Figure 3.

The wooden type of frame is shown in Figure 2. The hub is made of any hard wood 2-inch in diameter, cut in a 5/8 inch "slice." Nine, eleven or even thirteen holes drilled radially into the hub—spaced

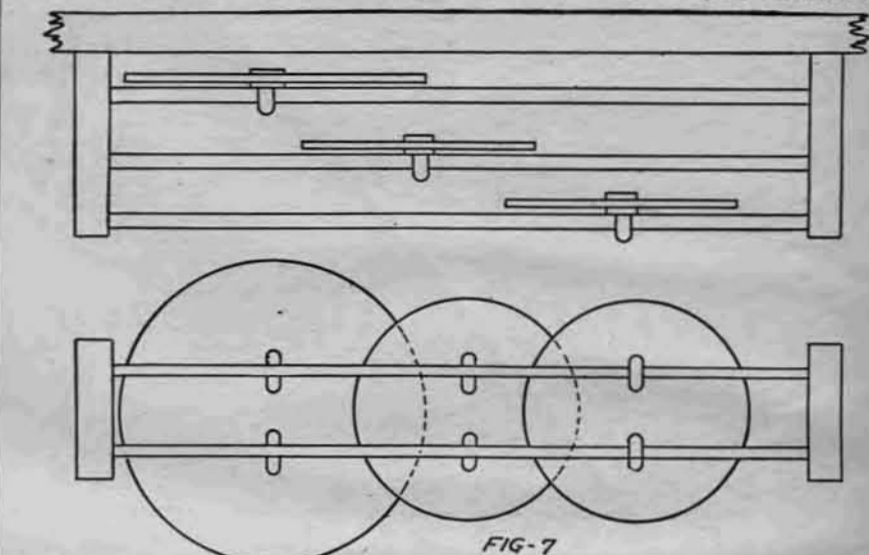
noticed that the tickler winding is first on the frame, and following in order then are the primary and the secondary windings.

When a three coil variable mounting is desired, the type shown in Figure 6 will be found very simple and easily assembled. The center coil is rigidly mounted and



means of a variable mounting. If fixed coupling is used, the windings should be accurately calculated for proper wavelength, and a variable adjustment provided by means of taps. Included in the fixed coupling, is the method of winding primary, secondary and even tickler all on one frame, utilizing tapped switches and condensers shunted across the coils for variable control.

records is also very popular. In winding on records a little more care must be taken as they are rather brittle and break



equally around the circumference. The writer found it easiest to turn a template into which the hub fitted very snugly. The radial holes were very accurately drilled in the template which then guided the bit for drilling the hubs. The tem-

fixed in the hinge block. The movable coils are fastened to wire arms by means of brass machine screws and nuts. The free ends of the wire arms are bent at right angles and are slipped through two screw eyes on the pivot block. This allows

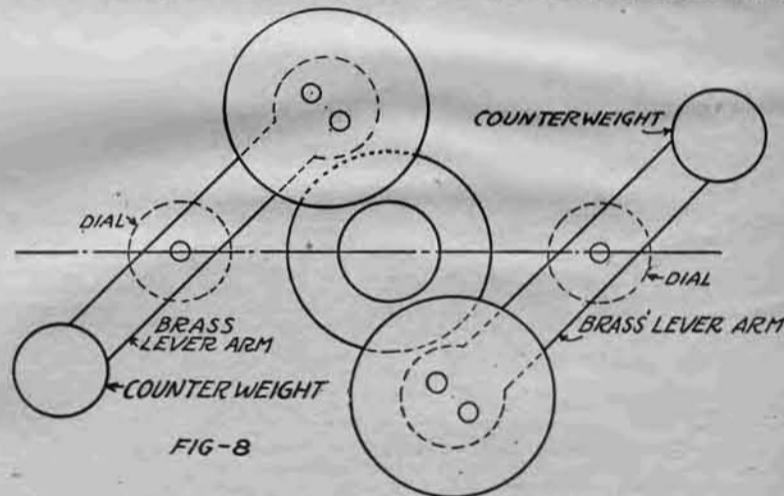
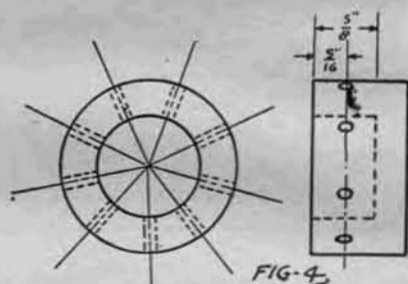
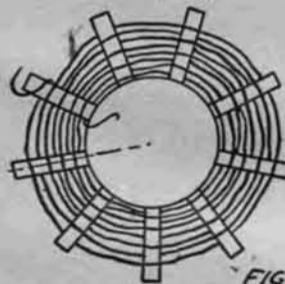
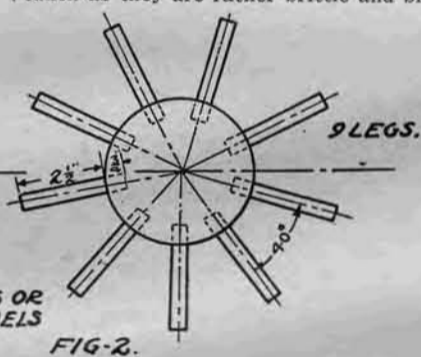
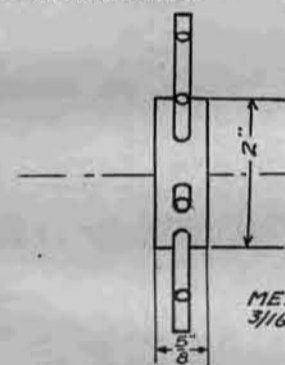


plate is illustrated in Figure 4. The hub holes should be 3/8 inch deep.

The legs are made of meat scivers, or doweling (3/16 or 1/8 inch in diameter). These dowels should be 3 1/4 inches long.

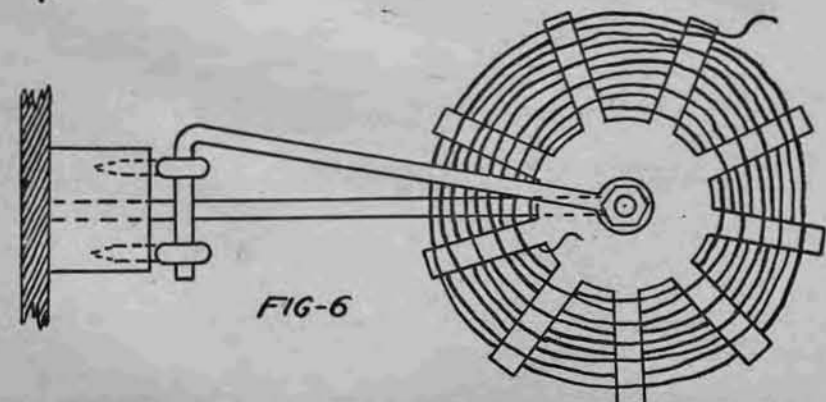
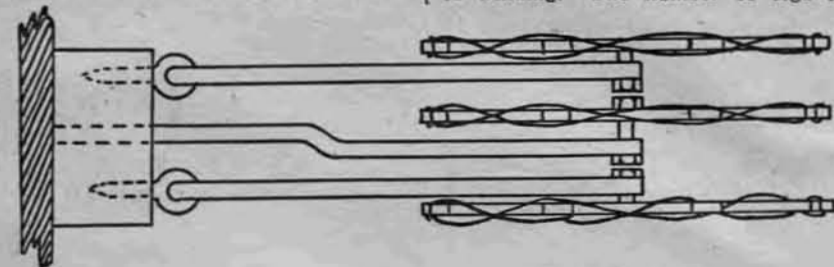
them to be adjusted in any angle. Taps can be taken off for rough adjustments if desired.

Another mounting can be constructed by sliding the coils past each other on



The calculation for the inductance of spider web coils are a little more complicated than the ordinary single layer

easily. The dimensions given can be varied as required by the type and method of winding. The number of legs must

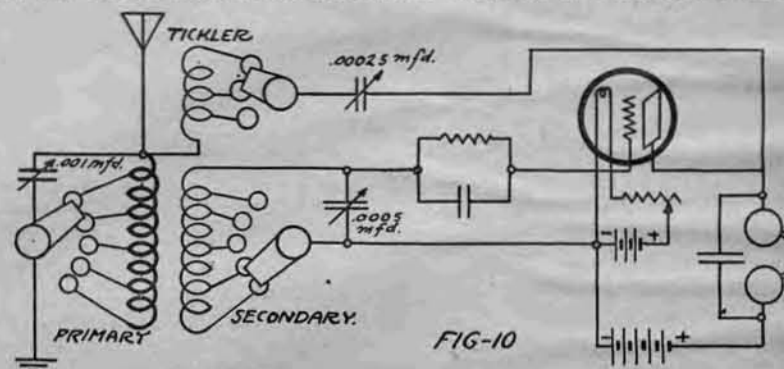


The one end is slightly rounded off, dipped into glue and forced into the hole in the hub. The legs should project 2 1/2 inches. However, this length is immaterial as the legs can be trimmed off to suit after the winding is completed.

The frames should be dipped or given a very thin coat of shellac before winding.

Two screw-eyes are fastened to the frame of each coil and two rods are passed through these screw-eyes to act as guides for the coil to slide along. Six rods are required for a three coil mounting.

The most compact and very efficient type of mounting is illustrated in Figure 8.



Method of Mounting

When all three windings are on one frame and taps are taken off each winding the method of mounting illustrated in Figure 5 is recommended. It will be

This coupling requires little space and yet permits very accurate adjustment. The counterweights can be eliminated but (Continued on page 14)

tube wound coils, and will, therefore, be taken up in another article.

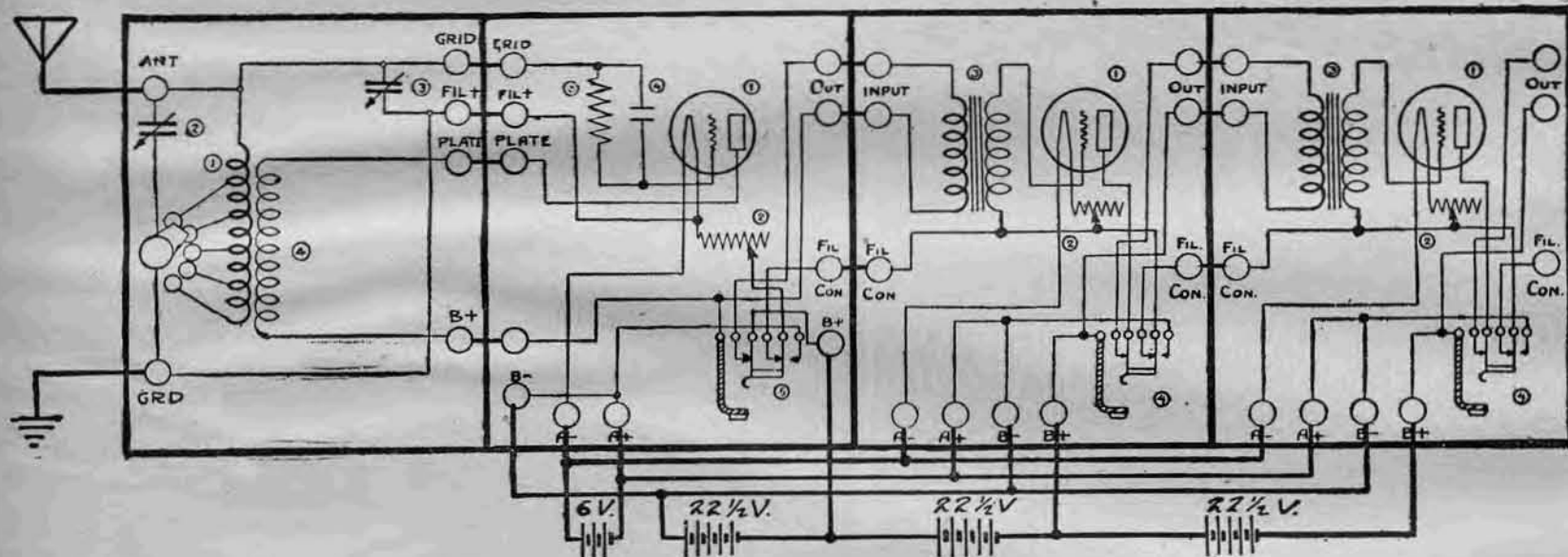
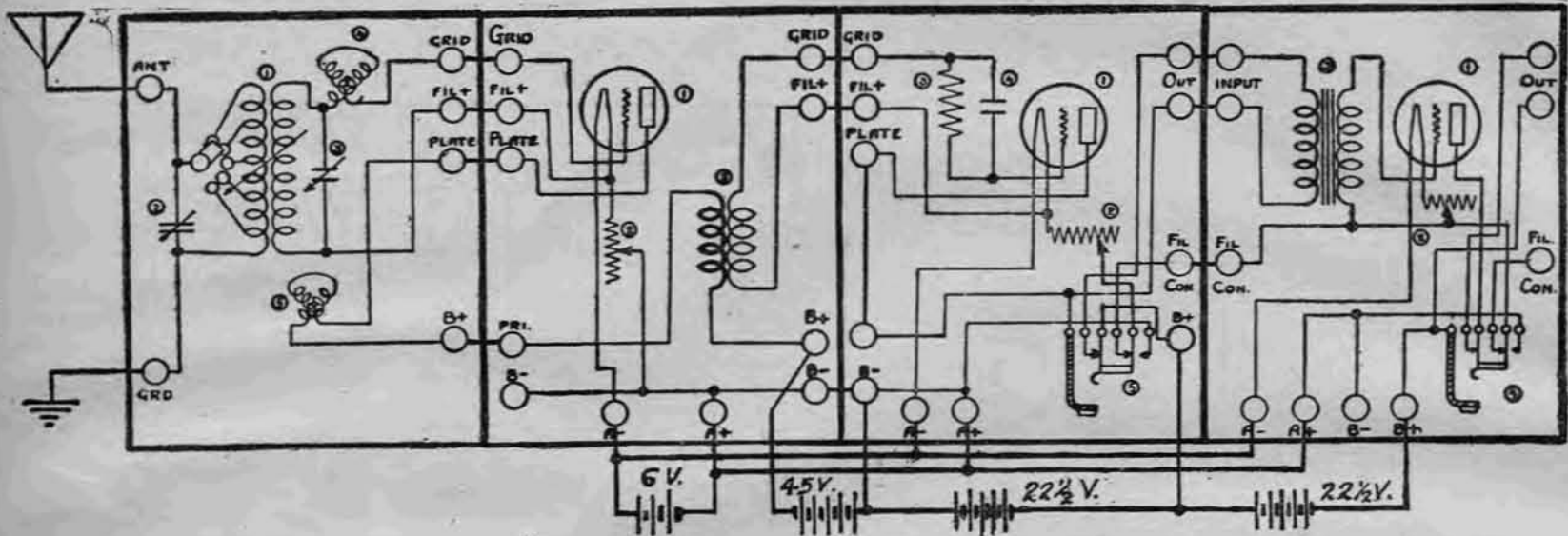
Construction

Probably the most popular frame for the spider web is that shown in Figure 1.

always be odd or the wire when staggered back and forth around the legs will always come on the same side of the leg. The fact that each succeeding layer of wire is always on the opposite side of

Panel Units for Your Receiving Sets

By Harry J. Marx



Continuing the diagrams started in the last number, showing the method of connecting the panel units for receiving sets, the above two illustrations are given. The top diagram shows the variocoupler, variometer tuning panel (described July 15th) in circuit with a Radio frequency amplifier panel (described July 29th), one vacuum tube detector panel (described July 22nd) and one audio frequency panel (described July 29th). The four units when so assembled give one stage of Radio frequency, detector, and one stage of audio frequency, a combination which, together with the efficient variocoupler and variometer tuning panel, makes very efficient reception for both local and long distance reception, especially over

the popular 360 meter broadcasting range. The method of connecting to one another and to external batteries, ground and antenna, is clearly indicated. The bottom diagram illustrates the variocoupler in which the secondary is used for the plate circuit (described August 12th), in circuit with the vacuum tube detector panel (described July 22nd), and through audio frequency amplifier panels (described July 29th). This circuit is especially efficient for local reception where loud speaker attachment is desired, although very high efficiency can be obtained for more distant receiving. By means of the jacks, the use of the amplifying stages can be controlled as desired. Both circuits described are of the feed-back or regenerative type.

SPIDER WEB COILS

(Continued from page 13)

It is rather difficult to keep the coils in place by spring tension on the dial shafts. The dimensions of the brass lever arms depend on the sizes of the coils and the panel layout. The secondary can be made the fixed coil and the primary and tickler the variable coils. The adjustment need not cover more than 180 degrees or half a revolution although there is nothing to prevent swinging the coils through the entire circle.

Winding Methods

In winding the coils No. 24 single cotton covered wire will serve in most cases. This can be varied depending on the number of turns and the space available. The size of the wire however should be within the limits of No. 20 to No. 30 gauge.

For a variable coil circuit, the primary should have 50 turns—with taps at the 10th, 20th, 30th, 40th and 50th turns. The secondary should have 75 turns with taps at the 15th, 30th, 45th, 60th and 75th turns. Small variable condensers can be shunted across the coils to facilitate accurate tuning.

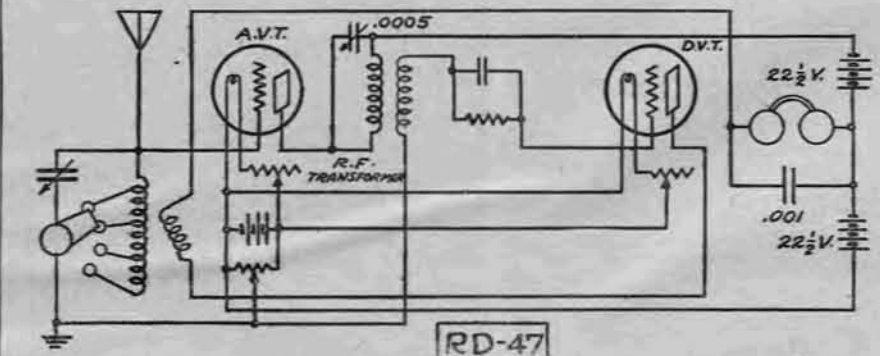
Figure 9 shows a hook-up using two coils as just described with a crystal detector. A 43-plate variable condenser is used in the primary circuit and a 23-plate variable in the secondary. The usual .001 microfarad fixed condenser is shunted across the phones as shown.

Figure 10 shows a hook-up that can be used with the spider web coil where all three windings are on the same frame. This circuit is of the regenerative type.

Three in One Frame Winding

The tickler, which is first wound on the frame, consists of 25 turns and is tapped at the 15th, 20th and 25th turns. A nine-plate variable condenser is used in series in the plate circuit. The primary is wound next with 50 turns and is tapped at the

HOOK-UP RD-47



In reply to a number of requests for additional amplifying stages to the hook-up using the variocoupler with the usual secondary coil inserted in the plate circuit, the following R.D.-47 is given: It varies somewhat from the conventional form of hook-up usually found for Radio frequency amplification. A potentiometer is shunted across the "A" battery in order to give the grids of both tubes the proper negative potential. It will be noticed that the tickler coil is connected to the plate circuit of the detector

tube and not of the amplifier tube. The method used in connecting the batteries permits 22 1/2 volts in the plate circuit of the detector tube and 45 volts in the amplifier tubes. The Radio frequency transformer has a .0005 mfd. variable condenser shunted across the primary for control of the wave length of the transformer. A suggested potentiometer resistance would be 400 ohms. The grid leak and grid condenser are of the usual fixed value type. Separate rheostats are indicated for the two tubes.

10th, 20th, 30th, 40th and 50th turns. A five point tap switch can be added for finer adjustments. In this case taps are taken at the 40th, 42nd, 44th, 46th and 48th turns, eliminating the 50th tap on the other switch and tapping at 0. A 43-plate variable condenser is shunted across the primary coil, but is not abso-

lutely necessary with the second five tap switch. A 5-plate condenser would do. The secondary is wound last and consists of 75 turns tapped at the 15th, 30th, 45th, 60th and 75th turns. If desired another tap switch can control the adjustment to the 63rd, 66th, 69th, 72nd and 75th turns. A 23-plate variable condenser (or

smaller in case the three turn taps are used) is shunted across the secondary coil. The balance of the circuit is made up of the usual apparatus required in a vacuum tube detector set.

For a three coil variable mounting, the same winding system just explained can be used. Any hook-up designed for honey-comb coils can be used for the spider web coils.

After the windings have been completed, the coils can be dipped into a very thin shellac. Any projecting legs can be trimmed 1/16 inch beyond the last winding.

If the wire has been wound evenly and with uniform tension, spider web coils will make a very neat and attractive appearance for panel mounting.

Repairing a Variable Condenser

Variable condensers frequently become short-circuited and when this happens the instrument will be absolutely useless. Usually the novice starts bending the plates to make a repair, but this is bad practice and, as a matter of fact, is really the last resort. Before bending any plates or trying other methods of repair requiring force, insert paper or cardboard washers of different thicknesses under one or more of the posts which support the condenser. This will raise or lower the rotating section and in all probability free the short-circuit without further trouble.

Should this method fail it is then time enough to thoroughly inspect the plates to see if any have accidentally been bent out of shape and if so they may be straightened. Condensers should always be handled carefully as, despite their rugged appearance, they are very easily thrown out of adjustment which causes them to become short-circuited.—Albert E. Jones, East Milton, Mass.

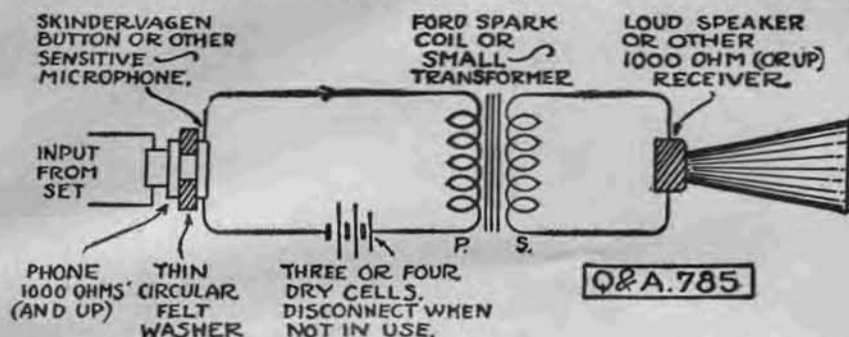
Questions and Answers

Telephone Repeater

(785) DH
Would you be so kind and answer a few questions for me about Radio diagrams?

Please send me a diagram for using a loud talker with a crystal receiver such as the one pictured on the back page of Radio Digest for the week of July 22 1922, page 16.

A.—The general scheme employed is really an old one. It is clearly shown on the accompanying diagram. This mechanical repeater is always less efficient than a triode tube cascade as the moving parts at best are awkward, heavy, and distortion producing. Clamp the microphone, felt washer, and phone receiver together.



Design of Tuning Unit

(436) EEW
Any information you could give me on tuning unit here described will be greatly appreciated.

Variable Coupling: Primary 4-inch bakelite tube, 3/8-inch bakelite ball rotor. Set on 45° angle (similar to Remler). Primary wound with No. 22 D. S. C. wire tapped 1 to 8 and every eighth turns to 64. Secondary wound 40 turns No. 22 D. S. C. wire.

Primary Condenser: 43-plate on D. P. D. T. switch to shunt primary or to connect in series with ground.

Secondary Condenser: 43-plate on switch to shunt secondary if wanted.

Plate and Grid Variometers: 4-inch bakelite tube, 3/8-inch bakelite ball rotors. Stators wound on outside of the 4-inch tube 40 turns No. 22 D. S. C. wire. Rotors also wound 40 turns No. 22 D. S. C. wire. Both variometers are alike. All rotors are pigtailed and all connections are soldered. Aerial 95 to 100 feet long 40 feet high single wire with 25-foot lead in. This unit is in cabinet shielded on all sides, with bakelite panel.

1. What do you think of the set up?
 2. Can you estimate the approximate wave length range?
 3. Are the condensers an advantage here?
 4. Do you think that a vernier variometer in the plate and grid circuit worth putting in?
 5. Can one or two steps of Radio frequency be used with this tuner?
- A—1. Sounds all right.
2. See page 13, issues 9 and 10, June 10 and 17. About 200 to 700 meters.
3. Yes.
4. No.
5. Yes. See page 13, issue 12, July 1.

Connections Wanted

(358) JRG
Please send me the proper connection for the following instruments:

1 variocoupler, 1 variable condenser, 1 vacuum tube (detector), 1 rheostat, 1 grid leak and grid condenser, A battery, B battery, pair phones.

A—See RD-4, page 13, issue No. 3, April 29, 1922. Omit variometer if desired.

Long Wavelength Range

(466) TAO
I will appreciate an answer to the following questions: I am sending you a diagram of a hook-up of a receiving set which I am about to build or purchase.

1. Will this hook-up give me a range from 200 meters to 24,000 meters by changing the coils?
 2. Is this hook-up correct? What changes are to be made, if not?
 3. Is the honeycomb coil set practical for this range in meter length?
 4. Is it necessary to attach the negative wire of the B battery to the positive wire of the A battery?
 5. Could I afterwards include an amplifying unit between the detector unit and the honeycomb coils?
 6. About what could I expect of this set? Could I receive under good conditions stations WGY, KDKA, KYW, WWJ and WLK? If not what other instruments would I need in the set to make it complete?
 7. About what will this set cost to purchase it on the market complete?
 8. What length aerial should I use for this set?
- A—1 and 3. See issue 4, May 6, page 13, on honeycomb coils.
2. Connect + of A battery to — of each B battery.
3. Yes. See 1.
4. Yes.
5. Yes

6. 2-stage amplifier about 200 miles ordinarily. More range with 3-stage Radio frequency. See page 15, issues 9 and 10, June 10 and 17.

7. See advertisers. Depends a lot on workmanship.

8. About 150 feet.

Tuning Apparatus Calculations

(469) CAE
I would like to take advantage of your question and answer columns. I am making a Radio receiving set and would like to get some information. I am making a sliding coupler outfit and intend to hook it up like the one you show in the April 29th issue of RADIO DIGEST, R. D.-6. I am going to use one detector bulb and

later on add two amplifier bulbs. I have made my sliding coupler by using a round cardboard box 9 inches long and 5 1/4 inches in diameter wound with 250 feet of No. 20 wire making 10 taps for my primary, and using 400 feet No. 26 wire, 10 taps, for my secondary. The wire was cotton covered enameled. I have 3,000-ohm receivers, necessary batteries and condensers mentioned in your diagram R. D.-6.

1. Could you offer any suggestions?
 2. How far will I be able to hear concert with this outfit with and without amplifier bulbs, using a good aerial?
 3. Is it all right to use varnish on the sliding coupler instead of paraffin dip?
- A—1. See page 13, issues 9 and 10, June 10 and 17, for tuning apparatus design.
2. Range without amplifiers in summer, 75 miles or more.
3. Should be a good insulating shellac. Varnish will work probably.

Mining Camp Radio

(420) GEP
While looking through your RADIO DIGEST of the last three weeks I have found some very interesting news of Radio. I am going to ask you a few questions if you will oblige me by answering same. I am going to a small mining camp on the coast of Alaska, 700 miles from Seattle and 1,000 miles from Portland, and was figuring on putting up a Radio station as we are 50 miles from the nearest town over a mountain trail and are very lonely. Now could I receive music that distance?

1. There is nothing there to recharge batteries but there is a 32-volt Delco lighting system. Is that any good or could I use dry batteries?
 2. Now if you will give me two or three hook-ups that will not be too expensive and all the data that you have time to give me I will be very much obliged and a booster for your magazine. Kindly let me hear from you soon as Radio is going to be a wonderful thing for men who have to work out in this wilderness.
- A—1. Use 2 stage Radio frequency, detector and 2 stage audio frequency set for this distance.
2. Delco 32-volt system can be used. Tap off 6 volts to light filaments and 24 volts for B voltage.
3. See RADIO DIGEST July 1, issue No. 12, page 13, for hook-ups.

D-L Coils

(426) JWL
Can you give me a diagram of what you consider the best hook-up for receiving both short and long wave stations using D-L coils? We are not near any broadcasting station at the present time, DD5 of Denver, Colo., being the closest. However, I understand that there will be a broadcasting station at Butte, Mont., within a short time.

Wish to state that the RADIO DIGEST is some publication and the dope given therein much better than most of the stuff one is able to pick up out of the different text books on this subject as it is published in a way the average fellow can understand.

A—See RADIO DIGEST issue No. 12, July 1, page 13, for hook-ups. Refer also to page 15, issues 9 and 10, June 10 and 17.

All Over the World

(437) BM
I would greatly appreciate an answer to the following questions:

1. Give hook-up for three honeycomb coils, detector tube and two steps of amplification?
2. Give hook-up for a loose coupler and a detector tube?
3. Can I construct a set to receive telephone and telegraph all over the world?
4. How can I construct a good, loud speaker?

5. Is there such a thing as a step up amplifier? If there is, can they be home made?

- A—1 and 2. See RADIO DIGEST issues 9 and 10, June 10 and 17, page 15 for hook-ups.
3. Yes, but it would take considerable experience and quite an investment.
4. Cheaper to buy than attempt to make.
5. Yes, all have some step up ratio, but making one is quite a job. See page 12, issue 13, July 8.

Two Step Amplifiers

(434) PM
Would you kindly tell me how to connect two steps of amplification to my regenerative set, the diagram of which I enclose. Would I need another A battery or any more B batteries? If you think it worth while to write please enclose a diagram of how to connect and oblige.

A—See RADIO DIGEST issue No. 12, July 1, page 13, for hook-ups. No additional A or B batteries are needed.

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The very latest innovation in Radio is the aerial hat. Some hat, but how can you get a hundred feet of wire up there to catch the ether waves? It seems as if Miss Bobbie Person makes use of her Radio outfit to good advantage at the beach, even though it is a simple set.

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The government intends to direct night flying for the air mail routes by Radio. Photo shows experimental plane fitted with Radio set for this purpose.

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Radio concerts have offered practical use in dancing and other things, and now the practice of fencing is taken up to the music of Radio. Bert Lytell, movie star, at the foil.

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