Radio Frequency Amplifiers Explained–Page 11

Radio Digest

EVERY WEEK **Illustrated** TEN CENTS

TRADE-MARK

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WORLD CATCHES CRAZE

PROSPECTOR FIRST ON SCENE IN RUSH

EMPLOYS RADIOPHONE TO INFORM OF STRIKE

Receives Message from Partner in City and Speeds to New Claim

(*Special to RADIO DIGEST*)

THE PAS, MANITOBA.—Radio is giving the rush to the gold rush. Jack Anderson, prospector and explorer of the Canadian wilds, has started it. He has just arrived with a Radio receiving set which, he says, will keep him many bounds ahead of all the old-time gold rushers.

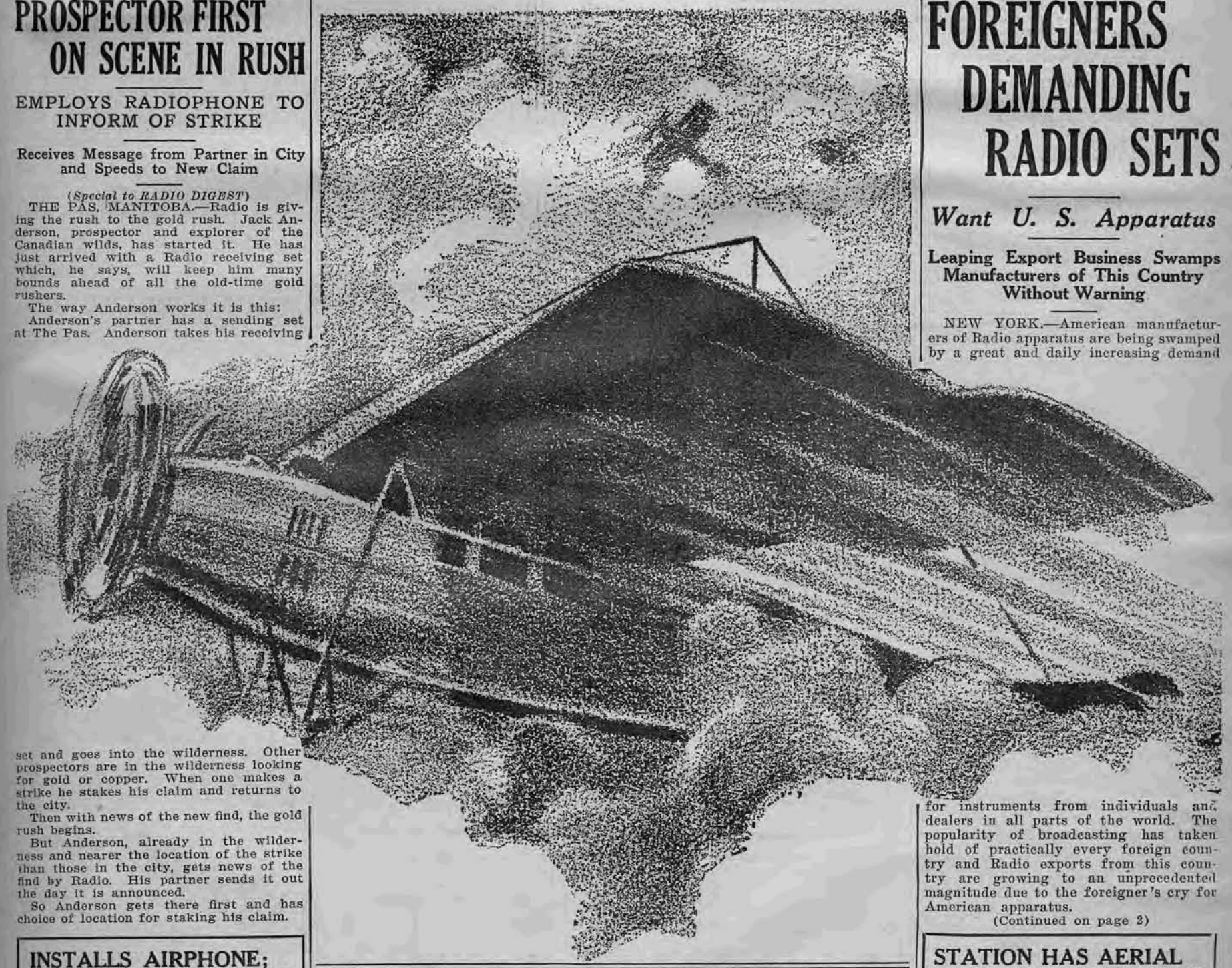
The way Anderson works it is this:

Anderson's partner has a sending set at The Pas. Anderson takes his receiving set and goes into the wilderness. Other prospectors are in the wilderness looking for gold or copper. When one makes a strike he stakes his claim and returns to the city.

Then with news of the new find, the gold rush begins.

But Anderson, already in the wilderness and nearer the location of the strike than those in the city, gets news of the find by Radio. His partner sends it out the day it is announced.

So Anderson gets there first and has choice of location for staking his claim.



FOREIGNERS DEMANDING RADIO SETS

Want U. S. Apparatus

Leaping Export Business Swamps Manufacturers of This Country Without Warning

NEW YORK.—American manufacturers of Radio apparatus are being swamped by a great and daily increasing demand for instruments from individuals and dealers in all parts of the world. The popularity of broadcasting has taken hold of practically every foreign country and Radio exports from this country are growing to an unprecedented magnitude due to the foreigner's cry for American apparatus.

(Continued on page 2)

INSTALLS AIRPHONE; SELLS HOUSE QUICK

DALLAS, TEX.—Just because he could not sell a good, but not modern house, a real estate operator of this city installed an up-to-date Radio receiving set and so advertised it in the leading daily paper. Replies came in quickly and offers were made for the old house, and it was disposed of at a good profit.

Soviets Erect High Power Station Near Bogorodisk

MOSCOW.—Russia has added another high power station to its chain of thirty-eight transmitting stations by putting into service a 100 kilowatt transmitter at Bogorodisk, near Moscow. The new station has a system of towers that are over nine hundred feet high, according to a report of the Assistant Commissioner of Posts and Telegraphs of the Russian soviet government.

Michigan Opens Ether War on Illicit Liquor Traffic

DETROIT.—With Lansing as a headquarters, Michigan has opened war on the illicit liquor traffic along its lake and other boundary lines. In the scheme of things Radio is playing the major role and six powerful broadcasting stations keep the official "hooch hounds" well informed of the activities of bootleggers and the agents are in constant touch with their headquarters.

STATION HAS AERIAL UP ONLY TWO MILES

PORTLAND, ORE.—Probably one of the highest spots on which a regular Radio station has been established is on top of Mount Hood, some 11,200 feet above sea level, far above the clouds, where as a link in the almost "air-tight" chain of fire prevention in the National Forest Reserve it performs an indispensable duty.

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WORLD CATCHES CRAZE

(Continued from page 1)

Manufacturers of other countries are endeavoring to sell their equipment in the new markets, but without much success, for the efficient American types of sets are decidedly in favor.

Following up this intense demand, just within the past few days, three leaders in the manufacture and sale of Radio apparatus have left for Europe to investigate the situation and make preparations to supply the market. These are Rodman Wanamaker, the well-known New York and Philadelphia merchant, M. B. Sleeper, president of the Sleeper Radio Corporation, and J. C. Schlier, of the Law Sam Corporation. The three are but a few of the many representatives of American Radio interests now on the way or in Europe.

Means Greater Production

The unexpected turn, that of developing business in foreign fields so soon, has taken the entire group of American manufacturers by surprise. It will necessitate even greater production than that of which they are now capable in order to supply the foreign demand as well as the orders at home which will also increase greatly with the first cool days of the Fall.

Not alone Europe but Africa, South America, Canada, Australia, Asia, and Central America, including Mexico, are calling for Radio sets of American make. The residents of practically every country in the world can now be included in the great body of fans which six months ago was confined fairly well to this country. The mind of the globe is turning to the study of electromagnetic waves and the many allied mysteries of broadcast transmission and reception. With it all, American apparatus stands paramount. Indications are that Radio manufacturers of this country are about to reap in a harvest and to dominate the world in the sale of their wares.

Radio Exports Grow

The total value of equipment shipped abroad during the first five months of this year is more than 60 per cent of the total for the calendar year 1921, and the inquiries from abroad have increased considerably. As productive capacity here catches up with the domestic demand, a strong export trade may be expected.

Due to the volume and the variety of the home demand, American manufacturers have developed simple, compact, efficient, reliable and economically priced receiving sets, which should take well abroad. As an indication of the interest shown by foreign buyers, one manufacturer reported a few days ago that as a result of circulars recently sent a list of London electrical importers, he had already received two inquiries by cable.

As an interesting feature of the sales abroad, there has for several months been a considerable call for receiving sets from our neighbors on the north and south —Canada, Cuba, Mexico, and Central America, where Radio "fans" found that tube sets would permit them to readily listen in on some of the important American broadcasting service.

Dark Africa Gets Busy

South Africa is the latest convert to the use of the airphone. While the government is turning its attention to the problem of initiating Radio communication with Great Britain, the possibility of utilization of Radiophone in remote parts of the South African veldt is also under consideration.

The high cost of generating power for the stations and lack of commercial business appear to be the main drawbacks confronting government participation in Radio work in that country. In the meantime amateurs in Cape Town have formed a society for promotion of the science and, as in the United States, broadcast reception has become a popular sport.

Thief Forgets to Listen In

ALBANY, N. Y.—Radio messages broadcast in the name of the district attorney to stop the expected flight of Isidor Nathan, wanted by the New York police in a theft case involving $60,000, resulted in the return of Nathan by the Albany police. He was to be brought to New York by Detective Cuniff of the district attorney's squad.

To Utilize Ether Waves in Control of Salt River Irrigation Project

Arizona Station Will Broadcast Flood and Drought Warnings Also—Inlet from Roosevelt Dam Reservoir to Be Opened and Closed by Airphone Orders from Verde

PHOENIX, ARIZ.—Radio control of an irrigation project comprising some 200,000 acres of reclaimed land in Arizona, is the latest use to which over-worked Radio has been put by the Government. The Salt River Valley Water Users' Association, which is a local agency controlling the Salt River Irrigation Project for the Interior Department, has installed and equipped a Radio house toward the source of the Verde River, their natural water supply. There is no railroad or means of communication between Phoenix, Arizona, and the upper reaches of the river where sudden storms cause the ordinary low water to rise with great rapidity, frequently flooding the ranches and farms below and causing enormous damage.

Believing that a Radio service would provide a timely warning, the operators of the project have taken up the latest means of quick and direct communication, and received the approval of Secretary Fall of the Interior Department. Gauges are placed in the upper Verde and also at Cave Creek, so that any appreciable rise can be noted and broadcasted from the station to the manager's office in Phoenix and, to all ranch owners who listen in.

Will Control Inlet from Reservoir

There is also another phase of usefulness to the new Radio station. When the Verde, which flows into the Salt River near Phoenix, is supplying plenty of water only a little is used from the reservoir back of the big Roosevelt Dam, and in the future the inlet from the reservoir will be controlled by telephone from Phoenix based on reports from the Radio station as to the state of the water in the Verde. When the storage water is not needed, or the Radio station advises the operator at Phoenix that rain is falling in the Verde basin, the inlet to the system from the Roosevelt Dam will be closed and nature will take care of the irrigation; but when the Verde is low, the inlet at the dam will be opened by telephone orders from Phoenix. This control will conserve considerable of the valuable storage supply for emergencies.

In the past there have been some bad years, when the water was short, but with the new Radio control and communication it is believed that the water can be so conserved as to insure a steady and lasting supply.

BUS PASSENGERS HAVE MUSIC WITH ROAD DUST

Hear Station WBAD While Going 30 Miles Per Hour

MINNEAPOLIS, MINN.—The first Radio bus ever to be put into actual operation on schedule in the United States is now operating between Minneapolis and St. Cloud, Minn., making the trip in a little over two hours and keeping its patrons amused with Radio music while enroute.

The bus cost its owners, the Jefferson Highway Transportation company of Minneapolis, a little over $15,000, and was built in the twin cities complete with Radio installation.

An ordinary audion receiving set, with four-step amplifier, has been installed, using a 172-foot single strand antenna which is stretched in eight strands along the roof of the huge bus, with a ground wire to the frame of the chassis. Twenty-four headphones have been connected in parallel, one for each passenger. The driver of the bus operates the receiving set.

In its first test, the bus drove at a speed above 30 miles an hour continuously for 25 minutes, and throughout that time received plainly a concert being broadcast from Station WBAD of Minneapolis. The motor hum causes no trouble, although the music is less plain near the front than in the rear seats, which are divided off into a luxurious smoking compartment.

The bus makes two round trips daily from Minneapolis to St. Cloud, a distance of 67 miles each way, driving at an average speed of 27 miles an hour. It is planned to put a similar bus in operation over a different route in the near future, according to officials of the company.

WESTERN BOYS' CAMP TO LISTEN AND LEARN

Major A. H. Hutchinson, "Y" Secretary, to Teach Fundamentals

SAN FRANCISCO.—Radio is to serve both as a source of education and entertainment to boys of Camp McCoy, the annual boys' summer camp of the San Francisco Y. M. C. A.

For the first time in the history of this camp, a Radio outfit will be installed. It will be under the direction of Major A. H. Hutchinson, who was a "Y" secretary overseas. Not only will the boys be enabled to catch messages from their folks at home, but they will be entertained with concerts, educational talks and news reports from bay cities broadcasting stations. The intricacies of Radio will be explained to the boys by Major Hutchinson.

LAND OF LOST WAVES FOUND IN CALIFORNIA

Messages Cannot Penetrate Space of Radio Silence

LOS ANGELES, CALIF.—Southern California has developed the land of the "lost Radio wave." That is vouched for by scientific investigators. According to their reports there is a "space" between Porterville and Modesta inside the radius of which Radio messages absolutely disappear. So far as Radio is concerned it is a region of eternal silence.

Some sort of invisible barrier in the ether or the ground seems to barricade the Radio waves and nothing happens. It is just as though an ethereal door were shut against all the world. Not from the north, south, east or west do the Radio phone messages leak in.

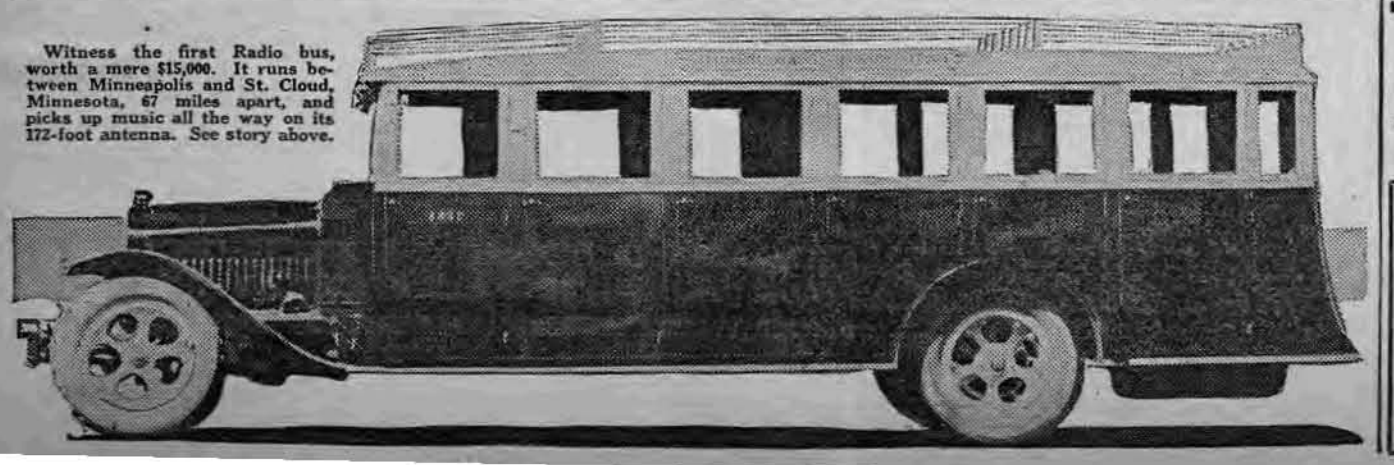
L. M. Maynard, of the Citizens' National Bank, of Los Angeles, tells of this phenomenon of the air. He has just been traveling in that district and expected to keep in touch with his bank by Radio.

Cut Off from World

Finding this impossible, Mr. Maynard thought at first that his apparatus was out of order and reassembled it. Then, when he arrived at Fresno, he found that other Radio operators were having the same trouble. They were simply cut off from the rest of the world, save for an occasional pick-up of a message.

The Radio fans in the "lost Radio wave" territory have already begun to experiment to ascertain the cause of the trouble. They are preparing box kites to which they attach fine wires, hoping that in the upper stratas they may find the elusive medium which they thought was all saddled for their service, but which has persistently evaded the touch of the most efficient outfits.

PITTSBURGH, PA.—The "Radio masher" has broken out. He cuts into concert programs with a description of his entertaining qualities and his automobile, and offers to meet any good looking young lady at a prescribed place and designated time.



Witness the first Radio bus, worth a mere $15,000. It runs between Minneapolis and St. Cloud, Minnesota, 67 miles apart, and picks up music all the way on its 172-foot antenna. See story above.

Radio Digest Illustrated

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Looking Ahead

Everyday Analogies for Radio. A continuation of the series by Letson Balliet in answer to many requests from our readers.

Vacuum Tube Receiving Sets, Section I. Peter J. M. Clute will describe the action of the triode tube in single and two circuit receivers. Section II will give its application in regenerative circuits.

Radio Frequency Amplification. A conclusion of Benjamin F. Miessner's article on this subject will appear soon.

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TEACH PATRIOTISM AND CITIZENSHIP

AMERICAN LEGION GIVES AIRPHONE LECTURES

Nebraska State Post Uses Ether for Instructions in Americanism

(Special to RADIO DIGEST)

LINCOLN, NEBR.—Desiring to serve the country in peace as in war, the American Legion, Department of Nebraska, with executive offices located at the state capital of Nebraska, has installed a complete Radio broadcasting set and is furnishing programs on patriotism, Americanism, and citizenship to the people of Nebraska.

At present, one program a week is being furnished. After conditions become more favorable, it is expected to broadcast at least two programs each week, besides making announcements and giving special talks to local Legion posts in the state. All of these programs to date have been of a patriotic nature, with good music before and after each talk. No political or commercial matter of any kind is ever broadcast from this station.

Teach Patriotism and Citizenship

"We have two purposes in mind in the installation of this station," advises Mr. Frank B. O'Connell, department adjutant, who is in charge of the work. "Our first purpose is to serve the people of the state. We want to furnish them high-class patriotic instruction and entertainment. One of the fundamental purposes of the American Legion is to ever keep bright the spark of patriotism in America. We find that Radio is an excellent means for doing this. We reach hundreds of boys—citizens of tomorrow—besides thousands of adults, and we tell them about our country and what each of us must do if our country is to grow and prosper. We place special emphasis on respect for the flag. Every few weeks we broadcast the rules governing the respect of the flag. This one lecture, has brought in dozens of letters from Nebraska people who appreciate the information we give out. Besides this, we talk on the duties and obligations of the citizen; on the proper way and necessity for the observance of law and order. In short, we are teaching patriotism and all its duties by ether waves.

Aids Work of Legion

"Our second purpose in installing this station is to serve the 350 local posts of the Legion that are located in the Department of Nebraska. We find that a receiving set in the clubhouse of a local post is a fine attraction, and not only brings new members into the American Legion but it increases the activities of the local unit. Then, too, here again the local post can serve its respective community by furnishing the people with market and weather reports, public concerts and the like."

The American Legion of Nebraska has a very elaborate publicity department, and it is felt that Radio will play a very important part in increasing the efficiency of this work. Each week news stories are sent to all Nebraska newspapers; an organization paper is published weekly, and now weekly Radio programs are prepared and broadcast. Bulletins are sent out prior to each concert announcing particulars. This bulletin is sent to all newspapers and any fan who has a receiving set, so that he can arrange a Radio party if he wishes.

Norway Building Big Station

BERGEN, NORWAY.—With a new and powerful Radio telegraph apparatus being placed on Rundemanden, a 2,500-foot mountain here, it is believed that direct communication with America will be possible. The Radio telegraph will have a 3,000-kilometer radius. An 800-kilometer radius Radiophone for communication with England and continental Europe will also be established.

CLAIMS RADIO WILL SAVE CHRISTIANITY

CHICAGO.—Sermons at St. Luke's Episcopal church, Evanston, will be broadcast by Radio for the benefit of people who do not care to come to church, the Rev. George Craig Stewart announced today. "Radio," he declared, "will help save Christianity in this country. The persons who come to church will come anyway."

FORECASTS RAISE OF RENO HOTEL RATES

SAN FRANCISCO.—In a divorce suit here the wife said that her husband hadn't noticed her for three weeks, all on the account of Radio entering the home. Reports from Reno since the case show an enormous increase in the sale of Radio apparatus. The next thing Radio will be named as corespondent.

NEW SET HAS NO RECTIFIER?

© U. & U.

Here is Mrs. Elba Wilk of Chicago listening in on an entirely new receiving device in an Illinois Central dining car. The "desk" instrument, invented by G. D. Norton, also of the "Windy City," has one tuning control and a "modulator." The latter is said to replace the crystal and other forms of rectifiers by a circuit Mr. Norton is not yet prepared to announce.

Kansas Exposition Heads List of New Radio Shows

NEW YORK.—Radio shows are being planned for the fall on a large scale, with Pittsburgh staging the first one at Westview Park on August 24. This show will be followed by the Kansas Radio Exposition during the week of the State Fair, September 16 to 22, at Hutchinson, Kan. Chicago is next with a Radio show at the Coliseum, beginning October 14 and running for the week. New York is figuring on great activity and is preparing the First International Radio Exposition and several other shows. The dates for the New York activities have not yet been definitely decided.

New Logging Camp Outfit Overcomes Pocket Bogy

KERRY, ORE.—Among the modern Radio installations so far in the logging camps of the Pacific Coast is one placed in operation at the camp of the Hammond Lumber Co., located on the line of the Columbia & Nehalem River Railroad, Kerry, Ore. The receiving set enables the entire camp to sit around the instrument and hear of the life of the cities 100 to 800 miles distant.

In the installation at Hammond camp a victory has been won over the "lower Columbia Pocket," which had somewhat thwarted amateurs in "getting" Portland, and interior broadcasting stations.

AUTO LINKED WITH FUTURE OF RADIO

BOTH INDUSTRIES WILL BE CLOSELY ALLIED

Airphone to be Valuable Aid in World Wide Commerce, Says Reeves

(Special to RADIO DIGEST)

NEWARK, N. J.—Asserting that Radio is now in the economic position in which the automobile industry found itself in its adolescence of sixteen years ago, Alfred Reeves, general manager of the National Automobile Chamber of Commerce, in a message broadcast from Newark on June 10, declared that the Radiophone business will soon develop into a position of broad economic usefulness.

"Experiments already have been made that indicate a future alliance between Radio and the automobile in the performance of various functions," Reeves said. "With their addition of Radio, the farmers, one-third of whom own cars, will find their efficiency greatly increased and their lives made more enjoyable at the same time.

"Farmers can obtain news of great importance regarding markets while traveling about in their cars. Doctors as they make their calls can be gathering valuable data on their patients' condition. Clergymen, because of the Radio, can obtain larger audiences through the country. Similarly the newspaper reporter, the workman, school teachers and children will benefit by Radio sets attached to automobiles.

"To stimulate world-wide commerce by improved transportation, to encourage progress by conservation of human energy and by diminution of distances, and to cement the ties of friendship between nations, is the mission of the motor vehicle. In its efforts, the Radio is going to prove an important ally."

EQUIPPING ARMY AIR FLEET WITH AIRPHONE

New Apparatus Makes Air Force World's Best

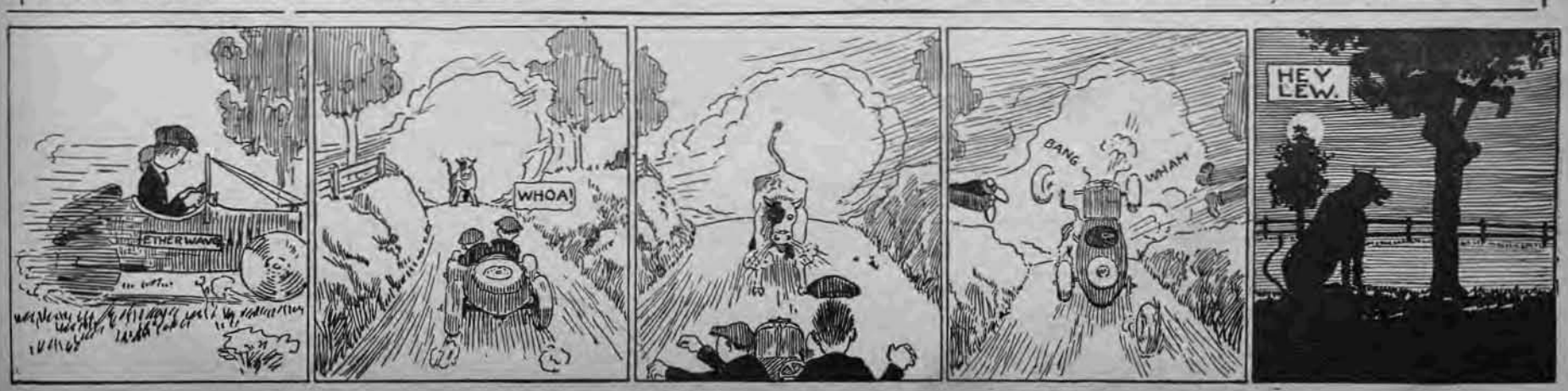
WASHINGTON.—America's aerial fleets, in the army at least, will soon be equipped with the best Radio apparatus in the world, and will for that reason be superior to the aircraft of any foreign nation. The largest and strongest set, S. C. R. 135, designed for bombing planes, will have a Radio telephone radius for plane-to-ground of about 75 miles, and a telegraph radius from plane-to-ground of about 200 miles.

For pursuit planes, S. C. R. 133 is designed to give a reliable plane-to-plane Radiophone radius up to five miles. Set 134, for observation planes, will insure Radio-telephony between two planes on the wing up to about 10 miles. The largest sets which are to be installed in the Martins, it is expected, will make aerial conversation possible up to 25 miles. In aerial Radio work a trailing wire or "fish" aerial is used, and the metal part of the plane serve as the ground.

Propose Huge Buying Syndicate

NEW YORK—The National Retail Dry Goods Association is obtaining favorable response from its members in answer to an inquiry on the advisability of forming a syndicate of stores to handle the distribution of Radio apparatus. The inquiry was sent out recently, and the report of the retailers' committee appointed to study the Radio problem was communicated to the stores at the same time. This report put forward the idea of having the stores pool their purchases and suggested that a company be formed for the purpose which would not be connected directly with the association, but tied up to it in some way, possibly in an advisory capacity.

THE ANTENNA BROTHERS — Bovine Breakwaters Stop Ether Waves



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Making a Practical Ground Switch

Construction of Switch Parts Given in Detail

A very satisfactory lightning ground switch for the Radio aerial may be made cheaply of parts as shown in the illustration. The description is for a single pole double throw switch. The switch is made in three parts, all alike. Copper is the proper material to use, brass being a fairly good substitute. The required materials are as follows:

6 pieces of copper 1/8 inch thick, 1 inch wide and 3 inches long.
3 pieces of copper 1/8 inch thick, 1 inch square.
1 piece of copper 1/8 inch thick, 1 inch wide and 8 inches long.
6 pieces of slate 1/8 inch thick, 3 inches wide and 4 inches long.
12 leather washers.
36 brass washers.
6 small bolts and nuts.
12 long screws.
4 rivets.
3 binding posts.
1 board 2 inches thick, 6 inches wide and 18 inches long.

The first mentioned copper pieces are bent into the shape of an L, Figure 1.

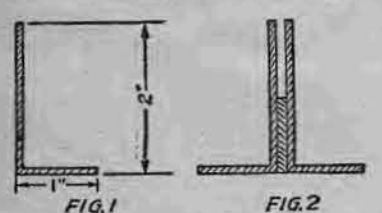


FIG. 1 FIG. 2

Each piece for the switch is made of two L-pieces with one of the flat 1-inch strips between, as shown in Figure 2. These are riveted solidly together. Each built-up piece is provided with a binding post, Figure 3. A binding post taken from an old dry cell will serve the purpose nicely. This is shown in Figure 4.

The blade is attached permanently to the center piece with a rivet, as shown in Figure 3, just loose enough so that the blade can be swung from one position to the other.

The base for each standard is built up of slate pieces, the same kind of material used in the slates for the little red schoolhouse occupants—in fact, one of the slates can be used for making the pieces. Each piece is 4 inches square.

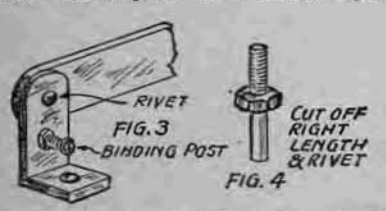


FIG. 3 FIG. 4

The slate is very brittle and it must be handled carefully. The manner of constructing the bases is clearly shown in Figure 5. Slate can be sawed by an ordinary hack saw.

Each of the switch sections is mounted on a built-up slate base, using washers on the underside of all screws to prevent the slate from crumbling. The three sections are then mounted on a heavy hardwood base, as shown. An old spark plug porcelain can be used for the knob on the blade.—J. Oscar Johnson, Wakarusa, Kansas.

GROUND SWITCH FOR AERIAL

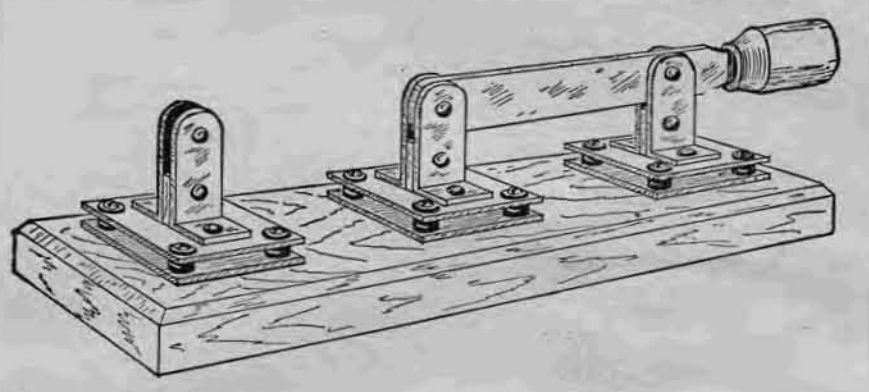


Fig. 5

WORKSHOP KINKS? EARN A DOLLAR—

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

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

Care of Storage Batteries

Storage batteries must be given attention regularly or they will fail to give you service and deteriorate rapidly. When the solution evaporates to a point almost down to the top of the plates distilled water must be added. Do not use ordinary drinking water for this purpose. Batteries not in regular use should be charged every four weeks. Do not place storage batteries on polished floors or expensive carpets. Some time or other a portion of the sulphuric acid solution inside the battery will be spilled on the floor and a brown charred hole or spot will result. The battery should always be placed on a sheet or tray of hard rubber, glass, porcelain, lead or copper.—Charles Fitch, New York, N. Y.

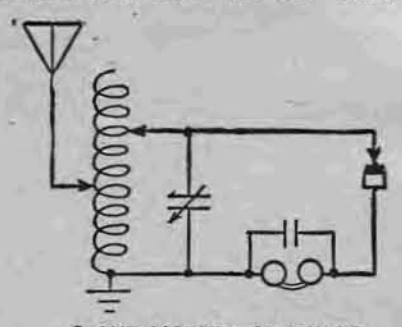
Bolts Make Binding Posts

While constructing a small Radio set I found that I needed two binding posts. Looking in the box that I use to retain things for Radio work I found many brass bolts and some old battery cells. The thumbnuts on the terminals of the battery cells were removed and fitted on the screw end of the bolts. The bolts were run through the holes in the side panel. The bottom nuts of the terminals of the battery were first screwed on the bolt ends and then the thumbnuts placed on the bolts in the usual manner. These make excellent binding posts.—Sydney Hagdohl.

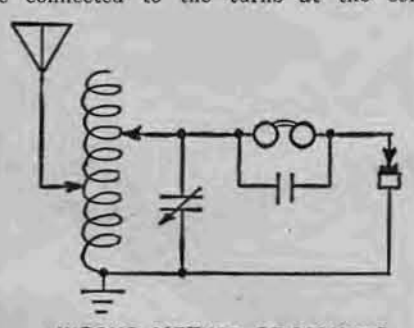
Proper Detector Connections

The accompanying diagrams show the right and wrong ways of making detector connections.

Inasmuch as the tuning coil is in effect an air-core transformer, there is an appreciable drop across the coil. Being a


RIGHT METHOD OF MAKING DETECTOR CONNECTIONS

voltage-operated device, the highest potential on the detector is obtained; if the crystal is connected directly to the turns on the antenna end of the coil. The 'phones, on the other hand, should be connected to the turns at the coil


WRONG METHOD OF MAKING DETECTOR CONNECTIONS

end next to the ground, since this end is at the lowest voltage with respect to earth. Although this will not make as much difference on the longer wavelengths as on the shorter ones, it will be well to bear these points in mind when making connections.—P. J. C.

How to Make a Radio Receiver

A bar magnet about four inches long and one-half inch square is wound for about half its length with 1,000 turns of No. 40 gage wire. The wound bar is fitted into a hollow wooden handle, with the wound end just below the surface of the wood. A tapered hollow wooden cone fitted over the upper end of the handle widens out to about one and one-half inches and provides a support for the diaphragm, which is of thin sheet iron placed about 10-1,000ths of an inch above the end of the magnet. A narrow wood ring fastened with two screws holds the diaphragm in place.

Connecting Phones in Series

Those who are using binding posts to connect the telephone receivers, as shown in Figure 1, may easily adapt the set so that two pair of receivers can be connected in series by adding a second pair of

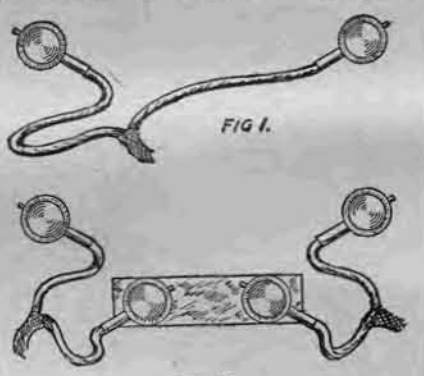


FIG 1.
FIG. 2.

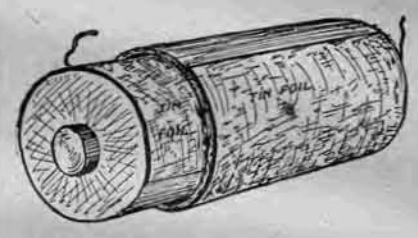
binding posts, which are connected together with a short strip of brass as shown in Figure 2.

When only one pair of 'phones are used they are connected to the top binding post, as shown in Figure 1. When two pair are to be used the connections are made as shown in Figure 2.—Albert E. Jones, East Milton, Mass.

Variable Condenser Is Made of Carton Tubes

The condenser shown in the illustration gives the same results as one costing several dollars and the expense of making it need not exceed twenty cents. First procure two circular cardboard cartons, one slightly smaller than the other, and coat one-half of the circumference on each with tinfoil, making two tubes with semicircular metal coated sides. Shellac can be used to make the foil stick to the tubes. Place the smaller tube within the other and make the two connections to the plates. Adjustment is obtained by rotating the smaller carton within the larger.

The condenser described has a capacity of a 23-plate condenser of the rotary semicircular plate type, or about .0005 mfd., that is, if common oyster boxes are



used as the frames. Increasing the size of the cartons rapidly increases the capacity of the condenser.—W. S. Malone, Asheville, N. C.

FOWLER'S PRACTICAL RADIO TEXT BOOK

Fowler's Practical Radio Text-Book tells you what you want to know about radio. The book explains radio in plain language; it helps the radio operator get better results from his set, and it is of value to the expert radio-electrician in presenting the latest facts and most recent developments in the science of radio communication.

The book measures 8 inches by 5¼ inches, has 96 pages, 20 large illustrations; is substantially and attractively bound in cloth. The very latest work on radio. A most comprehensive survey of the science of radio communication. Send check or money order $1.25. We keep you posted with the latest radio improvements.

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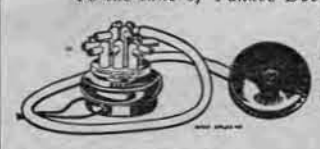
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You now use alone,
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Everyone should have Gregg's Set,
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Does one use the phone,
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MINNEAPOLIS STOPS WILD BROADCASTING

Group of Small Stations to Withdraw in Favor of Two Larger Plants

By Robert Andrews

Radio has ceased to be a fad and has settled down to a sound business basis of practical use and scientific development in Minneapolis and throughout the Northwest.

It is no longer a plaything but a State-operated public utility, a means of furthering the interests of large commercial enterprises and a school for embryo Radio engineers of Minnesota.

For two great steps have been taken in Radio development within a week. Three Twin City newspapers which have for some time operated small transmitting stations have signed an agreement to withdraw from the field in favor of a central broadcasting station to be erected and developed at the University of Minnesota, and other private stations plan to follow suit in the withdrawal. And eight large firms have underwritten a broadcasting station of the same size as that operated by the Detroit News—in other words, one of the largest privately owned broadcasting stations in the United States.

"We are out of the woods at last" is the general expression among amateurs. And the Radio experts of the Northwest agree with them.

Radio Struck With Bang

Radio struck the Northwest with a bang not more than three months ago. Prior to that time there had been a number of devoted amateurs working away at their craft, but only a few electrical supply companies carried stocks of Radio apparatus and to the average person the art was a closed book.

Then the craze came.

The Minneapolis Journal and the Minneapolis Tribune had both glimpsed the coming development of Radio and begun development of Radio stations to take the air along with WLB, the University of Minnesota station, which had been in operation for some time. So had the Pioneer Press and Dispatch of St. Paul. All three were working secretly, each hoping to distance the other by being first in the field. The Journal won by 12 hours, followed by the Tribune and then by the Pioneer Press. They were licensed for three months, as WBAD, WAAL and WAAH, respectively, and then began the transmission of concerts.

Air Becomes Jargon of Noise

The air was a jumble of concerts and lectures. There was no schedule of operations. Each station sent when and what it pleased, all on the fixed wave length of 360 meters. When WCE, the Findley Electric Company station, entered the field the jumble was worse. It was still worse when WBAH, the Dayton Company's station, began operations. Then St. Olaf College, Northfield, Minn., was licensed as WCAL, and the Dunwoody Industrial Institute of Minneapolis installed but did not open a station licensed as WCAS. That made seven operating stations in a radius of less than 100 miles.

Co-operation was essential. So the station owners conferred with Professor C. M. Jansky, of the University of Minnesota, a member of Secretary Hoover's committee on Radio, and adopted a fixed broadcasting schedule. Time limitations made it impossible for any station to send concerts more than two nights a week. Every hour of the day was filled. The university station, actually more entitled to priority consideration than any other station, withdrew and cut its broadcasting to a short news and market bulletin daily, because of the insistent demands of the other stations for "more time."

Governor Enters Muddle

Some further co-ordination was forced upon the stations. Then Governor J. A. O. Preus, of Minnesota, the same man who has done much to develop aeronautics in the State and the Northwest, took steps to settle the trouble when he communicated to each of the three newspapers a suggestion that they discontinue their stations in favor of a central station at the State University, to be operated by the electrical and engineering department on a large scale, for the benefit of the State at large.

The newspapers conferred and accepted. In their agreement, as signed at a conference with the governor, they made plain their reasons for acceptance.

"There is legislation in early prospect that will limit the activities of broadcasting stations, so that it is probable that only a limited number will be permitted to operate," the agreement says. "In this view it becomes clear that the newspapers should step aside in favor of the State University, which above all other interests in the State should be the head of broadcasting service. We will, therefore, yield to your desire in the matter by arranging for early discontinuance of our respective Radio services and leave the field clear for the State University."

To Close in Favor of University

The three stations, which in common with other stations in Minnesota have never developed a transmitting radius greater than 200 miles—being, in fact, stop gaps until the owners were sure of their ground in the new art—will go out of existence as soon as the university station is ready to take up the burden. And it is planned to make the university station the most powerful in the State. That means that it will be operated by student Radio engineers, giving them practical training of a high class. It will serve the people of Minnesota and the Northwest with a widely varied program of concerts, lectures, news and all the other material deemed worth while to Radio fans. No cheap concerts or speeches of no general interest will be included in its program, Governor Preus says. Rather, it is hoped eventually to make the university a center of information and entertainment for all Radio fans of the middle West.

That was the first big step toward practical development of Radio. Then came the second.

Second Big Station Announced

Just three days after the announcement of an agreement to discontinue WBAD, WAAL and WAAH, Marc Frazer, vice-president and treasurer of the Radio Engineering Corporation, announced through the Minneapolis Civic & Commerce Association that his concern had been underwritten by eight Minneapolis firms, and would establish a great Radio station capable of carrying on a complete service equal to that given by WWJ, WJZ or any of the other great transmitting stations. The eight firms which have underwritten the corporation for one year and will share in its hours of activity are the largest in their respective lines in Minneapolis—a bank, three department stores, two electrical supply companies, one Radio supply house and a farm publication.

The station will be a 500-watt transmitter, manufactured by the American Telephone & Telegraph Company, and costing around $15,000. It is contracted for early delivery and complete installation by August 1.

No definite location has been selected, but it is more than probable that it will go in at the Dunwoody Institute, there to be used to give students in the electrical engineering department practical training in Radio transmission and receiving. The station will be built on much similar lines to WJZ of Newark, with a broadcasting

(Continued on page 6)

"Broadcasting Has Come to Stay," Says Marconi

SCHENECTADY, N. Y.—Speaking to unseen fans by the thousands from the General Electric's broadcasting station at Schenectady, Guglielmo Marconi, in a most embarrassed manner, made his first Radio talk in America a few days ago. He said: "I think that broadcasting has come to stay. In thousands of homes in this country there are Radio phone receivers and thousands of intelligent people, young and old, men and women, well able to use them, even able to make the apparatus, and in many cases contributing or striving to contribute valuable information concerning the problems still unsolved."

MIND READER TELLS THE WORLD

©U. & U.

What next? Here is a man, Professor Julius Zancig by name, who heretofore has been content to be a plain mind reader, telling you of the past, present and future, just like any first class reliable mind reader would. But the Radio bug bit him too, and here is the "prof." broadcasting from station WEAS, Washington, D. C., for the edification of an unseen audience the truths which the unseen spirits tell him.

GLEE CLUB TO GO ON AIR

Washington State College to Install Large Transmitter Soon

PULLMAN, WASH.—A 500-watt Radio broadcasting set will be installed on the campus of the Washington State College for operation when the fall term opens, September 18, according to an announcement made by Dean H. V. Carpenter of the college of engineering. Since there are more than 20,000 receiving sets in the state, it will be possible to reach a large audience with the Glee Club concerts, lectures, and news service.

BOSTONIAN WINS CONTEST

T. R. McElroy Reads Code at 51½ Words per Minute

BOSTON, MASS.—At the recent Radio show Theodore R. McElroy, a Boston operator, won the world championship in Radio operating. McElroy was able to copy 51½ words a minute on the typewriter for three minutes without a mistake. His nearest competitor was Walter Vetromile, who made 46 words a minute before he failed. Jose Seron, who won the speed contest at the New York show, was defeated by McElroy at Boston.

ETHER VAUDEVILLE NEW IN WASHINGTON

STATION WEAS CATERS TO DESIRE OF PUBLIC

Julius Zancig, Mental Telepathist, Assumes Big Job Reading Futures by Radio

By Irving Goldenthal

WASHINGTON.—The Hecht Company, station WEAS, Washington, D. C., has initiated something brand new in Radio. The American public loves entertainment that is varied, and that has lots of pep. Vaudeville is a great success in this country for this reason. The Hecht Company decided that Radio audiences were no different from other audiences, and that if vaudeville was a success "on the legitimate," it ought to be a success over the Radiophone. So this progressive store has initiated Radio vaudeville. Instead of the cut and dried concert numbers that are employed by some broadcasting stations, this store is furnishing a real vaudeville program every Wednesday and Friday evening to the Radio fans of Washington and vicinity.

Decides on Mind Reading Attempt

The Hecht Company has even gone so far as to try mind reading over the Radio. So one day the Washington public was advised that they could have their minds read by Radio. The public was invited to send questions in writing to the store, which would be answered at the evening Radio concert.

Mr. Julius Zancig, the well-known mental telepathist, whose work has been approved by Sir Arthur Conan Doyle and other leading authorities, undertook to answer these questions.

The mind reading stunt took place on Friday evening, and for three days before, questions kept coming in from all sources, asking all kinds of information. One young lady was very anxious to know what she was "best fitted for." A local athlete was desirous of knowing whether he would win in the next swimming contest. One man asked a hard one; he wanted Mr. Zancig to inform him where his (the questioner's) grandfather was born, and in what state. He evidently meant what state in the United States. There was also a pathetic side to it, for one little boy, whose arm was paralyzed, wanted to know whether he would get well.

Answers Questions

On the night of the Radio concert, Mr. Zancig answered these questions and numerous others that came in over the telephone, while he was broadcasting.

Besides this feature, The Hecht Company has had some of the most prominent professional and amateur performers, orchestras, singers, musicians that could be obtained. Some of the stars that have performed at The Hecht Company Radio Vaudeville programs are Earle Foxe, screen and stage star; Herbert Swift, The Minstrel Man, formerly with Primrose and Dockstader; Miss Maude Hallam, prominent psychologist; Mrs. David H. Kincheloe, wife of Congressman Kincheloe of Kentucky; the Chevy Chase, Glen Echo, White Owl, and other leading orchestras.

Louisville Newspaper To Entertain Colonels

LOUISVILLE, KY.—Radio interest in Louisville now centers largely around the completion of a new broadcasting station by the Courier-Journal and Times which was expected to be ready by the first of July but delay in getting some of the material has held up the work.

Credo Harris, author, lecturer and journalist, will have charge of the broadcasting schedules, and since the station here will be somewhat similar to the one in Detroit, Mr. Harris made a trip to study the system used there.

The H. C. Tafel Co., 236 W. Jefferson, which has been recognized as the amateur Radio headquarters has been doing some local broadcasting and expected to continue until the completion of the Courier-Journal station, but the government ruled that the sending out of talks and music constituted commercial work, and since they are only amateurs and had no commercial license they had to discontinue that broadcasting because they did not consider it advisable to take out commercial license for the short period that would elapse until the new Courier-Journal station gets into action.

Toronto city enjoys the unique distinction of being the first Canadian city to use the Radiophone to broadcast its propaganda. Robert M. Yeomans, acting secretary of the Toronto Publicity Bureau, delivered to an audience scattered over something more than 3,000 square miles a five-minute discourse upon the manifold attractions of the city.

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RECEIVING SET BUILT BY CLAPP EASTHAM

REGENERATION AND AUDIO FREQUENCY EMPLOYED

Wave Length Range Extends from 180 to 825 Meters—Has Ease of Control

(See diagram on facing page.)

The set shown in this number is the type HR regenerative receiver and type HZ two stage amplifier manufactured by Clapp-Eastham Company of Cambridge, Mass. It has a wave length range of from 180 to 825 meters. The special features are a battery compartment for the "B" battery inside of the detector cabinet and the two small double pole double throw switches on the amplifier cabinet for connecting the detector and various stages of amplification as desired.

With a good single wire antenna this receiver will not only give clear sounds in the phones for the detector stage, but will permit efficient reception with an amplifying horn of any type when used in conjunction with the two stages of audio frequency amplification.

Explanation of Connections

The unit on the left is the regenerative receiver. Connect the antenna wire to the binding post marked "A" and the ground wire to the one marked "G." The ground should preferably be a copper wire of any convenient size soldered to a water pipe as near as possible to the point where it leaves the house. If not soldered, it may be securely wrapped several times around the pipe, first scraping the pipe absolutely clean. The antenna should be as high as possible and about 100 feet long, although good results may be secured with indoor antennas. For example, 100 feet of wire can be strung around the picture molding in the room.

The 22½-volt "B" battery is connected to the spring binding posts installed on the back of the panel, making sure that the positive and negative terminals are properly located as indicated. If the amplifier unit is not used, the phones are connected across the two binding posts marked "TEL". The six volt "A" battery is connected to the terminals as indicated in the diagram.

Use of Amplifier

When the amplifier unit (to the right) is used, the two "TEL" posts are connected to the two marked "INPUT" on the amplifier, likewise both sets of binding posts marked "A +" and "A —" on the two cabinets are connected together as shown. two binding posts in the upper right-hand corner of the amplifier cabinet are for the phones or loud speaker connections. The two below, marked "B +" and "B —" are for the plate batteries in the amplifier circuit, which preferably should be from 45 to 90 volts.

When the small double pole double, throw switch to the left is connected to the top posts the detector stage is in use. When thrown to the bottom, and the right-hand switch to the top, the first stage of amplification is used. It the second switch is also thrown to the bottom, both stages of amplification are connected.

How Adjustments Are Made

To operate the set, first adjust the filament rheostat in the direction marked "INCREASE" until maximum or nearly maximum brilliancy is reached, and after signals are received, adjust brilliancy to the point giving maximum strength of signals are received, adjust brilliancy to IND" should be moved to extreme left-hand position for all short wave length reception and for many Radiophone broadcasting stations. Longer wave lengths are received by moving this switch to the right-hand point.

The tickler dial is adjusted to about the 10th graduation. Leaving it in this position, the condenser dial is adjusted to the proper wave length after which the tickler dial can be re-adjusted for improvements. To use the amplifier units, throw switches as required and adjust the filament. These adjustments are very simple and after a few trials, proper tuning will be accomplished by the novice as easily as setting the hands of a watch.

Book Reviews

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 Experimenter's Hand Book. By M. B. Sleeper. This book will help in the selection and construction of simple apparatus for transmission and reception of Radio telegraph and telephone signals. Price, $1.00.

Home Radio—How to Make It. By A. Hyatt Verrill. This book is particularly adapted for the amateur that desires to know how to make Radiophones. Twelve full page illustrations and diagrams. Price, 75c.

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.

Experimental Wireless Stations. By F. E. Edelman. This book assumes that the reader has some knowledge of fundamental electricity and mathematics and is a readily understandable text for beginners in the art of Radio communication who desire to start with the elements. Price, $3.00.

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

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

RADIO 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.

MINNEAPOLIS RADIO

(Continued from page 5)

studio connected by microphones and cables to the transmitting room.

It will be the most powerful station in the middle West. And its sponsors guarantee positively that it will be operated in such fashion as to interfere at no time with the work of the centralized station at the State University.

Stability Promised Radio in Northwest

What all this means is simple. Minneapolis was flooded with Radio four weeks ago. It had come as a fad, not as a serious and practical scientific development. People who did not know a vacuum tube from an aerial bought a $10 set, and, when they found it didn't work perfectly at all times, decried Radio as a failure. The art was dying of too rapid growth.

But if the flood of small broadcasting stations is removed, as now seems certain, in favor of two great stations representing every interest and operated with the best talent to be secured in the United States, Radio has gone past a fad in the middle West. And Minneapolis will back Schenectady and Detroit off the map, as the Radio center of the United States, if the engineers of the Northwest can put over their present plans.

They have many advantages in favor of those plans. In the first place, Chicago stations can be heard only at rare intervals, for some mysterious reason never satisfactorily explained. The eastern stations interest only the true Radio "ham." The family buying a Radio set merely in order to hear concerts is more interested in local material than in that received from a great distance. Furthermore, there are not now any really powerful transmitting stations closer than Detroit and Chicago. So that Minneapolis is in a vast and almost virgin territory.

So Radio can stand on its own feet and sell itself as worth-while and practical to the Northwest. And that means a great deal to the art at large.

HOW TO BUILD A REGENERATIVE RADIO RECEIVING SET AT HOME FOR..... $17

Price includes receivers, socket, vacuum detector tube, rheostat, potentiometer, two condensers, cabinet, bakelite panel, B battery, binding posts, knobs, and complete aerial.

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START NOW
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Los Angeles has 19 Broadcasting Stations, more than any other city in the United States. California has more than any state in the East.
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No. VI combines tuner, one stage tuned radio frequency amplification and audion detector.

Mounted on formica panel, adam brown mahogany finish cabinet, without tubes, batteries or phones $30.00
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RECENTLY perfected in our own factories by experts in the design of radio apparatus, Crosley Receiver No. VI and Crosley Receiver No. X are unsurpassed for their superior finish and performance. Their simplicity makes them the ideal receiver for the use of the most inexperienced. This simplicity combined with quantity production enables us to offer you these receivers at a remarkably low figure.
The Crosley policy of "Better—Cost Less" has placed their apparatus foremost in the radio field.
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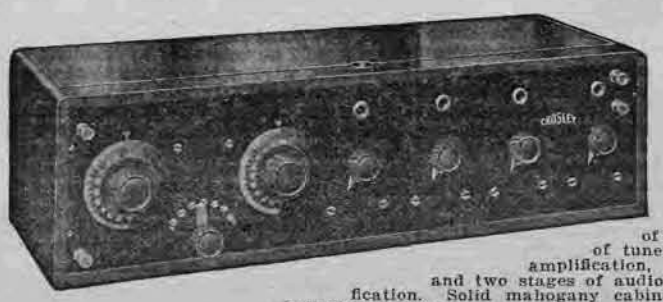
CROSLEY RECEIVER No. X
The volume, range and selectivity of this unit is remarkable. Nothing is to be compared with it at double the price. It consists of tuner, one stage of tuned radio frequency amplification, audion detector and two stages of audio frequency amplification. Solid mahogany cabinet, without tubes, batteries or phones.....$55.00
Write for Catalogue

21 Plate Var. Condensers.....was $3.55, now $2.80
43 Plate Var. Condensers.....was 4.50, now 3.75
Switch points .....each .01½
Switch levers .....each .35
Binding Posts, nickel.....each .04
Bakelite Panels, cut to size.....per sq. in. .02
Crystal Detectors .....each 1.00
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Pottstown Radio Supply Co.
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Bakelite Radio Dials
3-inch diameter, of molded Bakelite with inlaid white enamel markings. Brass insert for either 3/16" or ¼" shaft. Dial runs true on shaft. Material, workmanship, and finish are of the highest grade. Price 75c each. Not less than two to an order. No stamps.
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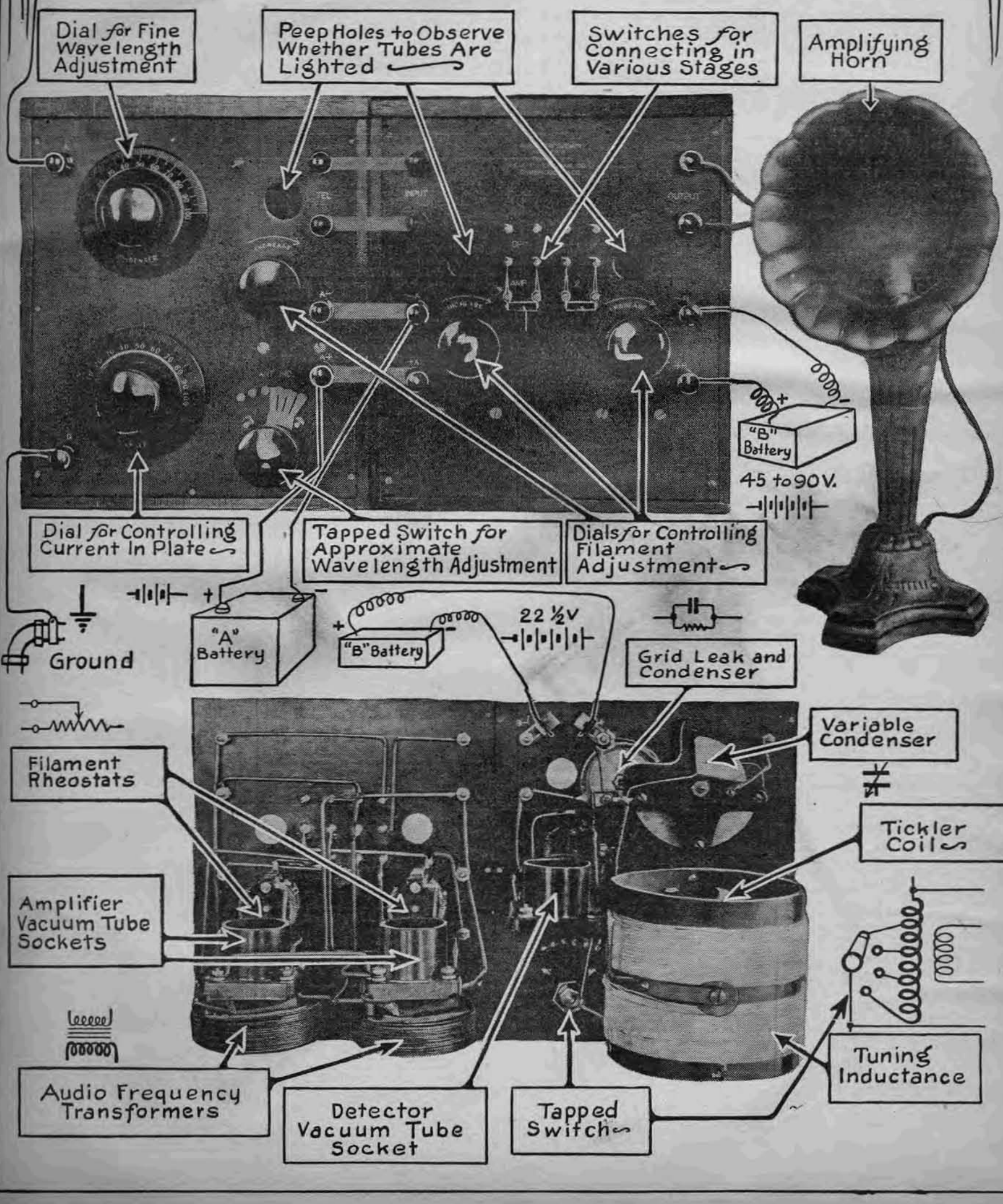
Radio Receiving Sets

Regenerative Receiver and Amplifier

Antenna

As the eleventh of the series of standard receiving sets, RADIO DIGEST presents the Clapp-Eastham type HR regenerative receiver and type HZ two step amplifier. Full information for connecting these units and the methods of tuning will be found on page six, first column. Although the novice may not have just this set, the instructions will be considerable assistance to him.



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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.

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

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

CHBC, Calgary, Canada. 410 also. 1,000 mi. W. W. Grant Radio Ltd. (Morning Albertan.) 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.

CHCQ, 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, 5-5:30 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.

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

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

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

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, 12:30-1 pm, 2-2:20, 4-4:20, music; 7:30, bedtime story; 7:45, news; 8:30-9:30, music, news. Sat, 3-4 pm, concert. Sun, 10:45 am, 2 pm and 7:30, church service. Eastern.

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

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

KDYX, 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.

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

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

KFAC, Glendale, Cal. 485 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. 200 mi. State College of Wash. Program irregular.

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

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

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

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

KFZ, Spokane, Wash. 300 mi. Doerr Mitchell Elec. Co. Daily ex Sun, 7:30-9:30 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, 4:30-6 and 7-7:30 pm, baseball scores, markets, news. Sat, 9:10 pm, instruction. Sun, 4:30-6 pm. Pacific.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

KNJ, Roswell, N. M. 300 mi. Roswell Public Service Co. Daily, ex Sun, 7-9 pm, weather, financial, markets, news. Sun, 7-9 pm, church service. 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, 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. Holzwasser Inc. Daily ex Sun, 4-5 pm and 8:15-9, concert, news. Sun, 10-11 am, 4-5 pm and 8:15-9, church service. Pacific.

KQP, 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.

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

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

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

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

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

KTW, Seattle, Wash. 200 mi. First Presbyterian Church. Sun, 11-1 pm, 7:30-10, church service. Pacific.

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

KUY, El Monte, Cal. 200 mi. Coast Radio Co., Inc. Daily ex Sun, 4-4:30 pm, music, lectures. Mon, Thurs, 9-10 pm, concert, etc. Pacific.

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

KWG, Stockton, Cal. 1,500 mi. Portable Wireless Telephone Co. Daily ex Sun, 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, 5:30-6:30 pm, music, news. Sunday, 2-3 pm, sacred concert. Pacific.

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

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

KYW, 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 foodstuffs. Pacific.

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

KZN, Salt Lake City, U. 100 mi. Deseret News. Daily ex Sun, 3-4 pm, weather, markets, music; 8-9, news, concert. Mountain.

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

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

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

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

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

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

WAAV, Athens, 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. 150 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. Rennyson. 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; 6:30-6:45, 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. Three nights of week, not regular.

WBAZ, 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, 3 and 8, church service. Eastern.

WCAB, Newburgh, N. Y. 100 mi. Newburgh Daily News. Daily ex Sun, on half hour 12:30-6:30 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. Entrekin 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.

WCAL, Northfield, Minn. 400 mi. St. Olaf College. Fri, 9:15-10 pm, concert, lecture, news. Sun, 8:30-9:30 pm, chapel, music. Central.

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.

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

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

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

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

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

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

WDAJ, College Park, Ga. 600 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; 8-9:30, 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; 12:17, 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 music. Tues, Thurs, Fri, 9:15-10 pm, concert. Sun, 5 pm, chapel. Eastern.

WDAU, New Bedford, Mass. 50 mi. Slocum & 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.

WDAX, Centerville, Ia. 250 mi. First Ntl. 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; 7:30, church service. Eastern.

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

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, 940, 10:40, 11:40. Sun, 8-9 pm irregular, concert. Central.

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

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

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.

WEY, Wichita, Kan. 485 also. 500 mi. Cosradio Co. (Wichita Beacon.) Daily ex Sun, hourly, 8:40 am-12:40 pm, stock markets. Daily, 10:45 am and 4:30 pm, weather; 8-10 pm, baseball, concert, lecture; 10:45 weather. Sun, 8:10 pm, church service, concert. Central.

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 finals; 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, 9:45, 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.

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 Elec. Service Co. Daily ex Sun, 1 pm, markets etc. Central.

WFAP, Peoria, Ill. 200 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.

WFAX, Binghampton, N. Y. 50 mi. A. L. Kent. No fixed schedule.

WFI, Philadelphia, Penn. 350 mi. Strawbridge & Clothier. Daily ex Sun, 1:16 pm, news; 3:30-4:30, concert; 5:30-6, baseball. Mon, Fri, 6:30-7 pm, Radio talk. Wed, Fri, Sat, 7:30-8:30 pm, concert. Fri, Sat, (alternate weeks) 7:30 pm, concert at 8:30 pm. Sun, 4 pm, church service. Eastern, 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.

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.

WGAQ, Shreveport, La. 300 mi. W. G. Patterson. Daily ex Sun, 7:45 pm, news, sports, music. Sun, 11 am, 7:45 pm, church service. 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.

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. Mon, Wed, Thurs, Sat, 7:30-8:30 pm, concert. Sun, 10:30-12 am, sermon. 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, 2:55 pm, music; 3, news; 7:30, baseball, news; 7:45 pm, police reports. On Tues and Thurs, 7:30 and 7:45 pm programs at 7:45 and 7:55 pm, respectively. Sun, 8 am, church service; 8:45 am, sacred concert. Special features week nights, 7:30-9 pm. Eastern.

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

WGR, Buffalo, N. Y. 485 also. 200 mi. Federal Telep. & Teleg. 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 mi. Univ. of Wis. Daily ex Sun, 12:30-1 pm, weather, markets. Tues, Thurs, Fri, Sat, 12-1 pm, weather, markets, time. Tues, 8-9 pm, concert. Fri, 8-9:15 pm, news, concert. Sat, 1-1:20 pm, instruction. Central.

WHAA, Iowa City, Ia. 150 mi. State Univ. of Ia. Daily ex Sun, 7-7:30 pm, news, music. Sun, 10:45-12 am, church service. Central.

WHAB, Galveston, Tex. 485 also. 500 mi. C. W. Thompson Co. Daily ex Sun, 9:30 am, police news; 9:45, weather; 10, markets; 12 m, markets; 3 pm, markets; 5, weather, police news, general news. Mon, Wed, Fri, 8 pm, entertainment. Sun, 10 am, church service. Central.

WHAE, Sioux City, Ia. 300 mi. Automotive Elec. Service Co. Daily ex Sun, 12:30-5:30 pm on half hour, news. Thurs, 8:30 pm, concert. Central.

WHAI, Davenport, Ia. 30 mi. Radio Equip. & Mfg. Co. Daily ex Sat and Sun, 2-2:30 pm, 4:30-5:30, 10-11. Sat, 10-11 am, 2-2:30 pm, 5-5:30, 11-11:30. Central.

WHB, Kansas City, Mo. 485 also. 1,000 ——. Sweeney Auto & Tractor School. Daily, 10 am, 3 pm, 5, weather. Daily ex Sun, 2 pm, ladies' hour; 7, bedtime stories. Tues, Thurs, Sun, 8-10 pm, concert. Central.

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

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

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

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

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

WJAC, University Place, Nebr. 485 also. 150 mi. Nebr. Wesleyan Univ. Daily ex Sat and Sun, 12 m, weather; 4 pm, markets. Sat, 12 m, markets, weather. Tues, Thurs, 9:30 pm, concert. Central.

WJD, Granville, O. 100 mi. Dennison University. Daily, 5-6 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, Penna. 1,000 mi. Elec. Equipment Co. Daily ex Sun, 7:30 pm, baseball, markets, weather, police reports. Mon, Wed, Fri, 8, bedtime stories; 8:15, concert, lecture. Sun, 7:45 pm, church service. Eastern, daylight saving.

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

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

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

WLK, Indianapolis, Ind. 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. 1,200 mi. Crosley Mfg. Co. Tues, Thurs, Fri, 8 pm, concert, lecture, news. Sun, 8 pm, church service. Central.

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

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

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

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

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

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

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

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

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

WOR, Newark, N. J. 150 mi. L. Bamberger & Co. Daily ex Sun, 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; 9-9:30, 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, sermonette. Daily, afternoon, baseball scores. Central.

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

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

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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. 200 mi. Federal 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 m, markets; 2:30 pm, markets; 4, music; 5-6, baseball, markets, music, bedtime stories; 7-8, concert, etc. 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 (code). Central.
WTK, Paris, Tex. 300 mi. Paris Radio Elec. Co. Daily ex Sun, 10 am to 5 pm, 7-11 pm, miscellaneous. Sun, 11 am to 8 pm. Central.
WTP, Bay City, Mich. 75 mi. Ra-Do Corp. Daily ex Sun, 1-2 pm, 6:30-7:30, 10-11, concert, baseball, markets. Sun, 1-2 pm, 6:30-7:30, 9-10. 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 10 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; 4-6 pm, special. Sun, fill in wk, 2-4 pm, special; 6-10, church services and special. Eastern.
WWX, Washington, D. C. 1,160 only. 600 mi. Post Office Dept. Daily ex Sun, 10 am, weather; 10:30, markets; 5 pm, 7:30, 8, markets; 9:50, weather. Eastern.
WWZ, New York, N. Y. 200 mi. John Wanamaker. Daily ex Sun, 1:40-2 pm, 2:40-3, 3:40-4, 4:40-5, 10:30-12 midnight, concert. Eastern.
3YN, Washington, D. C. 100 mi. Nat'l Radio Inst. Daily, 6:30-7:30 pm, instruction. Eastern.
9ARU, Louisville, Ky. 200 only. 200 mi. Darrell A. Downard. Mon, Wed, 8 pm, police news, concert. Central.

State, City, Call

Alabama:
Birmingham, 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, KFBD
Hollywood, KFAR, KGC
Long Beach, KSS
Los Angeles, KLP
Los Angeles, KDZD, KDZF, KDZP, KFI, KHJ, KJC, KJS, KNN, KNR, KNV, KNX, KOG, KON, KQL, KUS, KWH, KXS, KYJ, KZI
Modesto, KOQ, KXD
Monterey, KLN
Oakland, KLS, KLX, KZM, KZY
Pasadena, KDYR, KLB
Pomona, KGF
Reedley, KMC
Redwood City, KDYN
Sacramento, KVQ
San Diego, KDPT, KDYM, KDYO, KYF
San Francisco, AG1, KDN, KDZG, KDZW, KDZX, KPO, KSL, KUO
San Jose, KFAQ, KQW, KSC
Stockton, KJQ, KWG
Sunnyvale, KJJ

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

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

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

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

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

Idaho:
Lewiston, KFBA
Moscow, KFAN

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

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

Iowa:
Ames, WOI
Centerville, WDAX
Davenport, WHAI, WOC
Des Moines, WGF
Fort Dodge, WEAB
Iowa City, WHAA
Shenandoah, WGAJ
Sioux City, WEAU, WHAE
Waterloo, WEAZ, WHAC

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

State, City, Call

Kentucky:
Louisville, WHAS, 9ARU

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

Maine:
Auburn, WMB
Sanford, WFAR

Maryland:
Baltimore, WCAO, WEAR, WKC

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

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

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

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

Nebraska:
Lincoln, WCAJ, WFAV, WGAT
Omaha, WAAW, 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
Paterson, WBAN

New Mexico:
Roswell, KNJ
State College, KOB

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

North Carolina:
Asheville, WFAJ
Charlotte, WBT

North Dakota:
Fargo, WDAY

Ohio:
Akron, WOE
Athens, WAAV
Canton, WWB
Cincinnati, WAAD, WHAG, WIZ, WLW, WMH
Cleveland, WHK
Columbus, WBAV, WEAO
Dayton, WA1, WFO
Defiance, WCAQ
Fairfield, WL-2
Granville, WJD
Hamilton, WBAU, WRK
Lebanon, WPG

State, City, Call

Marietta, WBAW
Portsmouth, WDAB
Toledo, WBAJ, WHU, WJK
Wooster, WGAU
Youngstown, WAAY, WMC
Zanesville, WPL

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

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

Pennsylvania:
Bridgeport, WBAG
Brownsville, WDAQ
Clearfield, WPI
Erie, WJT, WSX
Harrisburg, WBAK
Lancaster, WGAL
McKeesport, WIK
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Pittsburgh, KDKA, KQV, WAAX, WCAE, WHAF
Villanova, WCAM
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Rhode Island:
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Pawtucket, 1OJ, 1XAD
Providence, WEAN

South Carolina:
Charleston, WFAZ
Orangeburg, WGAM

South Dakota:
Rapid City, WCAT
Sioux Falls, WFAT

Tennessee:
Memphis, WKN, WPO
Nashville, WDAA

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

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

Vermont:
Burlington, WCAX

Virginia:
Norfolk, WSN
Richmond, WBAZ

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

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

Wisconsin:
Madison, WGAY, WHA
Milwaukee, WAAK, WCAY, WHAD
Waupaca, WIAA

Hawaii:
Honolulu, KDYX, KGU

Porto Rico:
Ensenada, WGAD

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

RECEIVING RECORDS? SEND THEM IN—

The next complete list of receiving records will appear in the August 19 number of RADIO DIGEST. Amateurs who have beaten old records or made new ones will have their names listed each week. To be considered, the records sent in must have the number of miles given.—Broadcast Editor.

Station, Miles Record, and By Whom Heard.

CKCE—450—N. Theobald, Attleboro, Mass.
CJCG—380—G. W. Hutchinson, Santhey, Sask., Can.
KYG—370—H. C. Eade, Vancouver, B. C., Can.
KUY—485—J. L. Davis, Oakland, Cal.
WAAB—630—Radio Installation Service, Eureka, Kan.
WAAJ—690—A. E. Taylor, Coldwater, Wis.
WBAD—1,175—N. Theobald, Attleboro, Mass.
WBAJ—600—C. F. Lovely, South Amboy, N. J.
WBAJ—450—L. M. Knoll, Phila., Pa.
WBAW—500—E. B. Wagle, Geneseo, Ill.
WCAP—130—E. B. Wagle, Geneseo, Ill.
WCAW—125—E. B. Wagle, Geneseo, Ill.
WCX—900—L. P. Hurd, Madison, Minn.
WDAJ—775—R. Luther, Jefferson, Ia.
WDAL—200—M. Owen, Starsville, Ga.
WDAP—165—E. B. Wagle, Geneseo, Ill.
WDAS—1,035—W. G. Isemonger, Midlothian, Ill.
WDAW—625—E. B. Wagle, Geneseo, Ill.
WDAU—1,800—A. L. Lewis, Stanberry, Mo.
WEAC—510—M. Owen, Starsville, Ga.
WFO—600—C. F. Lovely, South Amboy, N. J.
WGAM—765—R. Latta, Clinton, Wis.
WGH—660—H. S. Rahiser, Pittsburgh, Pa.
WHD—750—R. Luther, Jefferson, Ia.
WKC—900—R. Luther, Jefferson, Ia.
WKY—1,100—R. Zimmerman, Dayton, O.
WLK—830—N. Theobald, Attleboro, Mass.
WOE—460—E. B. Wagle, Geneseo, Ill.
WOH—1,000—Wm. Holland, Brookline, Mass.
WOR—1,100—J. Hammond, Minneapolis, Minn.
WPE—545—A. E. Taylor, Coldwater, Wis.
WPL—690—R. Luther, Jefferson, Ia.
WSB—1,250—C. F. Lovely, South Amboy, N. J.
WSX—250—A. E. Taylor, Coldwater, Wis.
WWI—750—C. F. Potter, Auburn, R. I.
WWU—320—H. B. Plowman, Fairmont, W. Va.

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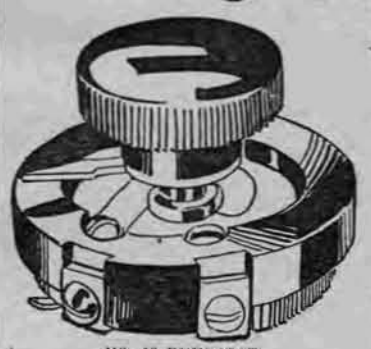
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In a new scientific field where many writers are contributing articles there will arise some controversy over the expressions of opinions and statements made from time to time. Some of these controversies may be taken into the courts for settlement.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

Vol. II Chicago, Saturday, July 29, 1922 No. 3

Will Surpass Cables

High Power Stations Planned All Over Globe

IT WILL be a matter of only a few years before the world will be covered with a network of Radio communication comparable in extent to and indeed surpassing the vast cable and wired telegraphic lines already in existence. Soon there will be high power stations in Columbia, Cuba and Bogota Bay.

In England there is a difference of opinion as to the relative advantage of the very high powered stations placed at wide distances apart, and the less powered ones at shorter distances and with arrangements for relaying messages. The latter method seems to have won. A new station is to be built near Cairo and it is expected to connect with the first link of the British chain at Leafiel, near Oxford, which was opened last summer. One branch of the chain will go from Cairo to South Africa, with an intermediate station in East Africa, while another will extend to Australia by the way of India and Singapore.

The French stations have been built on the other theory. The most powerful station in the world is now the French (American built) Lafayette station at Bordeaux. The new station at Port Jefferson, Long Island, will surpass this, and the new French one, Ste. Assise, near Paris, will come second to it.

Holland is also in the running, according to the same report, with powerful long distance stations under construction, one at home and one in Java—a distance of about 6,100 miles.

Looking Into the Future of Radio

Ether Waves to Be More Than Entertainment

THERE IS no doubt but what Radio is today one of the most revolutionary factors ever introduced into public circles. It has opened up new avenues of communication which has no other means of competition. While Radio of today is only a source of entertainment it will soon be a vital necessity in business and domestic life.

The government has assisted the movement by opening up a greater band of wave lengths, newspapers have instructed millions under the guidance of genuine amateurs, general knowledge has been advanced through inexpensive books of instruction, and today Radio stands impregnable.

It is true that at the present time popular interest is centered about the musical programs. Tomorrow the story will be different. Hundreds of thousands are contemplating the installation of transmitters, and ere long this movement will swell the ranks of the real American amateurs to figures inconceivable.

Radio of today has opened the doors of a new age. It was not long ago that a great mass of people all over the country lacked sources of education and entertainment. Today we find that the Radiophone has supplied all these things, and, further, it has introduced an excellent means of keeping the farmer and financier in touch with the things of greatest interest to him. The trend of the public mind shows that Radio is here to stay, and that the coming fall season will stimulate the business a hundred fold over last season.

Stump Orators Try Broadcasts

But Government Regulation Will Stop Them

THERE IS a great tendency for the enthusiastic ones and earnest ones who used to stump the streets and parks on store boxes to now besiege the Radio broadcasting stations for a chance to shout their reforms or their protests through the ether.

Not a day passes but what the Radio stations in the big cities are coaxed by some tense individual who begs for a chance to spread his ideas as to health or some new kind of "ism."

There is a government regulation pending which is designed to control politics, advertising and propaganda by air waves. People will not stand having their evening entertainment "horned into" by excited voices describing somebody's pet hair net, shoes, or possibly a way to get in and out of the water without getting your feet wet.

Ye Ed Asks 'imself

Question.—Will the Underwriters specify new rules and regulations for the installation and maintenance of receiving sets?

Answer.—The National Board of Underwriters have amendments to the Electrical Code only for those antennae that are installed outside of the building. The indoor antenna has been considered positively devoid of any hazard whatever. Publication of rules states that the principal danger is from lightning brought in over the antenna to the equipment or to some part of the building. It will be clear, therefore, that where no exterior antenna is used this hazard is entirely removed.

In addition to the usual warning as to the installation of any wiring outside the building coming in contact with high powered circuits attention is given to the necessity of splicing and soldering all joints. Lead in wires are not to be smaller than No. 14 B&S Gauge and a lightning protector capable of standing 500 volts specified. The use of a ground switch is not absolutely required. The ground wires shall not be smaller than No. 14 B&S Gauge. Wires inside the building shall not come nearer than 2 inches to any electric light or power wire, unless permanently separated by a nonconductor rigidly installed. In these rules no specification is offered against the use of a single contact plug in the electric light socket as antenna, so it may be assumed for the time being, at least, that there will be no objection to the use of an electric light wire as an antenna or as a means of broadcasting. No reference whatever is made to the use of wired Radio such as sending broadcasts over the electric light wires of the lighting plant. It may, therefore, be assumed that it will be also satisfactory to attach receiving sets to telephone wires in a similar manner.

Question.—Can more than one transmitting frequency be sent over a telephone or an electric light circuit for the purpose of broadcasting?

Answer.—By means of wired Radio, at least, four different frequencies can be sent at one time over a wired Radio system. In this manner four different kinds of service could be furnished simultaneously, such as sporting news, music, market reports and weather reports.

Question.—What is the principal difficulty in tuning out static conditions during the summer months?

Answer.—One of the principal difficulties in eliminating static in a receiving set is due to the fact that it is almost of the same frequency used in ordinary transmission. On this account no method has been devised to prevent it from entering the receiving set proper. Circuits, however, have been designed which lead off such static disturbances to ground through a local circuit. Wired Radio systems are, of course, free of all static conditions.

Question.—Will the use of a sending frequency of five thousand periods per second overcome the inductance in long cable lengths which might be present in wired Radio systems?

Answer.—Frequency of the specified amount should be satisfactory in overcoming the inductance of cable circuits in which wired Radio is employed. Preliminary tests which have been made over a total cable length of two and one-half miles gave excellent results using this frequency.

Question.—Are fuses and lightning arresters necessary in receiving set circuits where wired Radio systems are used?

Answer.—Fuses and arresters are essential in this respect as they are in protecting an ordinary telephone set. The ordinary subscriber's telephone station is thoroughly protected not only against high powered circuits but also against lightning by means of fuses and carbon lightning arresters.

Question.—What is the satisfactory wave length to be used for broadcasting services in a wired Radio system?

Answer.—Preliminary tests have shown that a wave length of 550 meters gives excellent results.

Question.—Name some of the defects in receiving apparatus that may be the cause of so-called static disturbances.

Answer.—One of the principal reasons for pirate noises in a receiving set is poor shielding of the parts. This is true, not only of the set itself but also of the parts of which it is composed. This condition is rapidly being improved by the sets which are now being produced but was one of the major defects in the receiving sets which have heretofore been manufactured. It has recently been determined that considerable noise in a receiving set which is somewhat difficult to locate and also impossible to tune out is caused by moisture in the cords of the telephone head sets. This is not a new trouble in the telephone business as the use of weatherproof cords not only for switchboard but also subscribers' circuit is a well known necessity.

A rubber protected cord with two braidings of cotton is now being put on the market by a well-known manufacturer and it is entirely moisture and weatherproof. This cord is also made up of phophor bronze tinsel instead of copper for prolonging its life and to overcome noisy cords brought about by the breaking up of the tinsel threads whenever a cord is subjected to rough usage such as it will receive in a Radio receiving set. While the use of this cord will increase the price of the telephone head set with which it is used the difference in cost will not be of such amount to prevent a large demand for quality cord. Fundamentally good receptions in receiving sets are entirely dependent upon the telephone head set and unless these sets are composed of the highest grade of parts a weak link in the chain such as a defective or poor cord will destroy its efficiency.

W. N. Furthman.

RADIO INDI-GEST

She Ought to Wear Galena Ear Rings

Radio? Listen, girls—don't mention Radio to me! I could be arrested for what I think about Radio. If there are any Radio sets in heaven, then I want a one-way ticket to the seventh circle of perdition.

I had the best husband in the world until the Radio bug got him. He used to be kind and thoughtful. He would come home at night, play with the kids and take me to the movies. But it's all off now. Married life ain't what it used to be.

Honest, girls, since that night he brought home a Radio set he hasn't hardly spoken to me.

He shuts himself up in the dining room and spends

the whole night fooling with galena and sliders and things. If the kids make a noise he gets sore, and if I come into the room he bawls me out.

"How do you expect me to hear anything with all this racket around here?" he yells.

And that ain't all. He brings home a lot of bums who sit around all night talking about condensers and wave lengths, and dropping cigar ashes on the rugs. He's got the dining room table cluttered up with wire and junk. We have to eat in the kitchen, and if I try to tidy up a bit he has a fit.

Music? Sure, he hears 'em playing a phonograph down at the city hall. We've got a $200 Victrola in the house, but he don't care anything about that. It ain't got no galena or nothing on it to monkey with.—Dallas, Tex., Herald.

Our Radio News Bull-etin

Ether waves ricochet off Washington monument and knock four bricks into Gulf of Mexico. Starting whistles in Seattle factories draw no action as sturdy workers have their heads strapped into debate over interest due from Austrian four debt. New York votes to secede from the Union, overwhelming decision that Rev. John Roache Stratton has a better act. Farmer near Kalamazoo writes his congressman that neighbor's tame crow persists in breaking in on the line. Anti-suffragists organize to assert that women congressmen jam the Radio vibrations. Society dame in Pittsburg runs on a platform of having all Radio waves marcelled by presidential proclamation. Go-to-church-by-Radio campaign utterly ruined as Radio listeners demand one day's rest in seven.

Since We Got the Ra-De-O

L. W. Bonsib

Home's not what it used to be.
Gosherino! Nosiree.
Every day an' night an' mornin'
Mother, Brother, Uncle Harmin
All the hull dern familee
Listens to the jamboree.

Since we got the Ray-de-o
Mother lets the cookin' go.
Gee! Can't blame her, GHY's
Shootin' music thru the skies.
With the head band on her ears
Sister sits and turns the gears.

Paw has fixed a riggin' so's
He can listen doin' cho's.
Milks the cow by Ray-de-o
When he doesn't let it go.
Farm life surely ain't the same
Since we got this patent game.

—Farm Life.

A Self Starting Loud Speaker

Perhaps the St. Louis man named his baby Radio because you can hear it so far away.—Columbus (O.) Citizen.

Was the Primary Wound Crooked?

Gifford Pinchot, recently nominated for governer of Pennsylvania by the vote of the people, acknowledges his great indebtedness to Radio. A primary coil, no doubt, played an important part.

They Start a Restaurant, of Course!

"What happens," asks Mr. C. H. Clark, of Newmarket, "when two ether waves, traveling in opposite directions, collide?"

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Characteristics of Vacuum Tube Amplifiers

Radio Frequency Amplification

By Benjamin F. Miessner

RADIO FREQUENCY amplification, as the name implies involves methods of increasing the energy of Radio frequency currents. Currents of Radio frequency are, of course, no different than audio frequency currents except that the number of cycles per second is higher. Obviously there can be no sharp natural border line of differentiation between the two, but by agreement among Radio engineers an artificial arbitary boundary has been set at 10,000 cycles per second; all frequencies above that value are considered as Radio; all below it audio. Perhaps a more rational definition would have as its basis the terms **carrier frequency,** which constitutes the frequency of the carrier waves governing the wave length of electromagnetic radiations, and **modulation frequency,** which may include the lower order frequencies contained in audible sound waves, or, in fact, any frequency of a lower order whether infra audible, audible, or ultra audible but still capable of being carried with reasonably good definition by the carrier frequency current.

With such an improved terminology, we would have **carrier frequency amplifiers** and **modulation frequency amplifiers** and there would be no confusion. With the present terminology, Radio frequencies are constantly approaching the arbitrary limiting value of 10,000 cycles, while audio frequencies certainly reach 20,000 cycles, a frequency already used for radiation or carrier purposes, the wave length of which is only 15,000 meters.

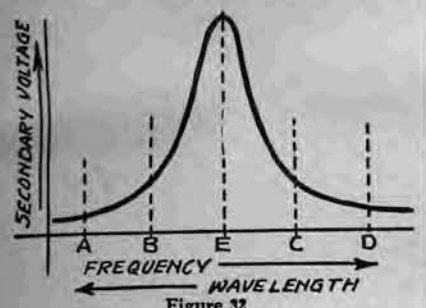

Figure 32

Radio frequency amplification then, is amplification of the carrier frequency and must be accomplished in the circuits preceding rectification.

"But why," one might ask, "should there be two kinds of amplifying systems? Why cannot we use as many stages of modulation amplification as are required to produce the required signal intensity?"

The answer lies in the limitations of available rectifying devices, which require a signal current of considerable magnitude before rectification is possible. The function of the carrier wave amplifier is to increase the amplitudes of those weak signal currents up to or above the point necessary for satisfactory rectification. Obviously when a signal is too weak to rectify, there is nothing for the modulation amplifier to amplify, and the great value of the carrier frequency amplifier lies in its ability to bring in signals impossible to hear regardless of the number of modulation frequency stages. Another practical consideration lies in the fact that more than two audio frequency stages cannot be used satisfactorily because of tube noises, tendency to oscillate due to stray amplifying, etc.

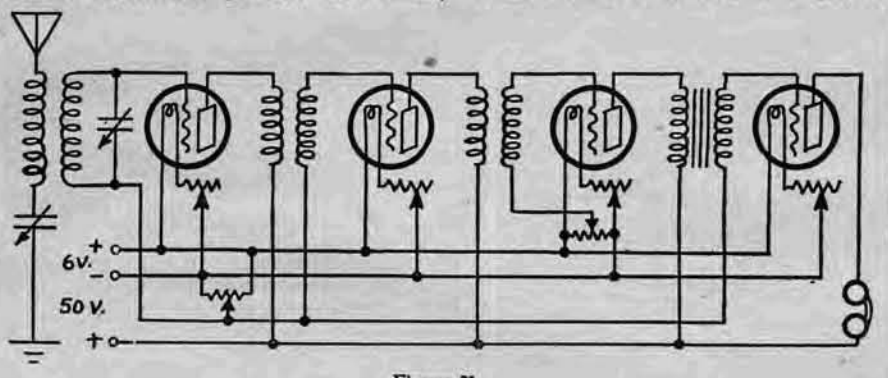

Figure 31

A receiving circuit with such arrangements for increasing the energy consists essentially of a radiation absorber, which may be an aerial, a loop, ground wire, etc., connected to apparatus for selection of wave length and increase of energy by resonance and which constitutes the tuning apparatus, circuits and tubes for further amplification of these same carrier frequency currents with their superposed lower frequency modulations, and finally, a rectifying device which makes possible the operation of the usual telephonic apparatus for transformation of audio frequency currents into audible sounds. If desirable, audio or modulation frequency amplifying circuits may be included between the rectifier and telephones for still further increasing the energy.

While modulation frequency amplifiers must be designed with great care if accurately enlarged reproduction of the original minute wave forms and resulting low distortion are required, carrier frequency amplification design rests on a somewhat different basis.

With the former, sound wave frequencies comprising a wide range or band must be amplified simultaneously and any characteristics of the circuits (chiefly inter-tube coupling devices) which prevent equal amplification of all frequencies, result in distortion. A receiving system which would respond to the same degree to all wave lengths included in a very wide band, say 300 to 30,000 meters, would represent a close analogy. As previously mentioned, resonance methods of increasing the response in modulation amplifiers is quite impossible in Radio telephony. In telegraphy, however, where a single tone carries the message in telegraphic currents, such resonance schemes may be used to advantage.

In carrier frequency amplifiers, however, since only one frequency is required to be amplified at a time, the above limitations respecting inter-tube couplings do not apply. Resonance type couplings may not only be used but used with excellent results, as all of the advantages of selectivity and high responsivity obtained in receiving tuners is secured in the amplifier circuits. Distortions in carrier frequency amplification, except these introduced by the tubes themselves, need not be considered, as the only distortions we are concerned with, are modulation frequency distortions, and carrier frequency circuits cannot appreciably affect the modulation wave forms of the carrier frequency currents which they conduct. So long as the previously discussed precautions with reference to the distorting characteristics of the tubes are taken, the practical minimum of modulation distortion will be realized in carrier frequency amplifiers.

As in modulation frequency amplifiers, several types of inter-tube couplings may be used, but greater variation is possible and a wider choice available, so that particular requirements may be met.

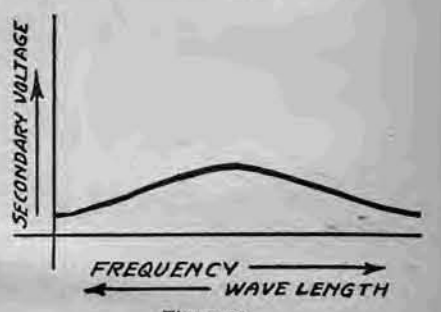

Figure 33

Among these may be mentioned transformers, which may be tuned or untuned. If tuned, the tuning may be fixed or variable. If fixed, only one fixed narrow band of wave length or carrier frequency will be amplified. If variable, this narrow band may be varied by proper tuning arrangements. Or again, an effort may be made to provide **an aperiodic or wide range** transformer which will have a flat frequency

(Continued on page 13)

Two Simplified Armstrong Super-Regenerators

Boston Inventor Makes New Circuit Feasible

By F. N. Hollingsworth

DR. GREENLEAF Whittier Pickard, of the Wireless Specialty Apparatus Company, Boston, inventor of the crystal rectifier and widely known for many other valuable contributions to the advancement of Radio communication, has recently added another to his long list of Radio achievements.

This is the modification and simplification of the new super-regenerative circuit so as to absolutely place it at the disposal of the amateur in his own Radio station—an invention that will be appreciated by thousands of Radio enthusiasts. The Armstrong super-regenerative circuit is a hard nut for the average amateur to crack. But the Pickard method has so simplified matters for the experimenter that it is only necessary for him to collect the essentials as given in this article and properly connect them into the circuits to experience the thrill of his Radio career.

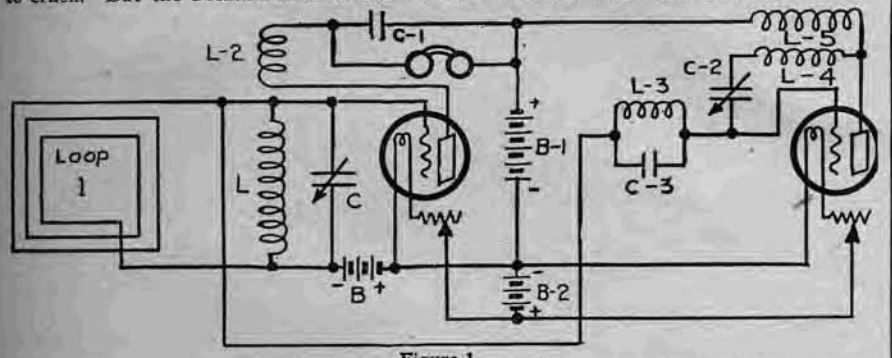

Figure 1

The circuit shown in Figure 1 was placed in operation within an hour's time by one of the older amateurs of this city and signals were copied from stations in the eighth district. This demonstration was witnessed by several Radio men, including George W. Crane of the electrical department of the S. Eugene Proctor Company, Boston.

Figure 1 illustrates a circuit employing two vacuum tubes and the values of the circuit contents are as follows: 1 is a loop, 3 feet on a side, wound with 9 turns of No. 18 (bell) wire; L-1 may be a duolateral coil of the same size ordinarily used in the secondary circuit of a receiving set for any particular wave length desired (for 360 meters L-1 may be a 50-turn coil); L-2 should be about twice as large a tickler as is ordinarily used—let us say a L100 coil; C is a variable condenser, .0005 microfarad capacity at the maximum; B is a 2-cell (3-volt) flashlight battery and is used to bias the amplifier grid negatively; C-1 may be a fixed condenser, capacity .001 microfarads; B-1 is a plate battery of 60 to 100 volts; B-2 is a 6-volt filament lighting battery; L-3 is an L1250 turn coil; C-3 is preferably a variable condenser, but may be fixed and has a maximum value of .00025 microfarads; C-2 is a variable condenser with capacity of .001 mfd.; L-4 is a 250-turn coil and L-5 a 1500-turn coil.

Notice that the loop and coil L-1 are in parallel or shunt. The variable condenser C tunes the input circuit as in the ordinary regenerative receiver and L-2 not only has twice as many turns as is ordinarily used for the "tickler" but is quite closely coupled to L-1 for maximum amplification. The telephone receivers are shunted by a fixed condenser, C-1 of .001 microfarads capacity.

The frequency of the oscillator tube, to the right, is determined by the tuned grid circuit L-3, C-3, and is usually of the order of about 10,000 cycles. The intensity of these oscillations is controlled by C-2, which varies the coupling between the plate and grid circuits of the oscillator tube by forming an adjustable back coupling. Coil L-4 is a choke and its purpose is to prevent 360-meter waves (oscillations of about 833,000 cycles) from running into the oscillator circuits. Coil L-5 supplies the plate inductance of the tube.

In putting the circuit into operation the following should be observed: first, light both tubes to proper brilliancy and adjust the tickler coupling and C-2 for maximum amplification. For any change in wave length, the two adjustments will have to be repeated, the tickler coupling tightening as the wave length is increased.

As condenser C is varied, a series of closely spaced beat notes will be heard, the 360-meter oscillations from the first tube beating with high harmonics of the oscillations of the second or oscillator tube. This is due to the oscillations of the second tube being too weak to effect control over the first tube and may be remedied by increasing C-2. If this fails, increase the filament current of the oscillator tube slightly.

The circuit of Figure 2 is identical in operation to that of Figure 1. A filter (C-4, R, R-1, C-5 and L-6) has been added to prevent the 10,000-cycle current of the oscillator tube from paralyzing the grid of the third or audio amplifier tube. This audio step needs no adjustment other than the filament, and the filter has but one adjustment, C5. This is varied until the loudest and clearest speech or music is heard, and then requires no further attention.

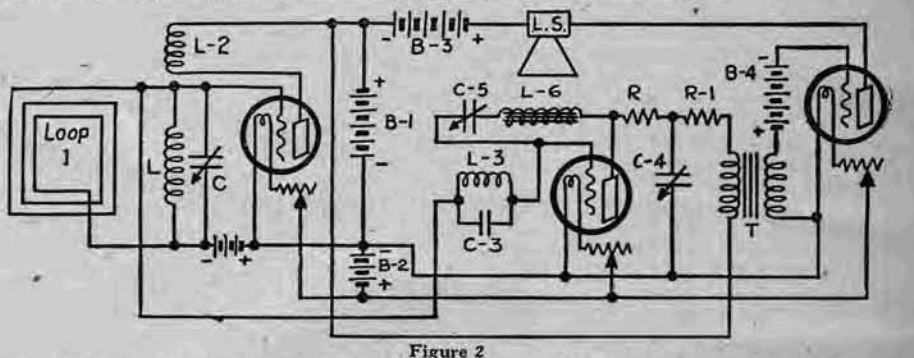

Figure 2

Values of the constants in this circuit are the same as those in Figure 1, with the following additions: C-4, .005, fixed condenser; C-5, .002, variable condenser; R and R-1, 12,000 ohm non-inductive resistances; L-6, one henry choke coil (iron core); T, UV-712 amplifying transformer; B-3, 80 volts, giving potential of from 160 to 200 volts on plate of third tube; B-4 grid bias battery of 22½ volts, negative terminal to grid.

The amplification obtained with this circuit is so great that it is absolutely necessary to use a loud speaker (shown as L. S.) in place of the usual telephone receivers.

The beauty of the Pickard circuit is its simplicity of control, there being but three adjustments altogether: first, the tuning of the input circuit by means of the variable condenser C; second, the usual "tickler" coupling, and, third, the back coupling between the plate and grid circuits of the oscillator tube by means of the variable condenser C-2, or, in the second circuit, C-5. Another valuable feature is the use of but one filament lighting battery.

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Radio Telephony for Amateurs and Beginners

Part IX—Crystal Detector Receiving Sets, Section II

By Peter J. M. Clute

To Explain—

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

X. Vacuum Tube Receiving Sets.
XI. Amplifiers.
XII. Useful Information.

IN THE previous discussion, we have deliberated briefly upon the operation and connections of the simplest types of crystal receiving sets, with fixed-step tuning. Closer and sharper tuning, however, is essential if it is desired to obtain loud and clear signals. As has been previously stated, continuous wave transmitters are tuned very sharply, and even the slightest variation in tuning inductance may have a great effect upon signal reception.

Continuous variation of tuning inductance is usually effected by using devices in which the relative motion of two coils varies their mutual inductance. In this way, the inductance of the combination is varied from a maximum when the coils are aiding to a minimum when their fields are opposing. Typical of such tuning contrivances are the loose coupler, the variocoupler and the variometer.

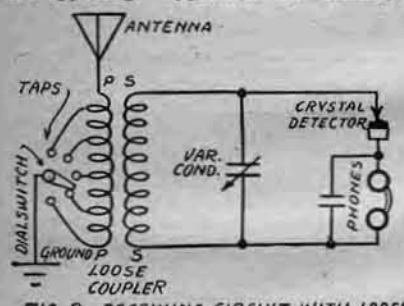

FIG. 9 RECEIVING CIRCUIT WITH LOOSE COUPLER FOR TUNING (TAPPED PRIMARY).

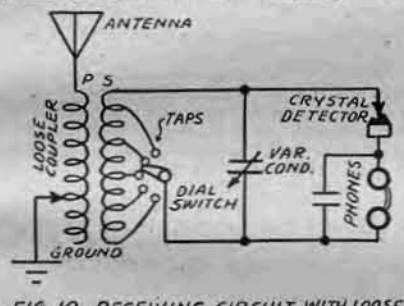

FIG. 10 RECEIVING CIRCUIT WITH LOOSE COUPLER FOR TUNING (TAPPED SECONDARY).

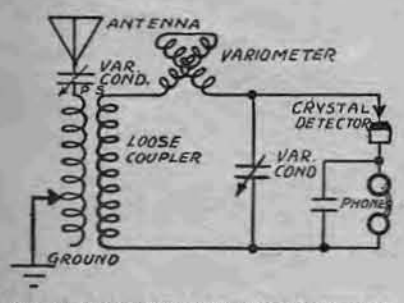

FIG. 11 RECEIVER WITH VAR CONDENSER IN ANTENNA CIRCUIT & LOOSE COUPLER.

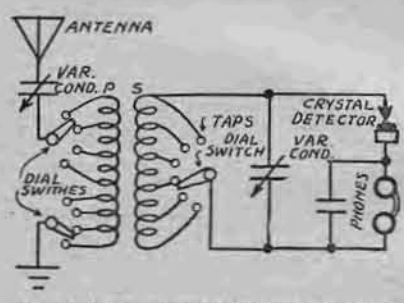

FIG. 12 LOOSE COUPLER (TAPPED PRIMARY) & SECONDARY) IN RECEIVING CIRCUIT.

How Tuning Is Accomplished

Tuning is accomplished by providing inductance and capacity in easily adjustable form. A variable condenser connected in series with the antenna permits reception of incoming waves shorter than the natural wave length of the receiving antenna system. If an additional inductance is inserted in the antenna circuit for "loading," fine variations may be obtained by adjusting the condenser. When

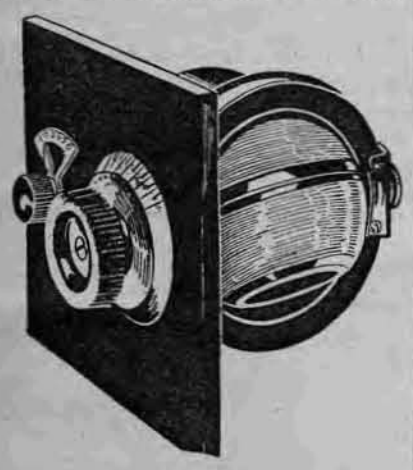

Fig. 13

the condenser is connected in parallel or multiple with the loading coil, it increases the wave-length in proportion to the value of capacity cut in the circuit. Even though the inductance steps may be large, the variable condenser connected in series or in multiple with it gives the fine adjustments necessary for good reception.

In the simple receiving circuits thus far discussed, there exists a direct connection between the aerial circuit and the detector circuit. In the arrangements following, with the exception of those involving variometers for tuning, the aerial or open circuit and the oscillating or closed circuit are entirely separate, that is, there exists no physical connection between them. Energy transfer is effected by the variable inductive relation between the primary and secondary windings.

The Loose Coupler

The loose coupler, the antecedent of the variocoupler, is more selective than the tuning coil, since signals received will be louder and clearer than similar signals heard with the latter. Inasmuch as the loose coupler can be set for a certain wave length, interference from other stations will be much less. The tuning coil, on the other hand, because of its construction, may respond to several waves simultaneously.

Figure 9 shows a typical crystal detector circuit with a loose coupler for tuning. The loose-coupler consists essentially of two windings, termed the primary and the secondary, the latter being wound on a smaller tube that slides in and out of a large tube upon which the primary is wound. It is essential that both the primary and the secondary be coiled in the same direction, otherwise the two fields would oppose each other, lessening the effectiveness of the coupling. The loose coupler tends to keep out the undesirable signals, and allows those signals to pass that are tuned in and desired.

Secondary Tuning

With the secondary inserted as far as possible within the primary winding, maximum coupling is obtained and tuning can be effected over a wide range of wave lengths with loud signals. In order to reduce interference and to get sharper tuning, the secondary should be moved farther out of the primary winding. A .0005 mfd. variable condenser connected across the secondary winding, permits sharper tuning and stronger signals.

A slider or a multipoint switch is generally used to vary the number of active turns in the windings of the loose coupler. In Figure 9, the primary winding is tapped and brought out to the contacts of a multipoint switch, so that the amount of inductance connected in the aerial or open circuit may be regulated. Figure 10 shows a receiving circuit in which the loose coupler has a slider for varying the number of active turns in the primary winding, and a switch with contact points for secondary variation.

Functions of Variable Condenser

In Figure 11, in addition to a slider arrangement, a variable condenser is placed in the antenna circuit for varying the wave length. A variometer, inserted in the detector circuit, permits close tuning within a small range of wave length variation.

The hook-up shown in Figure 12 contains a loose coupler with tapped primary and secondary windings. Relatively fine adjustment is possible by the use of two multipoint switches, connected to taps from the primary. One switch takes in groups of five to ten turns, while the other one cuts in one turn at a time. A variable condenser in the antenna circuit permits closer tuning on short wave lengths. A multipoint switch connected to taps from the secondary and a variable condenser across the secondary assist in the adjustment of the detector circuit.

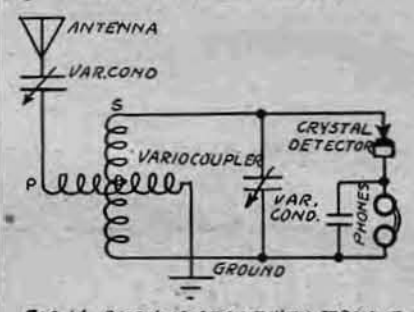

FIG. 14 RECEIVING CIRCUIT WITH STRAIGHT VARIOCOUPLER FOR TUNING.

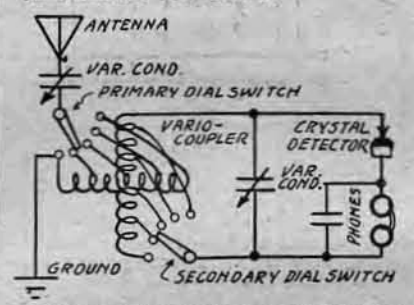

FIG. 16 RECEIVER WITH VARIOCOUPLER HAVING TAPPED PRIMARY & SECONDARY.

The Variocoupler

While the loose coupler is in more or less common usage, present day practice favors rotary adjustments instead of sliding arrangements. The variocoupler, such as shown in Figure 13, has taken the place of the loose coupler for coupling the primary and secondary circuits of a receiving set. There is a variety of different designs of variocouplers, or receiving transformers, among them being those shown in the diagrams in Figures 14 to 17 inclusive. Essentially it is the same as the loose coupler, with the exception that the secondary is wound on a rotating member instead of being a sliding element. The secondary winding may be rotated within the field of the primary, thus varying the degrees of coupling between the two. The coils are not connected together, the energy being transferred by induction. The primary is placed in the antenna circuit, that is, connected to the aerial and the ground; and in amateur receiving sets, it is customary to connect a variable condenser in the antenna or the ground lead, to assist in tuning of the primary circuit. A small variable condenser connected directly across the secondary winding is provided as a means of tuning the secondary. When receiving, the primary is first tuned to the wave length of the incoming signals. The secondary circuit is then tuned, using the variable condenser for fine adjustment until signals are heard the loudest. To cut out interference, the coupling between the two windings should be varied until as much of the extraneous signals as can be tuned out are eliminated.

Variocoupler

A straight variocoupler is employed in the receiving circuit shown in Figure 14. The primary circuit can be tuned, to a certain degree, by means of the short wave variable condenser in the antenna circuit, while the secondary tuning can be accomplished by using the variable condenser in multiple with it. Full range of coupling is possible by simply varying the relative positions of the primary and secondary windings.

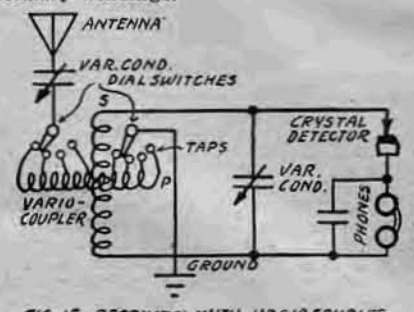

FIG. 15 RECEIVER WITH VARIOCOUPLER HAVING TAPPED PRIMARY.

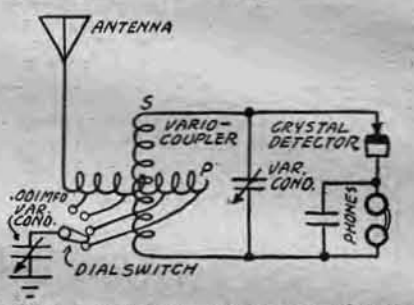

FIG. 17 RECEIVER WITH VARIOCOUPLER (TAPPED PRIMARY) & TUNING CONDENSER.

Figure 15 depicts a receiving circuit employing as a tuning device, a coupler with fine variations in primary inductance. Figure 13 shows a variocoupler of this type. Inasmuch as all adjustments are of a rotary nature, this sort of coupler is of the highest order of operating convenience. The inductance of the primary can be varied by two multipoint switches, while a variable condenser across the secondary winding is used for wave length variation.

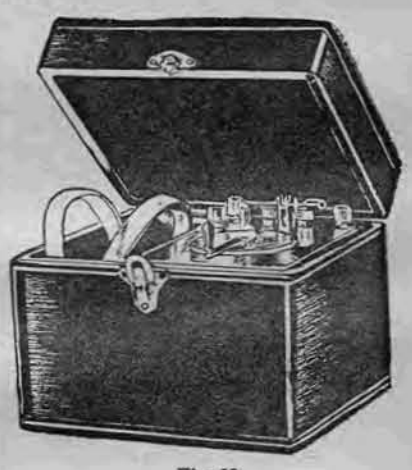

Fig. 18

A variocoupler with tapped primary and secondary is connected in the circuit shown in Figure 16. The wide range of secondary inductance makes it a most efficient device for use with all types of detectors.

Figure 17 shows a coupler with tapped primary connected in a receiving circuit with a crystal detector. In addition to the multipoint switch with contacts connected to taps from the primary winding of the variocoupler, there is shown a vari-

(Continued on page 13)

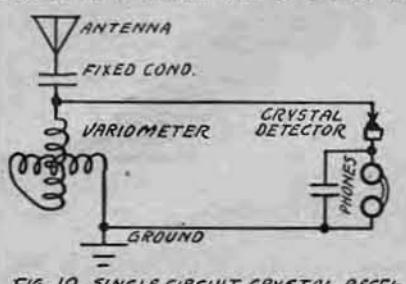

FIG. 19 SINGLE CIRCUIT CRYSTAL RECEIVER WITH VARIOMETER FOR TUNING.

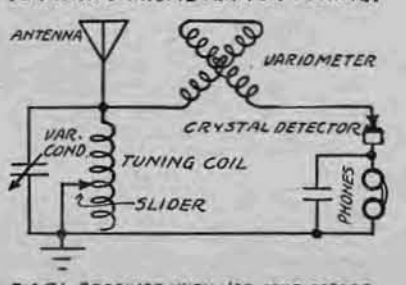

FIG. 21 RECEIVER WITH VAR COND. ACROSS TUNER & VARIOMETER IN DETECTOR CIRCUIT.

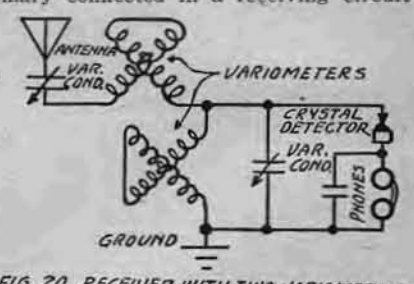

FIG. 20 RECEIVER WITH TWO VARIOMETERS & VAR. CONDENSER FOR TUNING.

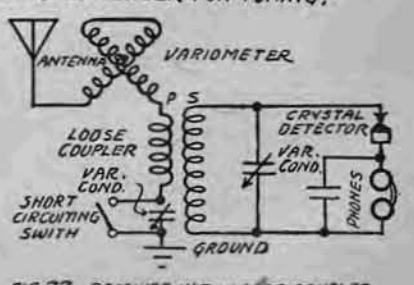

FIG. 22 RECEIVER WITH LOOSE COUPLER, VARIOMETER & VAR. COND. FOR TUNING.

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Simple Instructions for the Beginner

By Harry J. Marx

Tuning the Receiving Set

Part I

THE RADIO novice can take pleasure in operating a receiving set although he may be ignorant of every point about it, except the knowledge of tuning. He may not understand the detector, whether crystal or vacuum tube, or he may tuning, he can not get satisfactory results not know how the waves are sent out, and what is meant by high frequency currents or many of the other so-called mysteries that make up the new popular recreation. But the point is, that until he understands under the many different conditions that affect Radio reception.

The best rule to follow in tuning is to understand what each control does even if only in a general way, and to use the controls in a systematic manner. One need not know theory of gasoline engines in order to drive an automobile but one must know what the function is of each control, to drive safely and intelligently, and the better the controls are understood the more perfect will be the driving. In the same manner, an understanding of the general principles of the set and a knowledge of the functions of the various controls is necessary to make reception a source of satisfaction, rather than of annoyance.

Analogy of Tuning

In previous articles the subject of wave length has been thoroughly explained. For a simple illustration, the following experiment shows what happens in tuning. Take two glasses, preferably thin stemmed wine glasses, very similar in tone when struck a slight tap with a pencil. If there is a slight variation in their tones, water can be added in the glass that has too high a tone, until both sound alike. Now, if the one is struck a smart tap and the hand is then placed over it to stop its vibrations, the other glass will be heard ringing. Both glasses have been tuned to the same vibration frequency, and therefore one responds to the other by resonance. If water is added to either one so that the tone is distinctly different, the glasses will be out of tune and there will be no response in the other when one is tapped. In the same manner if two totally different glasses are used, by adding water, the natural rate of vibration can be varied until the tones are the same and the one will respond to the other. In other words, they have been "tuned in." It may happen that the natural period of a Radio set may not be varied sufficiently to reach the period of the sending station. Then tuning is bound to be a failure.

Wave Length of Antenna

It has been explained before that the antenna without the set but with the lead-in and ground conections, has a natural wave length to which it responds. This natural wave length depends on the capacity and the inductance. Tables for capacity and inductance of various antennae have been given in the previous articles. When the capacity and inductance are known, the wave length can be calculated from the formula:

$$W = 1885\sqrt{C \times L}$$

in which W is the wave length in meters,
C is the capacity in microfarads, and
L is the inductance in microhenries.

When a tuning coil or the primary of a loose coupler or variocoupler is inserted in series in the antenna circuit, Figure 1, it acts in the same way as adding water to the glasses, that is, increasing the wave length. When the coil of any tuning apparatus is inserted in series in the antenna or primary circuit the inductance of the coil in microhenries must be added to that of the antenna and substituted for "L" in the wave length formula. It is easily seen that an increase in the inductance value will also increase the wave length of the antenna circuit.

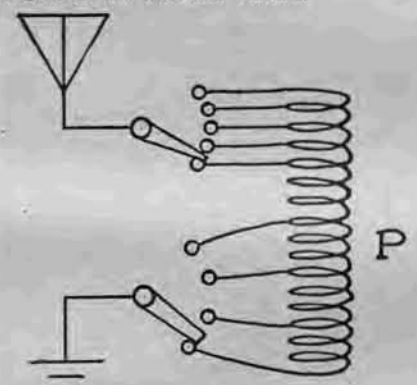

Figure 1

The primary coil of any tuning apparatus is usually provided with either a sliding contact or a tapped switch (Figure 1) by means of which the number of turns of wire through which the current flows is varied. In varying the number of turns, the inductance is changed, giving thereby a control over the wave length.

Effect of Series Condenser

When a condenser is inserted in series in the antenna circuit, as in Figure 2, it has the same effect as taking out some of the water in the glass, that is, it decreases the wave length. As the antenna has a capacity and acts as a condenser, the effect is the same as putting two condensers in series. The capacity of the combination then, will be:

$$C = \frac{1}{\frac{1}{Ca} + \frac{1}{Cc}}$$

If any two values for capacity are substituted and the formula is worked out,

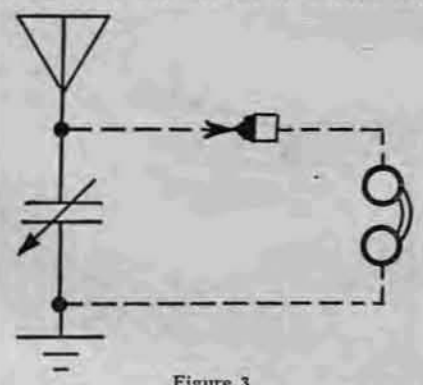

Figure 3

it will be found that **the resultant capacity of the two in series will always be less than the smallest alone.** Adding the condenser in series then, means that the capacity of the aerial circuit has been decreased, and for this reason, when the resultant capacity is subsituted in the wave length formula to get the corrected wave length, it will always be found less than before. If the condenser is of the variable type, of which the capacity can be decreased as desired, the wave length of the antenna circuit can likewise be decreased.

Practical Example of Capacity in Series

A variable condenser can be used for tuning therefore, although the actual range is very limited. Take for example, the circuit indicated in dotted lines in Figure 2. If the variable condenser alone is utilized for tuning, the antenna must have a high natural wave length. Let it be assumed that the aerial is of the four-wire type about 180 feet long and 100 feet high. The inductance then will be approximately 120,000 centimeters or 0.12 milhenries and the capacity .0007 microfarads. From Table 5 given on Page 13 of the June 24th issue of RADIO DIGEST, the wave length will be found to be about 546 meters.

If the variable condenser, inserted in the series as illustrated, is of the 43-plate type, .001 microfarads capacity, then the capacity of the combination of antenna and variable condenser in series will be

$$C = \frac{1}{\frac{1}{.0007} + \frac{1}{.001}}$$

C = .00045 microfarads.

From the table then, using the same inductance and the new capacity of the combination, it will be found that the wave length has become 430 meters. Since the condenser is variable and the capacity can be decreased, the tuning range of the set will run from 430 meters downwards to even below 200 meters. Of course, if a variable inductance is inserted in series, a more elaborate control of the wave length is possible. The above illustrates the fact that the variable condenser facilitates accurate tuning over a small range but that the rough adjustments over any considerable range must be controlled by inductances.

Shunting Condenser Across Coil

In many Radio receiving sets it will be found that a variable condenser is shunted across the coil as shown in Figure 3. This corresponds to coil and a condenser in parallel connection, but inserted in series in the antenna circuit. Every coil, besides inductance, has also a capacity value, but for the average amateur this is not important enough to affect seriously the operation of the apparatus. When a variable

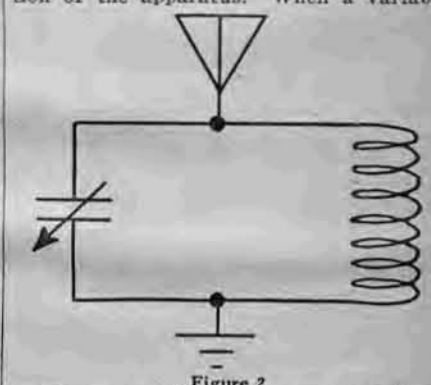

Figure 2

condenser is shunted across a coil as shown, the tuning qualities are vastly improved. The adjustment of the proper wave length is approximated by the variation in inductance of the coil, through the adjustment of number of turns in use, whereupon the variable condenser permits a much finer adjustment than would otherwise be possible.

(Concluded next week.)

RADIO FREQUENCY

(Continued from page 11)

characteristic giving more or less uniform amplification for all wave lengths within a certain specified range.

Another familiar type is the resistance coupling, suitable for use on all wave lengths because of the flat frequency characteristic of such coupling.

Still another is the impedance coupling, which may be tuned or untuned, corresponding in a general way to an auto or direct coupled-transformer or coupling device between any type of circuits.

Other Systems of Amplification

In addition to these several types of coupling, the relative advantages of which will be discussed later, there are several types of amplification systems, aside from the simple cascade system generally used, which possess distinct advantages in certain respects. Among these may be mentioned repeat-back systems in which the same tubes serve for both carrier and modulation frequency amplification, and super audible beat systems involving a reduction of the carrier frequency by heterodyning to a lower, although still super audible, frequency current which is amplified by a fixed tuned cascade amplifier wherein the bad effects of tube capacity on short wave lengths is avoided, and whereby individual tuning adjustments for the separate super audible tuned couplings are eliminated.

Typical Cascade of Carrier Frequency

In Figure 31 is shown a simple cascade type of carrier frequency amplifier with untuned transformer coupling, connected in a receiving circuit.

In this four-tube circuit, the first two act as carrier frequency amplifiers, the third as a rectifier, and the fourth as a modulation frequency amplifier. It will be noted that this is a conventional cascade circuit, but with grid potential control for all amplifier tubes obtained from one grid potentiometer, while the rectifier tube—which requires a grid voltage considerably different—has its own separate potentiometer. If the tube characteristics permit, as the small receiving tubes do, the first potentiometer may be omitted entirely and connection made to the negative side of the "A" battery. But unless the grid leak-condenser rectification scheme is used in the rectifier tube circuit, the other potentiometer will be necessary. It is possible for further simplification to omit filament control entirely by provision of a fixed resistance in case the battery voltage is not correct for the normal tube operating voltage—or otherwise a single variable resistance in the negative battery leg to all tubes may be provided for controlling all tube filament currents together.

Disadvantages of Untuned Type

The coupling transformers for untuned amplification, it may be mentioned, are handicapped by several important disadvantages.

In the first place, if resonance cannot be used, which, as the name implies, is the case, very little voltage increase, if any, may be expected from the transformer itself. In fact, special precautions must be taken to avoid resonance effects in such an amplifier, and the flat frequency characteristics must be obtained at the expense of voltage step up. Several schemes with this end in view are available which may be applied with some degree of success. Among these may be mentioned:

(a). The natural period of the transformer windings may be considerably below or above the operating frequency range, so that this range will occupy a comparatively flat portion of the resonance curve for the windings. Thus in Figure 32, if the natural resonance frequency of the transformer is at E, a range of frequency from A to B or C to D may be chosen over which the amplification will be more or less uniform; or conversely, if the desired range is from A to B or C to D, the transformer may be designed so that its resonance frequency will fall at E. Obviously no appreciable transformer voltage increase may be expected, as an inspection of the curve will show. Where close uniformity of amplification over a given range of wave length is not required, the operating frequency range may extend over the whole range from A to D. In this case high amplification would be obtained at a wave length corresponding to the frequency at E, while very little could be expected at any considerable variation from E, such as B or C, because of the dropping off along the resonance curve.

(b). If the high frequency resistance of the tranformer windings is low and the distributed capacity is also low, a rather sharp resonance curve, such as that shown in Figure 32, may be expected. Special efforts may be made to produce a transformer with a flat resonance curve, such as that given in Figure 33, but, as before stated, this if obtained will be at the expense of voltage amplification.

If the windings be given an extremely high resistance, the damping may be high enough to prevent any considerable resonance rise, but for short wave lengths this is almost impossible to realize in practice. Damping may also be introduced in other ways such as by leakage, by high dielectric losses, and by magnetic losses in core material.

(c). Another method for obtaining a flat characteristic makes use of windings of high distributed capacity, wherein the natural period is poorly defined. Such a design also attains the desired result at the expense of amplification.

In general then, it may be stated as a principle that the highest amplification cannot be secured with an untuned transformer type of inter-tube coupling, and that if uniform amplification is required over a wide band of wave length, say 200 to 1,000 meters, high amplification must be sacrificed. Extravagant claims along the lines of high amplification and wide wave length range are made by many manufacturers of such transformers and the Radio enthusiast is warned to accept these with reservations.

Editor's Note—In the next installment, carrier frequency amplification will be further discussed by Mr. Miessner. The insatiable fan who really wants to know all the fundamentals of vacuum tube amplification should "take a tip from Cleopat" and read every word of B. F. Miessner's articles.

CRYSTAL DETECTORS

(Continued from page 12)

able short wave tuning condenser connected in the ground lead.

The Variometer

The variometer differs from the tuning devices just described in that instead of merely an inductive relation, there is also a direct physical connection between the two coils. The coils are connected in series, one being placed inside the other, with the plane of the inner coil rotatable about a diameter, the self-inductance of the variometer depending upon the relative position of the coils. The less the clearance between the windings, the greater will be the range from maximum to minimum inductance. When the inner coil, or rotor, is turned through such an angle that current will be flowing in the coils in opposite directions, the coils are said to be in opposition, or "bucking" each other. In this position, the inductance of the variometer and hence the wave length to which it will respond is at its minimum. When the two coils are in the same plane, with the current flowing through the winding in the same direction, the inductance of the variometer will be at its maximum. Thus a wide range of wave length variation may be obtained by fine adjustment of the position of the rotating winding. The rotary action will be found much more convenient for tuning than the movement of sliders on a tuning coil.

A Single Circuit Crystal Receiver.

Figure 18 shows a commercial single-circuit crystal receiver involving a variometer tuner with fixed series condenser in the antenna circuit. The diagram for a circuit of this sort is illustrated in Figure 19, and the simplest sort of receiver with variometer for tuning is obtained by omitting the fixed short wave condenser. More resistance is presented to the Radio frequency currents by a variometer adjusted to a low value of inductance than by a tuning coil with the same amount of inductance. This feature allows a close tuning within a narrow range of wave length variation. In a tuning coil circuit, there is a certain amount of loss at the points of contact which tends to cut down the efficiency of the set. Because its winding is continuous, the variometer does the same work as the tuning coil without such losses. It is also possible to do the finest sort of tuning since the inductance is continuously variable.

Two Variometers in Circuit

Figure 20 shows two variometers connected in a receiving circuit with a crystal

(Continued on page 14)

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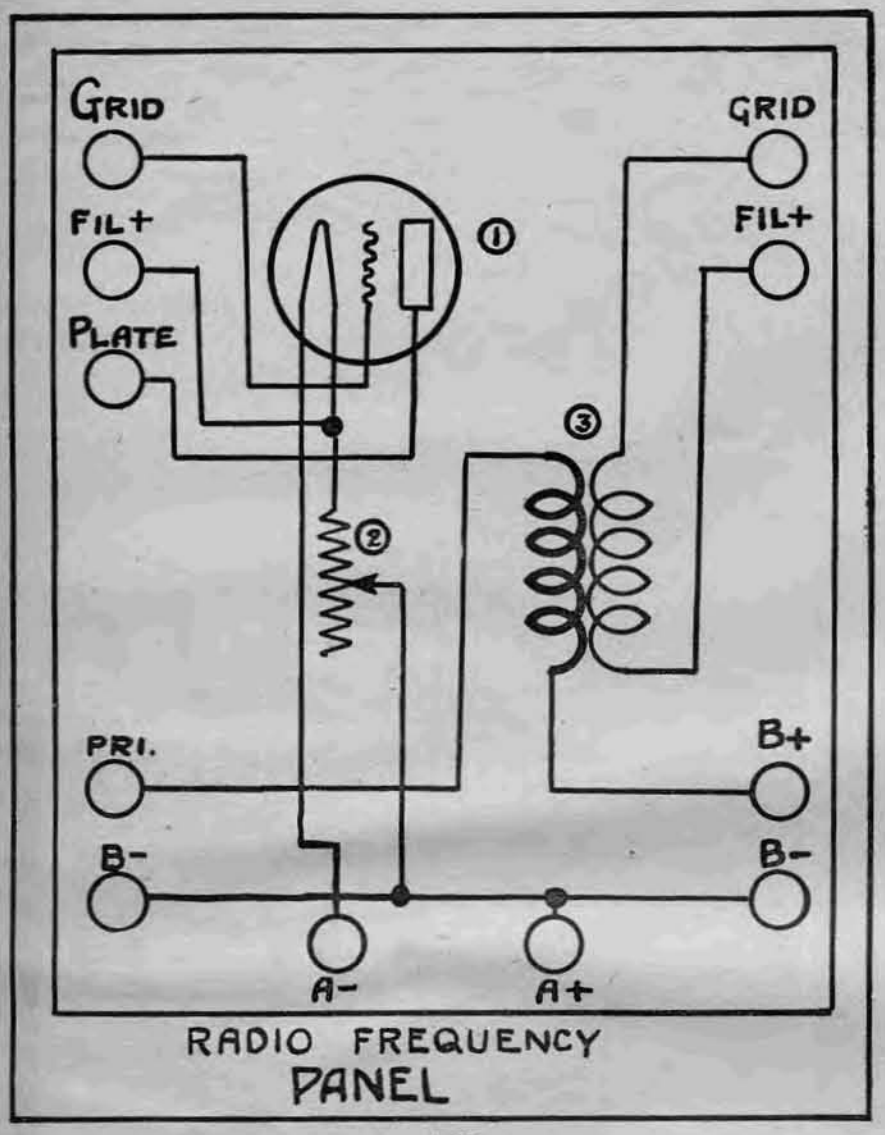
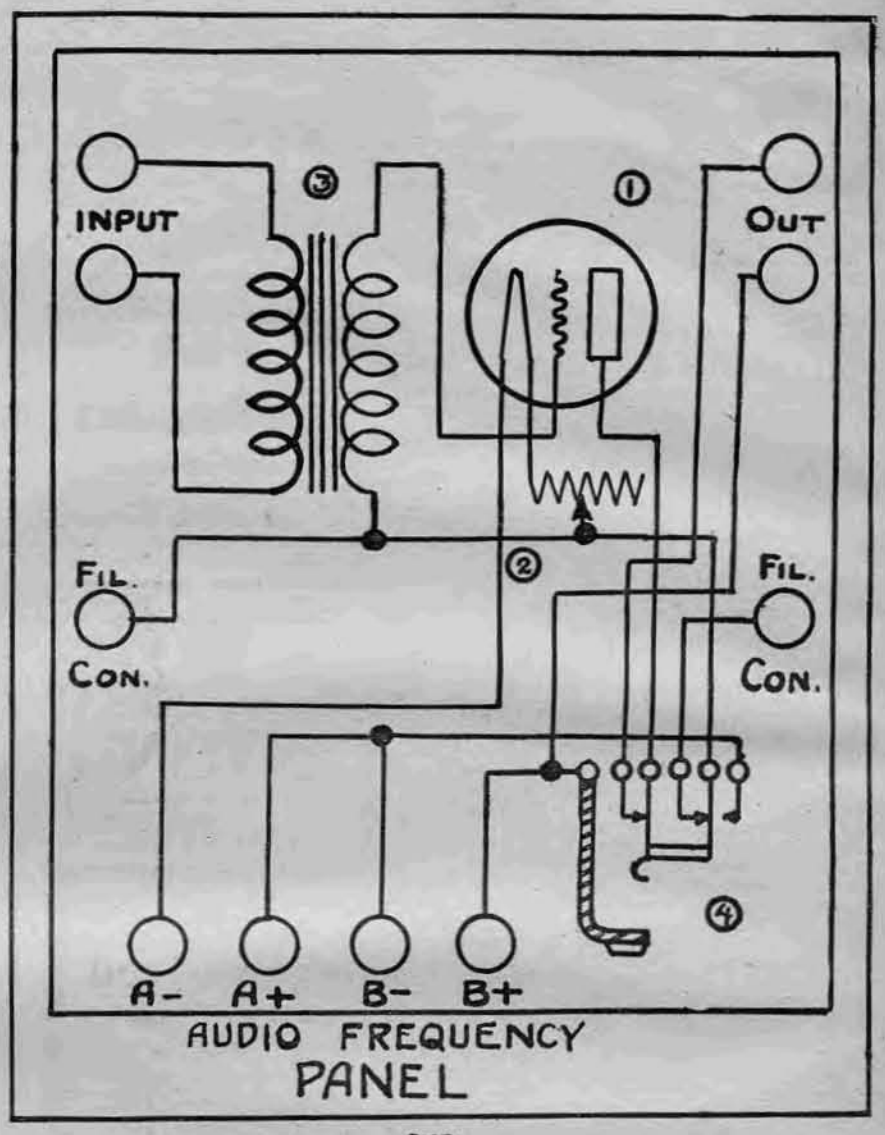
Panel Units for Your Receiving Sets

By Harry J. Marx



S-10



S-12

PARTS REQUIRED FOR RADIO FREQUENCY PANEL

1 Panel 8"x10"x¼"
11 Binding posts
1 Tube socket
No. 1—Amplifying vacuum tube
No. 2—Filament rheostat
No. 3—Radio frequency transformer

The two upper binding posts on the left-hand side marked "GRID" and "FIL +" are used for connection to the tuning unit. The two below marked "PLATE" and "PRI" are used for connection to the regenerative type of tuner. Otherwise they are connected together by means of a strap on the outside. The one in the lower left-hand corner marked "B —" is used when more than one stage of Radio frequency amplification is added. The two on the bottom of the panel are for the positive and negative terminals of the "A" battery." The two in the upper right-hand corner are the "OUTPUT" binding posts and can be connected to the parallel posts on either another Radio frequency panel, or the vacuum tube detector panel. The two in the lower right-hand corner are for the positive and negative terminals of the "B" or plate battery. When more than one stage of Radio frequency amplification is used, the corresponding "A" battery binding posts are connected together.

PARTS REQUIRED FOR AUDIO FREQUENCY PANEL

1 Panel 8"x10"x¼"
10 Binding posts
1 Vacuum tube socket
No. 1—Amplifying vacuum tube
No. 2—Filament rheostat
No. 3—Audio frequency transformer
No. 4—Filament control jack

The two binding posts in the upper left-hand corner marked "INPUT" are for connection to the output binding posts on the vacuum tube detector panel. The one below, marked "FIL. CON.," connects to the corresponding one on the detector panel or possibly another audio frequency panel. This connects to the filament control jack and furnishes the "A" battery current to the vacuum tubes in all the preceding stages of the one containing the plug. In the same manner the corresponding one on the right-hand side connects to any stages of audio frequency amplification following. The two binding posts on the left at the bottom are for the positive and negative connections of the "A" battery. The other two on the bottom are for connections to the "B" battery. The two in the upper right-hand corner marked "OUTPUT" are used for the phone connections or for further stages if added.

CRYSTAL DETECTORS

(Continued from page 13)

detector. In this hook-up, one variometer is used as a continuously variable loading inductance, while the other is used simply as a tuner. The variable condensers assist in the fine adjustments.

In the receiving circuit shown in Figure 21, a variable condenser is connected across the effective part of the tuning coil. A condenser in parallel with an inductance increases the wave length in proportion to the amount of capacity used. The value of the variable condenser comes in the fine adjustment of which it is capable. The variometer, shown in series with the detector while not really necessary, will be found quite useful for fine tuning.

Increasing or Decreasing Wave Length

Figure 22 shows a receiving circuit using a loose coupler in connection with a variometer and a variable condenser for increasing or decreasing the wave length of the antenna circuit.

The variometer is sometimes fitted with a small vernier attachment to permit very fine adjustment of the inductance. As its name inplies, the vernier adjuster is an arrangement of friction wheels which upon being turned allow the rotor of the variometer to be moved a small amount at a time. In this way, a correspondingly small variation in inductance results.

In place of loading and tuning coils, there is oftentimes used more compact forms of inductance, such as "duo-lateral" or "honeycomb" coils. These coils satisfy the demand for compactness, simplicity and convenience in coupling. The coils are cellular in shape the winding being such as to approximate a bank winding in one direction; the turns of one layer cross the preceding layer at an angle, making for minimum distributed capacity. The windings while fixed as far as their wave length values are concerned, can be used interchangeably, so that the operator can vary the wave length in steps, leaving the finer adjustment to the variable condenser or variometer connected in the circuit.

A loose coupler arrangement can be effected by means of a mounting stand, which permits moving the coils to and from each other.

The diagrams accompanying this and the preceding article give only a few of the representative connections for crystal detector receiving sets. The Radio amateur by experiment and by experience soon learns to try out new hook-ups that will be best suited for his particular needs.

WIRE TABLE—Outside Diameters for Various Insulations

B. & S. G. Number	D. C. C.	Enameled	S. C. C.	D. S. C.	S. S. C.	& S. C. C. Enamel	S. S. C. Enamel &
	Dimensions Given in Inches						
12	.0908	.0827	.0858	.0848	.0828	.0878	.0848
13	.0810	.0738	.0765	.0760	.0740	.0785	.0760
14	.0731	.0658	.0686	.0681	.0661	.0705	.0680
15	.0661	.0587	.0616	.0611	.0591	.0633	.0608
16	.0598	.0523	.0553	.0548	.0528	.0569	.0544
17	.0543	.0468	.0498	.0493	.0473	.0513	.0488
18	.0493	.0417	.0448	.0443	.0423	.0462	.0437
19	.0444	.0372	.0399	.0394	.0374	.0413	.0388
20	.0410	.0333	.0365	.0360	.0340	.0378	.0353
21	.0365	.0298	.0325	.0325	.0305	.0338	.0318
22	.0334	.0266	.0294	.0294	.0274	.0306	.0286
23	.0306	.0237	.0266	.0266	.0246	.0277	.0257
24	.0281	.0212	.0241	.0241	.0221	.0252	.0232
25	.0259	.01895	.0219	.0219	.0199	.0229	.0209
26	.0239	.0169	.0199	.0199	.0179	.0209	.0189
27	.0222	.01515	.0182	.0182	.0162	.0192	.0172
28	.0206	.01355	.0166	.0166	.0146	.0175	.0155
29	.0193	.01215	.0153	.0153	.0133	.0162	.0142
30	.0180	.01075	.0140	.0140	.0120	.0148	.0128
31	.0169	.00965	.0129	.0129	.0109	.0137	.0117
32	.0160	.00865	.0120	.0120	.0100	.0127	.0107
33	.0151	.00765	.0111	.0111	.0091	.0117	.0097
34	.0143	.00685	.0103	.0103	.0083	.0109	.0089
35	.0136	.00605	.0096	.0096	.0076	.0101	.0081
36	.0130	.00545	.0090	.0090	.0070	.0095	.0075
37	.0125	.0049	.0085	.0085	.0065	.0089	.0069
38	.0120	.0044	.0080	.0080	.0060	.0084	.0064
39	.0115	.0038	.0075	.0075	.0055	.0078	.0058
40	.0112	.0034	.0071	.0071	.0051	.0074	.0054

D. C. C.—Double cotton covered.
S. C. C.—Single cotton covered.
D. S. C.—Double silk covered.
S. S. C.—Single silk covered.

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Questions and Answers

Two Step Radio Frequency

(326) KF

1. Please send me the hook-up plans for 1 variocoupler, 2 variometers, detector and 2 step amplifier. In diagramming this set please give the voltage and amperage of the batteries. I intend to use UV tubes.

2. Is there such a thing as a variocoupler without any taps?

3. Will I be able to copy the broadcasting from Newark and Westinghouse? They are situated about 500 miles away by train, about 350 by air line.

A.—1. See issue of July 1st, page 13, diagrams S-1 and 3. Three 22½ volt "B" batteries and one 6 volt "A" battery, 60 amperes or better, are required.

2. Yes.

3. Yes, with enough Radio frequency amplification.

Spider Web Coils

(302) HS

I have a detector tube set and as I have never seen any hook-up that uses a spider web coil, would like to know if my hook-up is correct? I can hear KYW but no outside stations. What is the radius of my set? Here are the particulars: I have an aerial of four wires running east and west. My ground is a copper bottom wash boiler in a well. The length of my aerial is 50 feet. I use three spider web coils 4 inches in diameter with 50 turns on each. They are mounted on a board. To the first spider web my wires run to two side binding posts. From these binding posts my wires run to a variable condenser, to the inside and outside plates. I use a 21-plate variable condenser. My middle spider web is connected direct with aerial and ground. The other outside spider is connected with two front binding posts of which in turn one runs to the plate of detector tube and the other to the "B" battery. From variable condenser, inside plates, a wire runs through a grid condenser to grid on detector tube. From outside plates of the variable condenser a wire runs to a lower front binding post. (Not ones previously mentioned.) From the Jack for phones a wire runs to the "B" battery, and the other from the Jack to lower front binding post. (One just mentioned above.) From negative on tube, a wire runs to lower front binding post (just mentioned above). From my rheostat a wire runs to the positive on tube. Another runs to top binding post front (not mentioned before). From this top binding post a wire runs to the positive on my 6 volt storage battery. My negative on the storage battery runs to the lower binding post. I use a Cunningham tube, 30-volt "B" battery made up of 10 small batteries of 3 volts each, Murdock phones No. 55, a Howard rheostat and a Signal variable condenser. How can I catch other broadcasting stations? How can I change my hook-up to catch these stations and make KYW louder? I hope I have explained enough to enable you to tell me. My aerial is about 35 feet high.

A.—Hook-up poor. Try RD-11, page 14, issue No. 4 of RADIO DIGEST. You can omit the secondary and tickler condenser until you feel you want to invest more. The spider web coils are used like honeycomb coils. One hundred miles normal range. Lengthen your aerial. Also try honeycomb coils. See article in issue No. 4.

Crystal Set

(343) CLG

I have been reading your magazine on Radio and see where you offer to answer questions of those who are "stumped." Well I am one of those. I am greatly interested in Radio and have ordered a set, but fail to hear anything but a buzz or roar. This city is on high ground and is the highest point between the Illinois and Mississippi rivers. I have 100 feet of aerial wire bare copper No. 12 about 46 feet high and away from trees and other objects. I have a 1,000 meter, two slide tuning coil, galena detector, fixed condenser and a 2,000 ohm receiver. I have wired by several different diagrams but cannot get anything. Our nearest good station is KYW, Chicago, about 290 miles. There are other broadcasting stations being installed nearer, but do not know if they are in operation yet. How far should I be able to hear with my set if my set is not strong enough to hear Chicago? Can you tell me what to do to add to it or what parts to exchange for better ones? Also send me wiring diagram as I am very anxious to make a receiving set that will be a success. There are no amateurs near here, or I might learn from them.

A.—A crystal set has an average range of 20 miles. How do you expect to get 290 miles range? Get a 2 step Radio frequency amplifier and detector set. See issue of July 1st, page 13, diagram S-1.

Hook-Up Wanted

(339) MSS

Being a reader of the RADIO DIGEST I would like to ask if you will send me correct information that will enable me to hook-up my receiving set consisting of, honeycomb coils, variable condensers, V.T. control, vacuum tube, B battery of 22½ volts, A battery of 6 volts, Murdock head receivers, single wire antenna and ground.

A.—See RD-11, page 15, issue No. 4.

Sixty-Cent Set Works!

(345) RR

I have built your 60c receiving set and can get code about 15 miles. The way I tapped the coil was every ten to fourteen feet. I scraped a bare place of about ½ inch. Then took a helix clip and clamped the clip at the different bare places. My real purpose for writing this letter is to ask you a few questions.

1. I have a loose coupler, crystal detector and a 1,000 ohm phone condenser, antenna 80 feet long and 30 feet high, have a 10 feet ground lead. What is the wave length of this set? How many miles can I receive concerts? How many miles code?

2. With the same antenna and ground, how far could I receive concerts with a variocoupler?

3. Does a battery with a crystal set do any good?

4. How far would a variometer crystal set receive?

Thank you. Hope your paper is very prosperous. They fight to get it at local news stands.

A.—1. See page 13. Issues 9 and 10. Twenty miles phone reception. One hundred miles upward for code.

2. No difference. Better tuning will result though.

3. Yes, it strengthens weak signals. Only certain crystals, however, function well with a booster battery.

4. Twenty miles.

Patents

(459) FH

Referring to your May 20th issue on page thirteen regarding Armstrong patents.

1. Could you give me the patent number of this patent. Also if there is any information you can give me, I will appreciate it.

2. Can I make and sell a Crystal Detector Set complete without infringing on any patents?

A—See Patent No. 1, 113, 149 on Armstrong circuit.

2. Not necessarily. A number of crystal detector patents have been taken out.

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Radio Illustrated

Miss Juliette Day, starring at the Cort Theater, Chicago, in "Her Temporary Husband," keeps her beauty by listening to the ether waves. —Photo by Lewis-Smith Studio, Chicago.

Receiving set made by Daniel Callahan. He had trouble with the landlord in putting up an aerial but now uses a wire clothesline instead.
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One way to prevent the barber from talking to a customer. He is more interested in Radio
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Motion picture camera man receiving his instructions from the studio by airphone.
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