

# Radio Digest

EVERY WEEK

Illustrated

TEN CENTS

TRADE-MARK

Vol. 1

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CHICAGO, ILL., SATURDAY, JULY 8, 1922

No. 13

## MARCONI DENIES RUMOR

### MEETS SUCCESS IN PILOT CABLE TEST

#### RADIO STEERS MASSIVE STEEL SHIPS

Navy Department Pilots the Manchuria Through the Ambrose Channel Successfully in Test

(Special to RADIO DIGEST)

NEW YORK.—A recent test of the Radio piloting cable in Ambrose Channel showed that the mass of a large steel ship does not materially affect the audibility of the signals picked up from the cable, and that greater power in the cable is not necessary.

By means of underwater sound-detecting devices, a ship is enabled to keep practically over the submerged cable from which signals are constantly sent out through the water. There is a receiver on each side of the ship's bottom, and when one signal is weaker than the other the course is changed slightly until they are equal in intensity. In this manner a ship can proceed up the Sound even in dense fog.

As only tests with comparatively small steel vessels and tugs had been conducted by the Navy Department heretofore, it was feared that the mass of a large steel ship would absorb the magnetic field set up by the cable with the result that no signals would be picked up by the ship's receiving coils. The experiments, which were conducted by naval officers from New York on the U. S. S. Manchuria, also demonstrated that in the case of two ships passing each other, the absorption of the second ship would not reduce the strength of the signals received by the first.

### INSTALL AIRPHONE IN ALASKA LIGHTHOUSES

#### Boon to Keepers Shut Out from World News

The American light-house commission has decided to install Radio equipment on the lighthouses off the coast of Alaska. This will mean a great boon to the men who, in some instances, are at their posts for three years at a time, and receive no communications from the outside world for ten months at a stretch.

### WHEN YOU HEAR "US" YOU WILL KNOW WHO

WASHINGTON.—There is a small piece of land off Honduras in the Caribbean sea that has no ownership. This island is without a country, but it has a Radio station, and it uses the call "US," which is not a United States call. Italy owns the three letter calls, UPA to UZZ. The United States calls begin with the letters "N," "K" and "W." If the island should come into the possession of the United States the station would lose its extraordinary call.



### MARS STORY IS HEARSAY SAYS WIZARD

Inventor Wires Refutal of Celestial Communication Announcement by Press

Tells of New Invention

Radio Searchlight Is Latest Discovery—Directs Radio Waves Where Wanted

While stories upon stories have appeared in the daily press and elsewhere telling of the extensive tests which Senatore Guglielmo Marconi has supposed to have been carrying out in an effort to communicate with the planet Mars, a telegram from the noted inventor himself replying to an inquiry by RADIO DIGEST would seem to indicate that all of the stories so far published were nothing more than hearsay and rumor. The wire received was in Marconi's native language, Italian, as follows:

June 24, 1922.

RADIO DIGEST, Chicago.

Ringraziola per gentile telegramma. Smentisco assolutamente vico riguardanti comunicazioni Marziane. Saluti.

Marconi.

The translation of his message is: "Thanks for kind telegram. I deny absolutely rumors regarding communication with Mars. Greetings, Marconi." The inventor has been spending the most of his time of late in perfecting the Radio searchlight, a means of directing Radio signals in only one direction, as a searchlight does light rays.

The epoch-making device was announced and demonstrated by Mr. Marconi at a joint meeting of the Institute of Radio Engineers and the American Institute of Electrical Engineers held Tuesday night, June 20. Instead of scattering the Radio (Continued on page 2)

### AMATEURS WORK ENGLAND

#### New England Sparks Fly Over the Broad Atlantic

(Special to RADIO DIGEST)

NEW BEDFORD, MASS.—New England Radio amateurs who operate spark keys have been successful in getting messages to various stations in England. Four individual amateurs in Massachusetts and one in Connecticut have been heard in trans-Atlantic amateur tests in England. At the present time there are over 2,600 licensed amateur transmitting stations in New England, most of them operated by young high school or college men. In the recent trans-Atlantic Radio tests, for amateurs, W. F. Burns, of Cheshire, England, received messages from Station 1UN, Joseph B. Lodge, Manchester, N. H., 1ZE, Irving Vermilya, Marion, Mass., 1XM, Massachusetts Institute of Technology, Cambridge, and 1BCG, Minton Cronkhite, Greenwich, Conn.

### SENDS RADIO FOG SIGNAL

#### New Device on Coast Automatically Warns Mariners

(Special to RADIO DIGEST)

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

In foggy weather three distinct fog signals will warn the mariner near this vessel. On a 1,000-meter wave length the Radio signal will go out through the other to ships equipped with the Radio direction finder, a steam chime whistle will create sound waves in the air that will be recorded on human ears, and a submarine bell will send sound through the conducting water.

### MEETS TO GET NEWS OF FOREIGN MARKETS

A NOVEL feature, foreign market reports, will be added to two conventions of business men on July 11th and 12th. The New England Shoe and Leather Association Exposition and an import and export exposition, will hear the latest news of foreign markets and trade opportunities broadcast from the Arlington station. The broadcasts from Arlington (NAA) will be at 8 p. m., (Eastern Standard Time) on July 11th and 12th, using 2,650 meters wave length.

### DENIES RUMOR

(Continued from page 1)

waves in all directions upon leaving the antenna system, his invention, which does not in any way resemble a searchlight, sends the message through space in one direction only. The transmitting antenna resembles a reflector in shape, but is made up of a series of wires arranged in a special way so as to confine the emitted waves to the one direction.

Messages transmitted by Marconi during his lecture were picked up clearly on one side of the room, but could scarcely be heard with similar receiving apparatus on the other side, and vice versa.

#### Transmission Largely Secret.

"In these days of broadcasting, it may still prove to be very useful to have a practically new system which would be to a very large degree secret when compared to the usual kind of Radio," said Marconi.

With his system of reflectors, Marconi stated that he had successfully conducted Radiophone conversations between London and Birmingham, a distance of 100 miles. This is a record in long distance Radio transmission and reception with very short waves. In all these experiments the wave length varied from only one to twenty meters.

The reflectors make it possible for the receiving station to reproduce a telephone song or speech about two hundred times louder than is now possible, and without distortion. In addition, the transmitting aerial can be used both for transmitting and receiving at the same time.

Marconi described a revolving transmitter and reflector which acts as a kind of Radio lighthouse or beacon. "By means of the revolving beam," he stated, "it is possible for ships to ascertain in thick weather the bearing and position of the lighthouse."

#### How Automobiles May Interfere

Marconi stated that when very short waves are used, disturbances caused by static can be said to be almost non-existent and the only interference comes from the ignition apparatus of automobiles and motorboats. He predicted that "the day may come when we will have to screen our ignition systems or carry a government license for transmitting."

In Radio, electric energy is flashed into space in waves. The distance from one wave crest to another is called "the wavelength" and is usually expressed in meters. In these days, when Radio is the hobby of millions, the wave-length may be anything from 200 to 20,000 meters. In other words, the ether of space is shaken into terrific billows compared with which the mightiest upheavals of the ocean are mere ripples.

"As far back as 1895 and 1896, I had obtained some promising results with waves not more than a few inches long," said Marconi. He then proceeded to describe how he had returned to his original idea of using short waves.

#### Sending Radio Around World

"The question as to whether it would be possible to transmit Radio signals right around the world is one which has always fascinated me," Marconi assured his hearers. He discovered that "there is something in the idea of wireless waves traveling around the earth in various ways and reuniting at the antipodes." Sometimes these Radio waves traveling around the earth in different ways reinforce each other at the receiver and sometimes they interfere with each other. Tuning, however, overcomes the interference. The enormous station "Radio Central," at Port Jefferson, Long Island, Marconi found, sent waves which "preferred to travel three-quarters of the way around the earth rather than come the shortest way round."

Static, a subject to which the research engineers of the Radio Corporation of America have devoted much study in this country, was also discussed by Marconi. He told his hearers that there are particularly violent types of static over Africa and South America, but that static did not interfere very seriously in trans-oceanic communication in temperate zones.

Senatore Marconi is visiting this country for the first time in a decade. He came in his yacht, the Elettra, a floating Radio laboratory, to consult with American engineers on recent developments in the science.

### AIRPHONE USEFUL IN COLLEGE BOAT RACES

#### Naval Academy to Radio Poughkeepsie Race Periods

ANNAPOLIS.—Successful experiments conducted by Lieutenant Commander Frank W. Rockwell, Naval Academy rowing representative, with the Radiophone indicate that the device may be used to increase the pleasure of those who attend college boat races by keeping them informed as to the different periods of the race. It is planned to put the system in use during the Poughkeepsie regatta. Information will be sent into a receiving apparatus near the finish, and amplifying devices will make it practicable for many persons to receive the bulletins.

## Many Thousands of Fans Flock to See Chicago Radio Exposition

### Every Known Radio Device Found Exhibited at Show—Navy Has Booth—High School Students Show How Set Is Made—Manufacturers and Dealers Hold Meetings

CHICAGO.—Many thousands of Radio fans from all parts of the United States were in Chicago the week of June 26th to July 1st, to attend the National Radio exposition held in the Leiter building. Every known device used in Radio transmission and reception was displayed at the show. Working exhibits in which technical school boys made Radio sets before the eyes of the visitors attracted much attention at the exposition. Another feature was the separate concert room,

established the first municipal broadcasting station in the United States. Tuesday, the 27th, the jobbers were addressed by Paul A. Westburg, president of the Westburg Engineering Company; and on Wednesday the retailers had a meeting, at which the principal speaker was George B. Foster, assistant to the vice-president of the Commonwealth Edison Company.

The farmers had Thursday as their special day, when Samuel R. Guard, of the American Farm Bureau Federation, ad-

### PRESIDENT SPEAKS BY RADIO



In the foreground is the large framework with Radio megaphones above, by means of which President Harding gave a long distance dedication speech, June 13, for the Francis Scott Key memorial (shown in background), recently erected at Fort McHenry, near Baltimore, Md. The monument is a splendid testimonial to the man who composed the national anthem. © INT.

apart from the exhibits, where Radio concerts were held, eliminating duplication of concerts by exhibitors.

In addition to the display of commercial exhibits, showing every kind of Radio apparatus from the cheapest crystal set to the most expensive on the market, there were educational exhibits by the United States Navy, showing the evolution of Radio from its inception to the present time; the Radio inspection branch of the Department of Commerce, the United States weather bureau, Boy Scouts, Girl Scouts, Camp Fire Girls and the technical schools of Chicago. Lane Technical High School of Chicago printed a booklet at its booth, telling how to make a Radio receiving set. Lane students also actually constructed the set so that spectators could see how it was done.

#### Special Business Meetings Held

Special meetings were held afternoons and evenings at which prominent men in the industry discussed all its phases. The theory and the practical side of Radio were both well exhibited at the exposition.

On the opening day the manufacturers were welcomed at a special meeting by George E. Carlson, Commissioner of gas and electricity of Chicago, the man who

dressed them. At all the meetings there were open forum discussions.

Prizes were to be awarded in Radio speed contests and for the best set and devices manufactured. There were special classes for the school boy and the general public. The school boys took considerable interest in these competitions, awards for which were not yet made at the time this was written.

### Army to Teach Citizen Soldiers Radio Science

CAMP DEVENS, MASS.—A detail of 35 men from the Army Signal Corps at Washington, have been detailed to Camp Devens as a demonstration unit for the summer training of the National Guard, the organized Reserve, and the Citizens Military Training Corp. The detail will come fully equipped with all signal apparatus, including Radiophone, Radio and buzzer telegraph equipment and those units in camp which so elect may have instruction in any or all these branches. Many of those enrolled in the Citizens' Military Training Camp are already Radio amateurs, and this training will especially appeal to them.

# Radio Digest Illustrated

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Receivers and Loud Speakers. The Ninth Article of the Series by Peter J. M. Clute. All kinds of Receivers and Loud Speakers will be Described.  
Standardized Series Covering Panel Units for Different Types of Timers, Radio Frequency and Audio Frequency. This is a Special Feature Showing the Circuits. This Series will be Written by Harry J. Marx. They will be continued.  
"How to Make Department." An Exchange of Ideas and New and Unusual Methods of Using a Few Things to Get Results.  
Broadcasting Directory. Correct Station and Schedule List. The List Includes Every Public Service Broadcasting Station from the Date of License.  
Famous Stations You May Have Heard. One or More of These Stations are Shown Each Week.  
Radio Illustrated. You will see all of the Very Latest Pictures on this Page.

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# WIRE WAVES MAKE AUTOMAT STATIONS

## APPLY HIGH FREQUENCY CURRENTS IN TESTS

### "Remote Control" Used with Success in Operating Power and Light Plants

(Special to RADIO DIGEST)

LYNN, MASS.—A new application of high frequency currents is being worked out by the General Electric Plant here, in experiments conducted by Professor Elihu Thompson, head of the experimental and Radio work at the plant. The application is of a carrier current, acting like Radio waves, but going over wires.

The theory has been understood for years, but this application of it is new, according to Prof. Thompson. The purpose, when fully developed, is simply to send high frequency waves over wires that are used for power or light. Countless waves may be sent over a single wire, each wave attuned for a different station. By this means, light or heat at a certain station can be turned on or off from power headquarters by the use of the wave tuned to that particular station. This method is called remote control. If it comes into general use, it will mean the elimination of numbers of workmen who are now employed at branch power stations, and whose chief occupation is doing what the high frequency current can be made to do automatically.

#### Will Replace Workmen.

Often sub-stations or auxiliary stations that form part of a big power system, particularly in country or mountain districts, are far removed from the central station and difficult of access. Frequently only enough workmen are at these stations to turn on the current at given times and give occasional attention to the machinery. Other stations practically operate themselves. With the high frequency wave length system, these stations could be automatically started up or shut down as desired, with inspection for repairs and adjustment at stated intervals.

At Lynn, a high frequency generator was used to convert the ordinary 100-volt household lighting current into power at ordinary frequency. The output was then superimposed on the 4000-volt house lighting feeder circuit running to Nahant. It was then possible to regulate either of the relays at Nahant switching the lights on or off without interfering with others fed by the same line.

Any number of relays could have been operated automatically without bothering others, since each is set for a separate carrier frequency.

## Government to Sell 78 Complete Radio Sets

(Special to RADIO DIGEST)

WASHINGTON.—Radio apparatus valued at approximately \$250,000, located at Norfolk, Va., the property of the United States Shipping Board Emergency Fleet Corporation, is now available for sale.

The material consists of 78 complete Radio sets, composed of transmitters, receivers, storage batteries, generators, transformers, and component parts. These sets are of 1/2, 1 and 2 kilowatt capacity, the majority being of 1 kilowatt. They are the navy standard spark type, manufactured by Kilbourne & Clark, Marconi, Simon and Telefunken.

The Material Sales Division of the Emergency Fleet Corporation is desirous of selling these sets as complete units. However, there is a large quantity of extra transmitters, detectors, motor generators, batteries, coils, insulators, panels, rheostats, switches, transformers, etc., in fact, all spares necessary for complete sets, with the exception of receivers.

## LICENSE ISSUED TO PORTO RICAN SCHOOL

WASHINGTON.—There were thirteen or more broadcasting licenses issued during the past week. Included in these licenses were one for a Radio School in Porto Rico and one shop in Charleston, S. C. These were the first stations on the island and in the state. This leaves but five states without one or more broadcasting stations. This brings the total up to 386 stations in the U. S. and territories.

## RADIO WILL FEATURE NEW MOVIE COMEDIES

LOS ANGELES, CALIF.—A new corporation, Radio-Films, Inc., of this city, plans to produce a series of two-reel educational comedies based on the science of Radio. Each picture will teach a direct lesson as to the construction and operation of various kinds of Radio receiving and transmitting apparatus. They will also produce a reel film on what to do and what not to do in Radio work.

# RINGS FIRE BELLS WITH NEW DEVICE

## NEW ENGLANDER INVENTS RADIO FIRE ALARM

### System Starts Fire Engines—Small Town Equipped—Alarm Boxes Selective

(Special to RADIO DIGEST)

HARTFORD, CONN.—A New Englander has perfected a system of fire alarms by Radio. Here's the whole story, with the life story of the inventor, John Reinartz, a Radio amateur at South Manchester, a beautiful suburban manufacturing town nine miles from Hartford. In the initial stage of its development, fire alarm transmission by means of Radio has been accomplished successfully, and great possibilities ahead can be visualized. Reinartz, who is only 28 years old, is a natural electrician, accomplishing his experimental work with simple and inexpensive equipment. With a plain, compact set, he has picked up words from stations more than 1,000 miles away and messages from his station have been heard at the government Radio station at Hawaii. In this he has succeeded where many professionals have failed.

#### Equips Small Town With System.

Reinartz is employed in the electrical department of Cheney Brothers, silk manufacturers. Through him his firm has installed what is regarded as the most complete fire alarm system of any small town the size of Manchester, 16,000 people. When the Radio fire alarm comes in at headquarters, all station lights are automatically lighted; the engines of all the fine automobile equipment are started and the doors swing open, all through electrical relays, the system being figured out by Supt. Heebner of the Cheney Brothers' electrical plant.

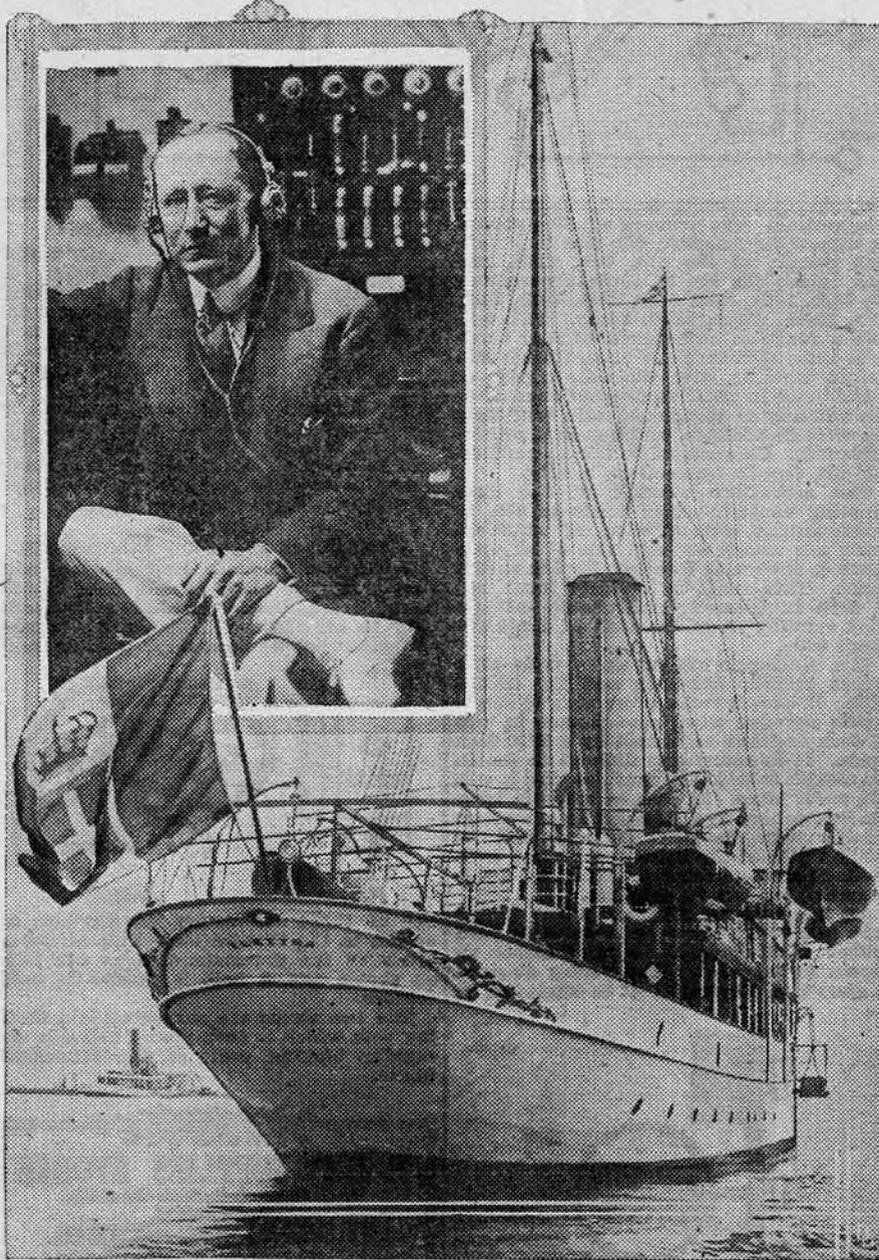
For months Reinartz has been experimenting in the field of fire alarm transmission after discovering that the Radio worked the usual indicator. Fire alarms have been transmitted from Hartford to South Manchester, nine miles distant, with the same perfection as over wired lines. Signals passed through the air and were mechanically recorded. In this experiment Supt. Sullivan of the Hartford fire department set up a fire alarm signal box in the broadcasting room of a transmission station, sent in an alarm and it was taken up on the repeater of the receiving station in the suburban town, recorded on the tape and the auxiliary bell was simultaneously sounded. The tap of the six-inch gong in the receiving station was also heard in the transmission station. Later the punched tape was visible proof of the success of the instrument.

#### Radio Alarm Boxes Selective.

By means of attachments, the fire alarm boxes in the different communities can be adjusted to varying wave lengths, and the receiving repeaters will be tuned to them. Confusion of alarms from different towns can in this way be avoided. By a system of multiple sets with individual taps and different toned gongs, a number of communities can all be covered from the same station, each community having a different wave length and the tuning remaining in constant adjustment, if necessary. An operator would soon become familiar with the different tones of the gongs, and in any event would have the automatic recorder to guide him, or as a check-up.

The manner in which confusion will be avoided in the case of two alarms from different boxes in the same community is controlled in the same manner as it is now avoided with ordinary signal systems. In the modern fire department, positive non-interfering succession boxes are used. Mix-ups in alarms are now rare. The Radio system will operate in the same way.

## MASTER OF ALL WAVES ARRIVES



Senatore Guglielmo Marconi, noted Italian Radio wizard, in the Operating Room aboard his good ship Elettra, anchored in the North River © INT.

## Radcliffe Girls to Study Radio

(Special to RADIO DIGEST)

CAMBRIDGE, MASS.—New courses in Radio vacuum tubes and electric oscillations are to form a part of the curriculum at Radcliffe college for women next fall, to meet the rapidly increasing interest in Radio among Radcliffe girls.

## To Handle Credits by Airphone

(Special to RADIO DIGEST)

NEW YORK.—The exchange of credit information by Radio is to be inaugurated by the Foreign Credit Interchange bureau of New York, operated by the National Association of Credit men, according to Benjamin Tregoe, manager of the bureau.

## THE ANTENNA BROTHERS

## Spir L. and Lew P.

## Part II—Wild Ether Waves



# How to Make Short Wave Tuning Unit

## Efficient Short Range Receiver Made Easily

The greater majority of Radio fans have no desire to pick up messages other than the general broadcasting stations operating on the standard 360 meter wave length. In such case it is advisable to employ a tuning unit of no greater range than that

**WORKSHOP KINKS? EARN A DOLLAR—**

**T**HERE 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.

required, and thus avoid the losses inherent with using only a small part of the total tuning range of an inductance coil. When in tuning on a set capable of receiving very long wave lengths, a considerable number of turns are cut out, a damming effect called dead end loss is created in that part of the coil not in use. This interferes seriously with the efficiency of the coil. It will, therefore, be better to

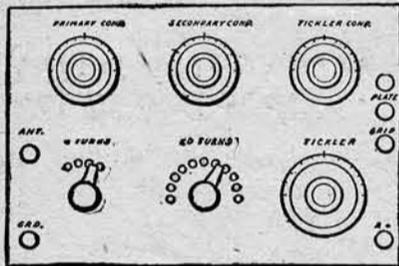


Fig. 1

have a coil capable of receiving a wave length of 360-meters or slightly more and have another coil than can be substituted at those rare occasions when long wave length reception is desired.

A serviceable tuning panel capable of very fine adjustment can be made by anyone with but little trouble if the following directions are followed carefully. Select a cardboard tube and treat to waterproof it. It will be found then more impervious to atmospheric changes than even fiber. It should be 8 inches long and 3 3/8 inches in outside diameter. The primary inductance winding should begin about 1 1/4 inches from the end and will be about 3 inches long. A gap of 1/2 inch should be left between the primary and secondary. The secondary is wound in two parts, separated by a space of 3/8 inch to allow for tickler tube shaft. This leaves another open space about 1 1/4 inches long at the other end.

A good method of fastening the tube to the base is illustrated in figure four. Cut two pieces of wood to conform to the shape and dimensions of the tube. The radius of the curve should be 1 15/16 inches. The tube can be fastened directly to these pieces by means of four round-head wood screws with washers. In order to drive the screws straight drill holes in the tubing large enough to let a thin screw driver pass through at points exactly opposite the screw holes. Don't attempt to fasten the screws through the open end of the tube, although it looks

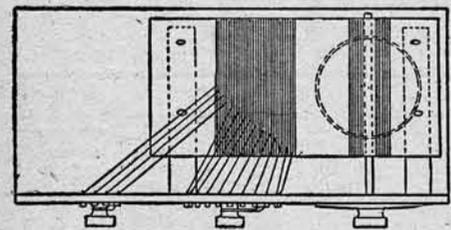


Fig. 3

easy. They cannot be driven straight in that manner, and will probably split the wood. These pieces can then be mounted upon a base board forming the bottom of the panel. This base board should be about 12 inches long and about 7 inches wide, 5/8 of an inch thick.

For primary winding use number 24 single cotton covered copper wire, which will wind 40 turns to the inch; 120 turns will be necessary. Two tapped switches should be provided, one with 11 contacts for rough adjustment and one with four contacts for

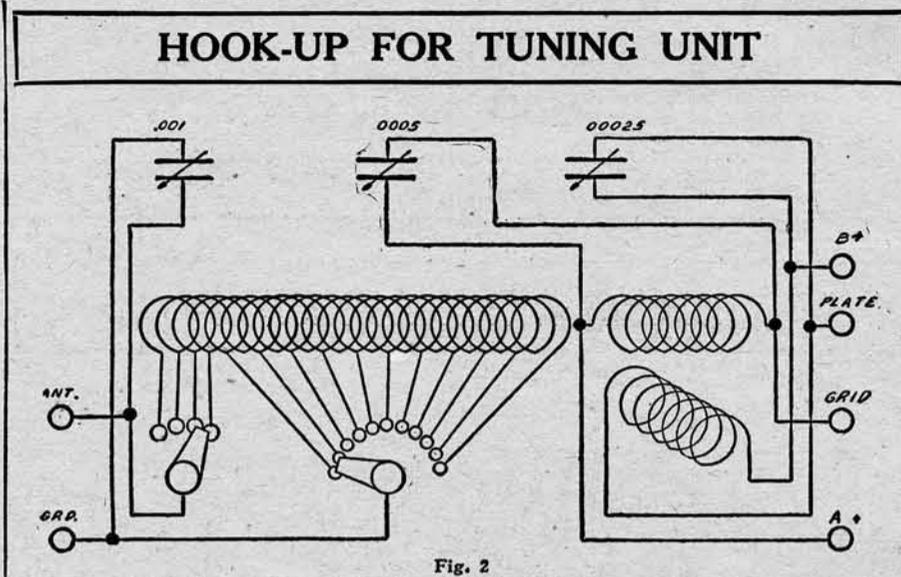


Fig. 2

finer setting. The primary winding should be tapped as follows: For the four contact switch at the 4th, 8th, 12th, and 16th turns; for the 11 contact switch at the 20th, 30th, 40th, 50th, 60th, 70th, 80th, 90th, 100th, 110th, 120th turns. This will give a range of adjustment of four turns at a time, sufficient for accurate control. Before winding, give the tube a coat of shellac and in addition another coat after the winding is completed, this will keep the wire in position, and act as a protective cover. Care should be taken in soldering the tapped connections neatly.

The secondary winding of the fixed coupling consists of 32 turns of No. 26 single cotton covered wire, of which 16 turns are wound on each side of an open space 3/8 inch wide to allow for the tickler shaft. This shaft is made of brass rod 1/4 inch in diameter and should make a good running fit in the wall of the cardboard tube.

The tickler is wound on a tube of 3 inches outside diameter and 1 1/4 inches wide. It has 32 turns of number 26 single cotton covered wire, also wound in two 16 turn sections separated by a 5/16 inch space. It is sometimes difficult to fasten the tickler tube to the shaft so that it will not work loose. If care is taken to have the holes about five thousandths of an inch smaller than the shaft diameter and the inside walls of the holes are covered with shellac before pushing the shaft in, a satisfactory job can be obtained.

All instruments comprising this tuning unit can be mounted on a suitable hard rubber or fibre panel 12 by 8 inches as shown in Figure 1. The wiring diagram is shown in Figure 2. It is advisable to

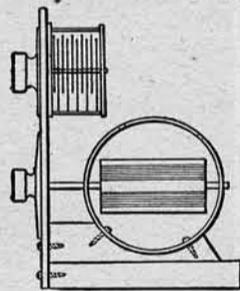


Fig. 4

solder all connections and to use stiff wire in preference to insulated flexible wire, which can then be bent at right angles. Three condensers are required with this unit, which are best bought as standard equipment. The one in the primary or antenna circuit should be a 43-plate variable of .001 microfarads capacity. The secondary requires a 23-plate variable of .0005 microfarads capacity, while the tickler circuit merely requires a .00025 microfarads variable condenser.

When made according to these specifications, the inductance of the primary coil is 114,200 centimeters. The tuning range can be varied to wave lengths from 100 to 460 meters, which is sufficient to receive broadcasting station without excess capacity and the resultant loss in efficiency due to idle turns. About 150 feet of No. 24 single cotton covered wire and 35 feet of the No. 26 wire will be required. Four dials, three variable condensers and six binding posts, plus the necessary parts for the switches will also be needed.

### TO GET TUBES—

**T**HE TWO tubes required for the article telling How to Make a Fixed Coupling Tuning Unit can be obtained by sending the sum of One Dollar to the How to Make Editor, RADIO DIGEST, 123 W. Madison St., Chicago, Ill.—Adv.

## Electric Flat Iron in Line Charges Battery

Have you ever dragged your heavy battery down to a charging station, waited 48 hours for it, dragged it back again and then wondered just how you could charge it yourself? This is the way it can be done if you have a direct current source:

A six-pound hand iron may be used, connected in the usual manner and then connected in series with the battery. One of the iron connecting cords should be cut about a foot from the iron. The positive and negative connections of the iron wire that has been cut should be connected to their respective terminals on the battery.

To ascertain the positive and negative wires of the iron wire the ends may be dipped in a glass of salt water. The wire which bubbles is negative, the other positive. The negative wire goes to the post of the battery marked negative and the positive wire to the other post. Charging should take about the same length of time as the period of time the battery has been in use since its last charge.

### How to Offset "Strays"

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

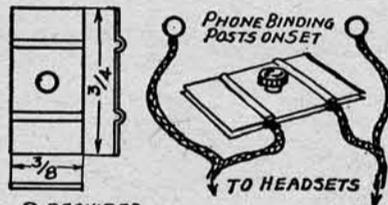
### Receiver Sensitivity Test

Telephone receivers can be easily tested for good operation and sensitivity. A sensitivity test is made by moistening the telephone tips and touching them together. The loudness of the click is a measure of the sensitivity of the 'phones.

Another test may be performed by placing the two tips on the tongue, about one-half inch apart. If one tip is held on the tongue and the other is raised and lowered to and from the tongue, clicks will be heard in the receivers. The small potential between the tips is registered by the sensitive receivers.—P. J. C.

### Connector for Two Head Sets

When two or more head sets are connected in the same circuit they should be connected in series. This is quite necessary in crystal sets. To do this a special connector is necessary. I have made



2 REQUIRED FIG. 1

FIG. 2

one of these connectors for my set, as shown in the illustration. Two strips of brass of the dimensions given are bent as shown and a hole is drilled in their centers.

The two strips are connected to a binding post which is then placed between the regular binding posts of the set.—John Shute.

**TELMACO**

**RADIO SUPPLIES STORES**  
Prompt Service—Quality Goods—Priced Right  
Radio Division  
**TELEPHONE MAINTENANCE CO.**  
20 S. Wells St. Franklin 3986  
5206 W. Madison, Austin 7041. 1122 E. 47th St.

Look for the TELMACO Sign

**Distributors FOR DeForest Radio Sets**  
All Types  
**IMMEDIATE SHIPMENT**  
Head Sets  
Vario-Coupler  
Variometers  
and all necessary parts for constructing your own set.

Write for Complete Price List  
Special Discounts to Dealers

**THOS. E. WILSON & Co.**  
42 South Wabash Avenue  
Dept. R. D. Chicago

**SELECTOR** PRICE \$4.25 Postpaid

A selective radio contact switch. For varying the number of turns in any kind of radio tuning coil. The SELECTOR can be mounted on coupler or coil direct, thus reducing leads to a minimum. Short leads and positive contact in radio instrument wiring are not only necessary, but are imperative for highest efficiency.

The SELECTOR combines these essential features and in addition is compact, positive and will give that commercial appearance to your panel.

**ROTORS AND STATOR SECTIONS**

Carefully and accurately made from specially selected and treated woods. Not "mere wood turnings," but manufactured to pattern makers standard. Rotors packed 50 and 100 in package. Stator sections packed 100 and 200 in package.

Dealers! Send for interesting circular and attractive proposition.

**NORRIS ELECTRICAL SPECIALTIES CO., Inc.**  
126 Liberty Street  
NEW YORK CITY Telephone Rector 6669

## MANY CITIES HEAR COLLEGIAN'S VOICE

STATION 1PR, BOSTON COLLEGE, WIDELY KNOWN

Plan Underway to Form Jesuit Radio Net—Cardinal O'Connell Gives Equipment

(Special to RADIO DIGEST)  
 BOSTON, MASS.—One of the most efficient Radio stations in the country is located at Boston College, on University Heights, Newton, just on the edge of Boston. Its calls are 1 PR, 200 meter wave length, and 1 XK, experimental, any wave length. The station was started with a small De Forest panel receiving set and gradually grew in importance through the interest taken by the students until finally Cardinal O'Connell became interested and made a gift of apparatus. The station has been in operation for two years, and its Radio messages are heard clearly in Cleveland, Detroit, Hobart and West Lafayette, Ind., Chicago, Buffalo, Rochester and Watertown, N. Y., Evanston, Ill., Hancock, Mich., Virginia and even North Carolina, according to postcards that have come in from various other stations.

At first, only the small receiving set was in use. Shortly afterward a 5-watt station was established. Now a new 150-watt C. W. Station is in operation nightly, and there are fifty students in the class, practicing code and studying the technique of Radio transmission and receiving both telegraph and Radiophone.

### Plan to Link Jesuit Colleges

Rev. Fr. Daniel J. Lynch, B. J., instructor in physics, is in charge of the station, and his chief assistant is Sylvester J. Connolly. Fr. Lynch is an enthusiast and an expert, having previously had a powerful amateur station in Newark, N. J., in the days before the wave length was limited for non-commercial stations.

He first established a Radio station at Fordham college, and while there he surprised the late Cardinal Farley, who was returning home from a visit to Rome, by getting into communication with him while the Cardinal was still aboard ship 250 miles from shore. When Cardinal O'Connell returned from Rome not long ago, after the election of the new pope, Fr. Lynch communicated with him by Radio, while the Cardinal was still far off shore. Fr. Lynch will endeavor to establish communication between the different Jesuit colleges, which will include Georgetown, at Washington, D. C., St. Joseph's in Philadelphia, Consistius, Buffalo, and one at Detroit, Mich.

### Relays Messages Often

Chicago is worked regularly by this station, which is a member of the Amateur Relay League and has frequently relayed messages for the league as a special transmission station.

Four of the students in the class are expert amateurs and often spend half the night at the set. Others of the class are coming along well and manifest great enthusiasm over the subject.

Some interesting reports have come in by postal card from different amateurs who have heard the Boston College station's transmission. Washington, D. C., Norman Lewis Hurd, reported that he heard Boston College distinctly with only one tube, while Chicago, Station 9AAW, reports the audibility as very QSA, with a steady, clear tone. Cleveland reported hearing Boston College on the Radiophone as the loudest of any station within reach, while Canada stations reported hearing it

## Capt. Amundsen's Ship "Maud" to Broadcast While at North Pole

Call Signal LWZ Belongs to Explorer—Will Be in Frozen Arctic Circle by October—To Transmit on 600 and 2,000 Meters Wave Length

(Special to RADIO DIGEST)

Fans, listen in for call-sign LWZ. If you should hear this call any night, tell the world. For it will mean that you have heard Capt. Roald Amundsen's ship, the Maud, which is now on the way to the north pole.

The Maud left Seattle June 10, bound for Nome, Alaska, as the first stopping point. There the famous explorer will join his ship, and set out for the long drift in the Arctic circle.

A reply to a wire to Capt. Amundsen for a short description of the Radio outfit on the Maud, states that both spark and continuous wave transmission will be used. The wave length for spark is 600 meters, and for continuous wave, 2,000 meters.

Captain Amundsen estimates the Maud's Radio outfit will have a range of 1,000 miles for spark and 2,000 miles for continuous wave transmission. This would mean that ordinarily he would be unable to make his dispatches heard throughout Canada. But when the ship gets up in the Arctic circle, where it is expected the normal range for Radio transmission will be increased tremendously, owing to clear atmosphere, it is possible that on stray occasions signals from the lone drifters will float down around here. And some amateur may become famous by picking them up.

### Receiving Wave Lengths.

The Maud has a wide variation of wave-lengths for reception, namely, from 300 to 2,300 meters. The operator will be on duty every day between ten and eleven o'clock in the morning, and from seven-thirty to eight-thirty at nights. It is Capt. Amundsen's plan to maintain communication with Washington, D. C., four times a day, starting in October.

There is nothing in fiction to excel the romantic nature of the trip that Captain Amundsen is taking. He expects to drift on pans of ice for five or six years, all the time making research that will be invaluable to science. He will endeavor to find out whether there is animal or vegetable life of any kind in the far north.

Besides, he will seek for traces of the "phantom fleet" which the Eskimos claim is frozen and gripped in the ice, swinging perpetually around the north pole.

Capt. Amundsen will tread where the foot of white man has never before been. But he cannot go to any corner of the earth where the voice of man has not already reached. For Radio has carried beautiful songs and addresses on many topics, to the most remote places wherever atmosphere exists.

very well. One man in Newark said he could hear the station without putting on the earphones. The station has also worked with Des Moines, Iowa. Cleveland, O., 8UK station, E. H. Poad, owner, reported the college's station as QSA in a recent card.

Other stations reporting by card as having heard the University Heights station are Pontiac, Mich., Newmarket, Ont., Waverly, N. Y., Cincinnati, and Springfield, with which the station works as a relay. Newmarket, Ont., reports that Boston College can be heard on the Radiophone all over the house.

### Will Keep In Touch with World.

While he is in those grim regions, where primeval nature holds sway, voices from civilization may from time to time reach him. Certainly, he will be in daily touch by the dot and dash system of signaling, with the world.



The S. S. Maud may be heard by many amateurs as it follows the dotted line on its trip to the north pole. Listen for it in October.

Beginning in October, when the vessel reaches far enough north, a daily weather report will be sent from the Maud to the United States weather bureau in Washington. These messages will have to be relayed by other land stations when the ship gets in the arctic circle. It may be that some amateur stations are destined to pick up and relay some of those messages.

Capt. Amundsen is starting on his long trip just at a time when the world apparently is on the verge of developments in Radio that will revolutionize the science. Who knows that before the explorers begin their long journey homeward it may not be possible for all amateurs who have Radio receiving sets in their homes to listen in daily to reports from the Maud?

Up to the time of Commencement, the station worked with colleges that have stations, when the Boston College baseball team was playing at that college. From the University of Vermont, at Burlington, they received the game by innings, posting it on the bulletin boards as the reports came in.

### Station Has Good Equipment

The station is equipped with the following apparatus:

One 160-watt transmitter, which can also be used with Radiophone (Fr. Lynch uses an ordinary style of telephone transmitter for Radiophone); also interrupted C. W.; three 50-watt radiotron power tubes; a D. C. motor generator capable of supplying 1,500 volts, average antenna currents six amperes; a magnetic modulator for voice and I. C. W. and a separate filament heating transformer of special design. This set has a range of approximately 1,500 miles.

## FARMER HELPED BY MARKET BROADCAST

DEPARTMENT OF AGRICULTURE EXTENDS PLAN

Wide Territory Covered by 45 Stations—Private Plants Aid by Co-operation

Since the first national broadcasting of official agricultural news by Radiophone in December, 1920, the national crop and market reports of the Department of Agriculture have covered more and more territory and increased in value to the farmer as well as the public in general, until today there are 45 Governmental and private broadcasting stations handling this form of news. Six applications, one each in Fort Worth, Nashville, Jacksonville, Cincinnati, St. Louis, and Hutchison, Minn., for broadcasting crop and market reports have just been approved, bringing the total stations to 51, while 29 other applications in several states are awaiting action.

The Bureau of Markets has official market stations at Boston, New York, Philadelphia, Pittsburgh, Cincinnati, Chicago, Minneapolis, St. Louis, Kansas City, and Omaha, as well as 73 branch offices in 46 large market centers, sixteen of which are directly connected with the Washington office by direct wire; all securing vital agricultural news. At least 15,000 individuals, firms and railroads co-operate in gathering data on fruits, vegetables, grain and live stock for daily use. Fifteen agricultural colleges are assisting in the broadcasting.

Besides the telephone broadcast, the Bureau of Markets, through the co-operation of the Navy Communications Service, sends out daily market reports in code from high powered stations at Arlington and at the Great Lakes Training Station.

## WASHINGTON DAILY RADIOS BULLETINS

Managing Editor of Paper Believes in Future of News Broadcasts

(Special to RADIO DIGEST)

WASHINGTON.—While all of the four Washington daily newspapers are carrying a so-called Radio page, only one paper, the Washington Daily News, is broadcasting.

At 12:30 p. m. (Eastern Standard time) each day the Washington Daily News broadcasts from twelve to twenty news stories through Station WPM, owned by Thomas J. Williams & Company, an electrical firm whose store is located next door to the News. It generally takes about five minutes to send out these news bulletins, as Lowell Mellett, the managing editor of the News feels that no one cares to listen to news bulletins for more than five minutes. Incidentally, Mr. Mellett feels assured that the broadcasting of news will be greatly increased as the pool rooms, cigar stands, and similar places install receiving sets.

On each Monday night at 8:30 the Williams Company stages a concert which is apparently widely appreciated from the letters received by the firm. These concerts include musical selections and occasionally a story telling expert is employed. Up to the present time, nothing but local talent has been engaged in broadcasting from the Williams Company.

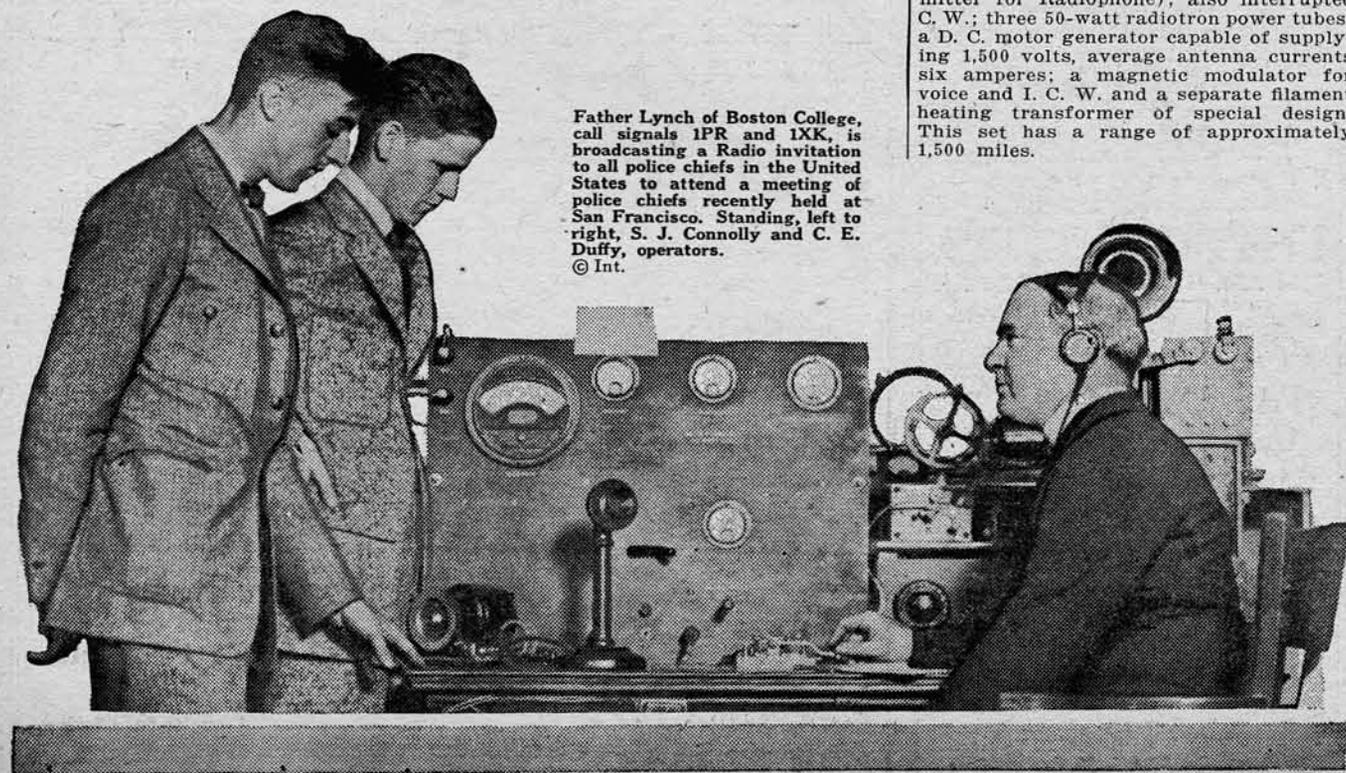
## Eastern Store Radio Has Novel Features

(Special to RADIO DIGEST)

BOSTON, MASS.—The Shepard Company has started to remodel its piano and phonograph department on the third floor of its big department store into a first-class Radio department. The broadcasting room will be large enough to accommodate a big brass band or the entire chorus of a big musical show. It will be the largest broadcasting studio in New England when completed. Two 63-foot towers are being erected, one on the Shepard store's building, and the other on a nearby roof. This will give a height of 200 feet from the ground.

The operating room with the transmission equipment will be located on the eighth floor, five floors above the studio for the musical and other artists. With the studio thus located so far away from the transmitting apparatus, there is little danger of interference through the generator hum and other noises being sent out through transmission.

Another feature will be a system of communication between the studio and operating station, by means of colored electric lights set into a panel on the chief operator's desk. There will be no bells or telephone in either the studio or operating room, so as to prevent objectionable sounds from being transmitted.



Father Lynch of Boston College, call signals 1PR and 1XK, is broadcasting a Radio invitation to all police chiefs in the United States to attend a meeting of police chiefs recently held at San Francisco. Standing, left to right, S. J. Connolly and C. E. Duffy, operators.  
 © Int.

## CROSLY RECEIVER EASY TO OPERATE

CONTROLS OF UNIT RE-  
QUIRE LITTLE SKILL

Harko Senior and Two Step Amplifier  
Combination Employs Non-Regenerative Circuit

(See Diagram, Page 7)

The set shown in this number is the Crosley Harko Senior and two step amplifier. It is of the non-regenerative type with a tapped tuning coil and variable condenser for tuning the circuit to the correct wave length. The controls are simple and are very limited in number, requiring very little skill in accurate adjustment. Even an inexperienced operator will have no difficulty in tuning the set to the desired wave length.

With a single wire antenna 150 feet long, this receiver will not only detect signals but amplify them to the extent that connection to a loud speaker is possible and the entire family may listen in.

### Explanation of Connections.

The Harko Senior, the unit on the left side in the front view, is the vacuum tube detector set. The binding post in the upper left hand corner is the aerial connection, while the one in the lower left hand corner is for the ground connection. The two in the upper right hand side of the panel are for the phones when the amplifier is not used. If it is used, they are connected to the two input binding posts in the left hand upper corner of the amplifier set.

The two binding posts in the lower right hand side of the detector unit marked "P" and "N" are for the positive and negative terminals of the filament lighting or "A" battery. If the amplifier unit is used, these two binding posts are, in addition, strapped to the two marked similarly in the lower left hand corner of the amplifier panel. This furnishes the battery current to the tubes in both the detector and amplifier units.

There are two flexible leads, one red and one black, extending from the back of the detector cabinet. These have clips attached, which are connected to the positive and negative terminals, respectively, of the 22½ volt "B" battery. The amplifier unit likewise has two similar leads, which are connected to the terminals of a 45 volt "B" battery. It is advisable to use separate batteries for the two units.

The two binding posts in the upper right hand side of the amplifier unit are for the head receiver or loud speaker connections.

### Tuning Controls Simple

The rheostat for the control of a vacuum tube filament is located directly to the left of the binding post marked "P" and "N" and a clockwise rotation of the knob increases the filament brilliancy, the degree of which may be readily observed from time to time, through the large hole in the panel. The contact points in connection with the switch are so connected as to give a fairly coarse adjustment of wave lengths and these adjustments are interpolated by means of the variable condenser controlled by the dial.

To tune for amateurs set the variable condenser at maximum capacity (100 on the scale) and place the switch on the left hand tap, making sure that the filament and vacuum tube has been adjusted to a point just below where hissing and extraneous noises begin.

Now adjust the variable condenser dial until signals are heard loudest. The middle tap on the switch is designed to receive wave lengths up to 400 meters and is therefore the correct one to use for the average Radiophone broadcast.

The procedure in every case is the same as outlined above for the amateurs, namely, to set the switch on a given tap and then adjust critically with the variable condenser. The tap on the extreme right is the tap on which the switch is set for the reception of commercial stations and Radiophone stations having a longer wave.

### Use of Amplifier

When using the amplifier, the two rheostat knobs control the brilliancy of the filaments. Both bulbs should be lighted to the intensity which gives the maximum amplification without undue tube noises.

If it is found that too much volume is received with two stages of amplification, only by turning down the tube current through the rheostats slightly, the desired results will be obtained. This will lengthen the life of the tubes and accomplish the same results as if there were a throw over switch in order to change from one to two stages of amplification, or vice versa.

### Hospitals Given Radio Sets

CAMBRIDGE, MASS.—Three detector and two stage amplifier receiving sets, together with three audiophone load speakers, have been donated to hospitals for disabled soldiers by the Park Kay Radio Company here.

## Book Reviews

**Elements of Radiotelegraphy.** By Ellery W. Stone. The text was written for the guidance and instruction of Radio students in the communication service of the Navy. It is an instruction book for Radio schools. Price, \$2.50.

**Radio Diary and Instructor.** A diary that can be used for recording interesting and valuable messages. It has provision for 365 entries. The instructor section has a short resume on the subject of Radio telephony. Price, \$1.00.

**Radio Receivers for Beginners.** By Snodgrass and Camp. Answers the universal question, "How can I receive Radio?" Price, \$1.00.

**Wireless Telegraph and Telephony.** By A. P. Morgan. In this book the author has endeavored to furnish a comprehensive explanation in simple language and without making any real attempt to enter into any engineering or constructive details of the theory and practice of Radio telegraphy and telephony. Price, \$1.50.

**The A B C of Vacuum Tubes.** By E. H. Lewis. Is a book for beginners who have no knowledge of either Radio or electricity and sets forth the elementary principles of theory and operation of the vacuum tube. No attempt has been made in this book to describe all the possible circuit arrangements, but those shown may serve as suggestions to experimenters who desire to evolve their own circuits. Price, \$1.00.

**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. Earlier editions of this book were published during the war. The 1922 edition has been revised and enlarged so as to cover the progress made in the last few years. Price, \$3.00.

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 Wins Speed Test Compared to Wire Lines

A recent test conducted by shipping board representatives at San Francisco, to determine the more efficient and economical method of handling communications between points, gave the honors to Radio. After a two-weeks trial with similar messages sent between various points on the coast the average time elapsed between filing messages at shipping board offices and the receipt of same by addresses for wire lines average 37 minutes, whereas the average was only 33 minutes via commercial Radio circuits.

**Carter Radio Co.**  
208 STATE STREET  
CHICAGO

**CARTER TU-WAY PLUG takes TWO head sets at same time; takes ALL types of cord tip terminals. Price \$1.50 each.**

If Your Jobber Is Unable to Supply, Write Us

WHETHER IT'S FAIR OR  
WHETHER IT'S NOT  
WHETHER THE WEATHER IS  
WEATHER OR NOT

## NATIONAL CRYSTAL DETECTORS

Will Always Give You Satisfaction



Price  
Only  
\$1.00  
COMPLETE

Base  
or  
Panel  
Mounting

THREE POINTS  
BULBS INTERCHANGEABLE

If you cannot procure from your dealer we will fill your order direct.

**NATIONAL RADIO WORKS**  
NEWARK, N. J.

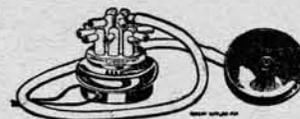
## RADIO FOR THE BEGINNER

tells you what you want to know about radio. It explains the principles of radio, the vacuum tube, radio tuning, etc., in plain language, and will help you make your set work better. Handy pocket size book, price \$1.00. Order to-day.

**ALFRED FOWLER**  
19 Board of Trade, Kansas City, Missouri

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

To the tune of Yankee Doodle



Price  
\$10

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

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

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

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

Write for Catalogue

**Gregg Company**  
Room 505, 35 South Dearborn Street  
CHICAGO

## RADIO MAILING LIST

6510 Radio Retail Dealers, per M... \$7.50  
681 Radio Jobbers, for list... 7.50  
524 Radio Manufacturers, for list... 7.50  
and any other list you want.

**Trade Circular Addressing Co.**  
166 W. Adams Street Chicago, Ill.  
Phone FRANKLIN 1182

## Silvertone Talker



The horn of excellence will get you the best results. Can be used on any amplifying set, with either single or double receivers.

Dealers  
Attention

Without Receivers  
**Silvertone Talker Co.**  
1432-34 Dime Bank Bldg., Detroit, Mich.

## Long Distance Reception

can be accomplished only by extremely close adjustment.

**B. T. VERNIER CONDENSERS** have the finest adjustment of any condenser made.

23-plate capacity ..... \$4.50  
43-plate capacity ..... 6.00

Postpaid

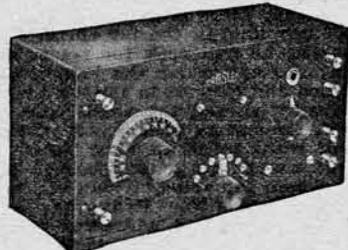
Buy no other if you want consistent long distance reception.

Satisfaction Guaranteed

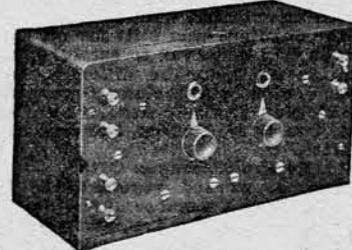
**BREMER-TULLY RADIO CO.**  
532-536 S. Canal Street, Chicago

## CROSLY RADIO APPARATUS BETTER—COSTS LESS

Crosley Harko Senior



Crosley Two Step Amplifier



The HARKO SENIOR was developed to supply the demand for a low-priced, efficient receiving outfit, having a range of from 150 to over 600 meters, thus bringing in on the average amateur antenna—amateur stations, radio telephones and commercial stations, operating up to and including 600 meters. Ships and stations on the Atlantic Coast are easily copied in Cincinnati. Radio telephone concerts and voice, from Newark, New Jersey and other New Jersey phones in addition to Pittsburgh, Detroit, Chicago and other phones, are regularly copied in Cincinnati, except under adverse conditions. It is just the thing for receiving radio telephone concerts. This instrument is a combination tuner and audion detector. It consists of a tapped inductance, a CROSLY VARIABLE CONDENSER, CROSLY Model "A" Rheostat, CROSLY V T SOCKET, CROSLY GRID CONDENSER and Leak. The hook-up is special—of our own design. The HARKO SENIOR is sold complete as described without tube, "B" Battery, "A" Battery or phone, as is usual with such apparatus.

PRICE ..... \$20.00

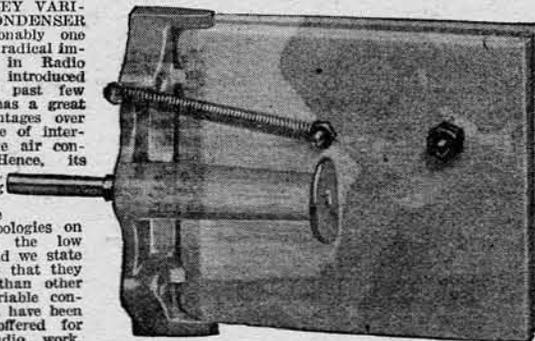
The HARKO SENIOR can be used in connection with the two-step amplifier described elsewhere.

To meet the demand for a moderately priced, efficient Two-Step Amplifier we have developed the one illustrated above. This consists of CROSLY Rheostat, Sockets and Transformers, mounted on panel of mica or other similar dielectric composition, complete with binding posts which are marked.

The CROSLY TWO-STEP AMPLIFIER is designed to work well with practically any audion detector hook-up, the phone posts on the detector being connected to in-put binding posts on the amplifier panel. The phones are then attached to the phone posts on the amplifier and the positive and negative posts connected with the "A" battery. Two leads with clips come out of the rear of the cabinet to be connected with the "B" Battery. The CROSLY TWO-STEP AMPLIFIER cabinet is designed to match up uniformly with either the CROSLY Detector Unit, the Crosley Crystal Receiver No. 1 or the HARKO SENIOR. The size of the cabinet of the Two-Step Amplifier is 11½ inches wide, 6 inches high, 4¾ inches deep.

Price of the CROSLY TWO-STEP AMPLIFIER without tubes, "A" or "B" Batteries, or phones, complete as shown in the illustration, is \$25.00

THE CROSLY VARIABLE CONDENSER is unquestionably one of the most radical improvements in Radio apparatus introduced during the past few years. It has a great many advantages over the old type of interlocking plate air condensers. Hence, its popularity. In marketing these condensers we make no apologies on account of the low price. Instead we state emphatically that they are better than other types of variable condensers that have been heretofore offered for use in Radio work, notwithstanding their low price. The CROSLY VARIABLE CONDENSER depends upon a thin sheet of mica as insulation between the plates. As there is no friction from the opening and closing of the plates, the mica will last as long as the condenser. Moreover, the



mica will stand up under much higher voltage than the average air condenser, without puncturing, breaking or showering. Therefore, the CROSLY VARIABLE CONDENSER can be used safely for C. W. Work or modulated C. W. work. Anyone who has experimented with Radio telephone will readily recognize the advantage of this feature.

Each CROSLY VARIABLE CONDENSER is carefully tested to withstand one thousand volts before shipment. Try this on an air condenser if you never want to use it again. Another decided advantage of the CROSLY VARIABLE CONDENSER is the fact that there is no danger of short circuiting. The slightest bending of one of the plates will make other condensers absolutely worthless.

PRICES: Model A, \$1.25; Model B, \$1.75; Model C, \$2.25  
For Knob and Dial, 40c extra

In addition to the above, we now are producing, in large numbers, the Crosley Crystal Receiver No. 1 and the Crosley Detector Unit, the two combined forming the Harko Senior. Our Radio Frequency Tuned Amplifier, costing \$15.00, is producing wonderful results. We also are producing transformers, variometers, vario-couplers, loud-speaking devices, sockets, cabinets, rheostats, tap switches, taps, binding posts, and many other articles used in radio outfits.

SEND FOR OUR CATALOG

**CROSLY MANUFACTURING COMPANY**  
CINCINNATI, OHIO

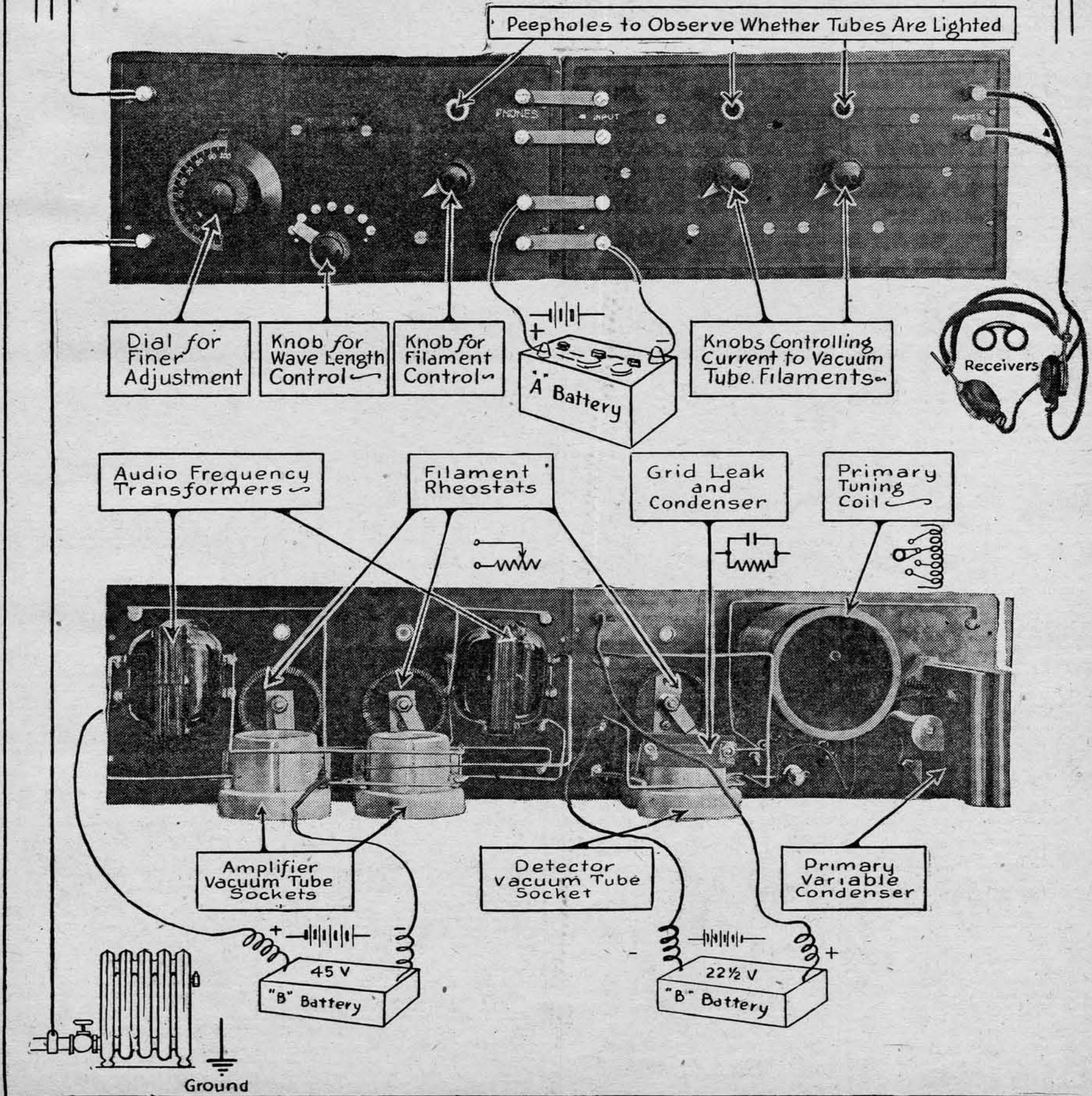
# Radio Receiving Sets

## Crosley Detector and Amplifier Unit

Antenna

As the tenth of the series of standard receiving sets, RADIO DIGEST presents the Crosley Harko Senior and two step amplifier unit, manufactured by the Crosley Manufacturing Company of Cincinnati, Ohio. Full information about this receiving unit and the method of connecting the various terminals will be found on page six, first

column. Although the beginner may not possess the particular make of set shown, it will undoubtedly pay him to read this page carefully. The points explained in both the chart and in the article on page six are applicable to many other types of receivers. The simplicity of construction and circuit make this set an interesting one.



# Radiophone Broad-casting Stations

## Corrected Every Week.

### CONTENTS AND HOW BEST TO USE—

A CHANGE in the broadcasting station directory has been made in order to give RADIO DIGEST readers maximum information about each station in the most useful form for the user. The directory, now listing 417 broadcasting stations in the United States, Canada and Hawaii, is, as it always has been, the most complete and authoritative directory of its kind. At much expense and trouble, this feature is revised and brought up-to-the-minute every week.

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

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

### Station Schedules

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

**CFBC**, Vancouver, Canada. 440 only. 500 mi. Daily. 1:30-3:30 pm, news, weather, concert. Pacific.

**CFCF**, Montreal, Can. 440 only. 200 mi. Marconi Co. Daily. 1:30-3:30 pm, concert. Mon, Thurs, 8-9 pm, concert. Eastern. Daylight Saving.

**CHBC**, Calgary, Canada. 410 only. 300 mi. W. W. Grant Radio Ltd. (Morning Albertan.) Daily. 8:45-10:15 pm, news, stock quotations, music. Mountain.

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

**CHCC**, Calgary, Canada. 400 only. 200 mi. Westerr 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.

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

**CJCD**, Toronto, Canada. 410 only. 200 mi. T. Eaton Co. Daily ex Sat and Sun, 4:40-5:30 pm, concert. Sat 12-13:30 pm, concert. Eastern.

**CHW**, Winnipeg, Canada. 420 only. 500 mi. Tribune Newspaper Company. Daily ex Sun, 12-3 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, 7:30-9:30 pm, concert, address, music. 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.

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

**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.

**KOYL**, 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.

**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.

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

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

**KFI**, Los Angeles, Calif. 300 mi. Earle C. Anthony. Daily. 1:45-2:30 pm, music, news; 4:30-5, news. Sun, 10:45-11:30 am, 4-5 pm. Pacific.

**KFU**, Grady, 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.

**KGG**, Hollywood, Cal. 300 mi. Elec. Lighting Supply. 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, baseball 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.

**KH**, Los Angeles, Calif. 50 mi. C. R. Kieruff & 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. Daily ex Sun, 11-12 noon. Mon, 10-11 am. Wed, 9-10 am. Sun, 1-2 pm, 5-8. Pacific.

**KJ**, Sunnyside, 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**, Redley, 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, 11-11 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. 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. Daily, 12-12:30 pm, markets; 5-5:30, news. Tues, Wed, Fri, 8:15-9 pm, concert. Pacific.

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

**KQP**, Hood River, Ore. 100 mi. Blue Diamond Elec. Co. Daily ex Sun, 7-7:30 pm, news. Mon, Wed, Fri, 8:30-9:30 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, 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. 100 mi. Coast Radio Co. Schedule unannounced.

**KVQ**, Sacramento, Cal. 1,000 mi. J. C. Hobercht (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**, Salt Lake City, U. 485 also. 300 mi. 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, 5:30-9:30 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.

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

**KYW**, Chicago, Ill. 485 also. 800 mi. Westinghouse Elec. & Mfg. Co. Daily ex Sun, 9:35 am-12:20 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. Sun, 3:30 pm, church service. Central, daylight saving.

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

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

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

**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. Bordereux Co. Daily ex Sun, 7:30-9 pm, baseball, concert. Central.

**WAAB**, 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.

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

**WAAB**, Huntington, 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. 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. 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. 8-9 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. 100 mi. Star Telegram. Daily ex Sun, 11-11:30 am, weather; 2-2:30 pm, road conditions; 3:30-4 pm, news, markets; 6:30-7, baseball; 8-8:30 pm, bedtime story, lecture; 10:30-11, concert. Sun, 2-2:30 pm, sermon. 3:30-4, concert. Central.

**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.

**WBAY**, 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.

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

**WBL**, Anthony, Kan. 300 mi. T. & H. Radio Co. Daily ex Sun, 8:50 am, 9:50, 10:50 and 1:15 pm. Kansas City grain markets; 1:15, roads, local markets; 7-8, concert, etc. Sun, 3-5, 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. Entrek Inc. 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.

**WVAL**, 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. 300 mi. Quincy Elec. Sub. Co. (Quincy Herald.) Daily ex Sun, 8:45 am, markets; 11, markets; 1 pm, markets; 5, music, baseball, Tues, Wed, Thurs, Sat, 8:30-9:45 pm, concert. Sun, 6:30-7:30 pm, religious. Central.

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

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

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

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

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

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

**WDAP**, Chicago, Ill. 485 also. 1,000 mi. Midwest Radio Central Inc. Daily ex Sat and Sun, 9:45 am, 10:45, 11:45, 1:45, 3:45, foreign exchange; 3:17, closing Chicago stocks, 8:45 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.

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

**WDAY**, Fargo, S. 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, 12:30 am, church service; 3 pm, lecture; 7:30, church services. 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**, St. Joseph, Mo. 485 also. 150 mi. N. W. Kansas City 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.

**WEAK**, St. Joseph, Mo. 100 mi. J. B. Abernethy. Daily, 8-9 pm, 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, Neb. 200 mi. Sheridan Elec. Service Co. Wed, Fri, Sun, 8-9 pm, concert, news, etc. Mountain.

**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; 7:45, weather. Sun, 8:10 pm, church service, concert. Central.

**WFAA**, Dallas, Tex. 485 also. 250 mi. News-Journal. Daily ex Sun, 12:30-10:15 pm intermittently, miscellaneous. Sun, 6-7 pm, baseball, news. Central.

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

**WFAJ**, 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.

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

**WFAT**, Sioux Falls, S. D. 100 mi. Argus Leader. Schedule unannounced.

**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; 7:45-8:35, baseball, news, concert. Sun, 11 am, church service. Central.

**WFAV**, Lincoln, Neb. 485 also. 300 mi. Univ. of Neb. Daily ex Sun, 10:10 am, stock and grain markets, weather; 7:30 pm (irregular), concert. Central.

**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.

**WGB**, 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.

**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 Hills, 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, 12m, 6:30 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, 9 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.

**WHB**, Kansas City, Mo. 485 also. 1,000 mi. 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. Seelye. 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.

**WIAC**, 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.

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

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

**WJT**, Erie, Pa. 1,000 mi. Elec. Equipment Co. Daily, 7:30-9 pm, concert, 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; 12:30 pm, 7-7:15 pm; 7-7:15 pm, 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; 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.

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

**WN**, Albany, N. Y. 60 mi. Stratton 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. Eastern.

**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. Sun, 8:15-8:30, 8:30-10, concert. Sat, 10-11 am and 1-2 pm, financial, music. Sun, 10-11 am, concert. Central.

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

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

**WOR**, New York, N. Y. 150 mi. L. Baumberg & 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;

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; Hollywood, 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, KZC, KZI; Modesto, KOQ, KXD; Monterey, KLN; Oakland, KLS, KXL, KZM, KZY; Pasadena, KDYR, KLB; Pomona, KGF; Reedley, KMC; Redwood City, KDYN; Sacramento, KVQ; San Diego, KDPT, KDYM, KDYO, KYF; San Francisco, AGI, KDN, KDZG, KDZW, KDZX, KGB, KPO, KSL, KUO; San Jose, KQW, KSC; Stockton, KJQ, KWG; Sunnyvale, KJJ; Colorado: Colorado Springs, KHD; Denver, DD5, KDYY, KDZU, KLZ, KOA; Connecticut: Greenwich, WAAQ; Hartford, WDAK; New Haven, WCJ; District of Columbia: Washington, WDM, WDW, WEAS, WIL, WJH, WMU, WPM, WWX, 3YN; Florida: Jacksonville, WCAN, WDAL; Miami, WFAW; Tampa, WDAE, WEAT; Georgia: Atlanta, WAAS, WDAW, WGM, WSB, 4CD; College Park, WDAJ; Illinois: Chicago, KYW, WAAF, WBU, WDAF, WGU; Decatur, WBAO, WCAP; Peoria, WBAE, WFAP; Quincy, WCAW, WCAZ; Springfield, WDAC; Tuscola, WDC; Urbana, WRM; Indiana: Anderson, WMA; Fort Wayne, WFAS; Indianapolis, WLK, WOH; Richmond, WOZ; South Bend, WBAQ; Terre Haute, WEAC; West Lafayette, WBAA; Iowa: Ames, WOI; Centerville, WDAX; Davenport, WOC; Des Moines, WGF; Fort Dodge, WEAB; Iowa City, 9YA; Sioux City, WEAU; Waterloo, WEAZ; Kansas: Anthony, WBL; Atwood, WEAD; Eldorado, WAH; Emporia, WAAZ; Independence, WFAF; Lindsborg, WDAD; Manhattan, WTG; Salina, WFAD; Wichita, WAAP, WEAH, WEY; Kentucky: Louisville, 9ARU

State, City, Call

Louisiana: New Orleans, WAAB, WAAC, WBAM, WCAG, WGV, WWL; Shreveport, WAAG, WDAN; 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, KPO, WCX, WWJ; East Lansing, WHW; Flint, WEA; Superior, WFAC; Minnesota: Hutchinson, WFAN; Minneapolis, WAAL, WBAE, WBAH, WCAS, WCB, WLB; Redfield, WCAL; St. Cloud, WFAM; St. Paul, WAAH; Missouri: Brentwood, WFAK; Cameron, WFAQ; Columbia, WAAN; Jefferson City, WOS; Kansas City, WDAF, WBB, WQQ, WPE; St. Joseph, WEAK; St. Louis, KSD, WAAE, WCK, WEB, WEW; Montana: Great Falls, KDYS; Nebraska: Lincoln, WCAJ, WFAV; Omaha, WAAW, WOU, WOV; Rushville, WEAV; Nevada: Reno, KDZK, KOJ; New Hampshire: Berlin, WEAQ; New Jersey: 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, WDM, WDT, WVP, WWZ; Poughkeepsie, WFAF; Rochester, WHQ; Ridgewood, WHN; Schenectady, WGY, WRL; Syracuse, WBAB, WDAI, WFAE; 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, WIZ, WLW, WMH; Cleveland, WHK; Columbus, WEAV, WEAO; Dayton, WAI, WFO; Defiance, WCAQ; Fairfield, WL-2; Granville, WJD; Hamilton, WBAU, WRK; Lebanon, WPG

State, City, Call

Marietta, WBAW; Portsmouth, WDAB; Toledo, WBAJ, WHU, WJK; Youngstown, WAAV, WMC; Zanesville, WPL; Oklahoma: Muskogee, WDAV; Oklahoma City, WKY, 5XT; Tulsa, WEH, WGAF; Oregon: Eugene, KDZJ; Hood River, KQP; Klamath Falls, KDYU; Portland, KDYQ, KFAB, KGG, KGN, KGW, KQY, KYG; Pennsylvania: Bridgeport, WBAE; Brownsville, WDAQ; Clearfield, WPI; Erie, WJT, WSX; Harrisburg, WBAK; McKeesport, WIK; Philadelphia, WCAU, WDAF, WFI, WGL, WIP, WOO, WPJ; Pittsburgh, KDKA, KQV, WAA, WCAE, WPB; Villanova, WCAM; Wilkes-Barre, WBAX; Rhode Island: Pawtucket, IOJ, IXAD; Providence, WEAN; South Carolina: Charleston, WFAZ; South Dakota: Rapid City, WCAT; Sioux Falls, WFAT; Tennessee: Memphis, WKN, WPO; Nashville, WDA; Texas: Amarillo, WDAG; Austin, WCM; Dallas, WDAO, WFAA, WRR; El Paso, WDAK; Fort Worth, WBAP, WPA; 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, KDZM; 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: Charleston, WAAO; Huntington, WAAR; Morgantown, WHD; Wisconsin: Milwaukee, WAAK, WCAV; Madison, WHA; 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, CHBC, CHCZ, CHVC, CJCD, CJCN, CJSC, CKCE; Vancouver, CFCB, CFYC, CHCA, CJCE, CKCD; Winnipeg, CHCF, CJCG, CJNC, CKZC

WAAW-390-E. Dahlgren, Rice Lake, Wis.; WAAZ-325-F. W. Steffen, Hartley, Ia.; WAH-175-D. Keigley, Miami, Okla.; WBAD-110-E. Dahlgren, Rice Lake, Wis.; WBAH-400-C. C. Dancer, Chicago, Ill.; WBAK-750-H. Walrath, Cedar Rapids, Ia.; WBAX-800-C. C. Dancer, Chicago, Ill.; WBL-660-E. Dahlgren, Rice Lake, Wis.; WBT-450-R. U. Waite, Vineland, N. J.; WBU-800-W. A. Knight, Hudson, Mass.; WBZ-1,175-R. O. Wise, Villisca, Ia.; WCAC-550-N. G. Garlock, Galena, Ill.; WCAK-665-S. W. Wilkinson, Knoxville, Tenn.; WCAL-130-E. Dahlgren, Rice Lake, Wis.; WCAT-590-E. Dahlgren, Rice Lake, Wis.; WCE-110-E. Dahlgren, Rice Lake, Wis.; WCK-200-C. Miller, Veedsburg, Ind.; WCM-1,500-C. M. Rice Jr., Worcester, Mass.; WCN-1,000-W. Lerne, Elkhart, Ind.; WCX-500-E. G. Waste, Spooner, Wis.; WDAF-350-F. W. Steffen, Hartley, Ia.; WDAF-925-J. S. Thompson, Toronto, Can.; WDY-1,000-F. D. Weeks, Milwaukee, Wis.; WEAQ-2,500-Dobson & Tucker, Oakland, Cal.; WEH-500 J. K. Stafford, Decatur, Ill.; WEI-2,000-Wm. Hayes, E. Liverpool, O.; WEV-320-E. S. Bee, Brookhaven, Miss.; WEY-600-E. Dahlgren, Rice Lake, Wis.; WFO-550-E. Dahlgren, Rice Lake, Wis.; WGF-635-C. D. Mason, Cleveland, O.; WGI-1,000-H. Walrath, Cedar Rapids, Ia.; WGT-1,250-T. E. Jones, Beggs, Okla.; WGY-3,100-J. J. Beales, Jr., San Anselmo, Cal.; WHA-900-J. B. Dusak, Worcester, Mass.; WHB-450-H. K. Goodall, Elmhurst, Ill.; WHQ-725-H. Walrath, Cedar Rapids, Ia.; WIL-670-J. K. Stafford, Decatur, Ill.; WJH-1,000-R. O. Wise, Villisca, Ia.; WJX-650-R. M. Sanford, Atlanta, Ga.; WJZ-3,000-J. J. Beales, Jr., San Anselmo, Cal.; WKN-750-A. N. Hopkins, Ashtabula, O.; WKY-400-R. O. Wise, Villisca, Ia.; WLB-850-Wm. Davis Jr., Canon City, Colo.; WLK-625-J. S. Thompson, Toronto, Can.; WLW-500-Wm. Hotland, Brookline, Mass.; WMH-725-W. A. Knight, Hudson, Mass.; WOE-270-E. Dahlgren, Rice Lake, Wis.; WOJ-970-M. Simmons, Shreveport, La.; WOI-500-A. E. Strong, Flagler, Colo.; WOK-700-F. D. Weeks, Milwaukee, Wis.; WOQ-1,100-G. W. Perkins, Thomson, N. Y.; WOR-950-E. Dahlgren, Rice Lake, Wis.; WOS-460-E. Dahlgren, Rice Lake, Wis.; WOU-475-A. Galloway, Grand Rapids, Mich.; WRK-600-R. O. Wise, Villisca, Ia.; WRR-700-H. Walrath, Cedar Rapids, Ia.; WRW-1,250-K. E. Gabbert, Clay Center, Kan.; WSB-1,800-S. S. "Betty B." Canal Zone; WSY-655-D. R. Bartsch, Galena, Ill.; WWJ-2,200-F. W. Hill, Cristobal, C. Z.; WWZ-315-H. S. Rahiser, Pittsburgh, Pa.; 2XJ-1,900-C. G. Munns, Hoisington, Kan.; 4CD-880-E. Dahlgren, Rice Lake, Wis.; 9YA-270-E. Dahlgren, Rice Lake, Wis.

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RECEIVING RECORDS? WATCH 'EM GROW! THE race continues! Amateurs who are able to beat the records listed below, or who can claim distance receiving records (100 miles or better) for stations not listed below, but which are given in the broadcasting directory, need only send in their records to be listed along with their names. One condition exists. Every record aspirant MUST GIVE the NUMBER OF MILES represented by the record, if his letter is to be considered. Otherwise it will be thrown out. Records to date are given below. -Broadcast Editor.

KGB-250-D. Lombard, Malden, Wash.; KGY-265-D. Lombard, Malden, Wash.; KHB-650-F. A. Rose, Two Harbors, Minn.; KHJ-370-D. Wolfe, San Jose, Cal.; KHQ-2,400-C. M. Rice Jr., Worcester, Mass.; KJJ-740-R. C. Bryant, Clarkston, Wash.; KJR-290-D. Lombard, Malden, Wash.; KLP-1,300-H. Wantuck, Fayetteville, Ark.; KLZ-1,575-C. M. Rice Jr., Worcester, Mass.; KNJ-1,150-N. M. Holmes, Chippewa Lake, O.; KOB-1,550-C. M. Rice Jr., Worcester, Mass.; KQW-1,725-W. E. Long, Sterling, Ill.; KUO-3,000-C. M. Rice Jr., Worcester, Mass.; KVQ-650-R. C. Bryant, Clarkston, Wash.; KWG-1,800-C. G. Munns, Hoisington, Kan.; KXD-120-J. J. Beales, Jr., San Anselmo, Cal.; KYG-310-R. C. Bryant, Clarkston, Wash.; KYI-250-J. J. Beales, Jr., San Anselmo, Cal.; KYJ-1,300-H. Wantuck, Fayetteville, Ark.; KYW-2,200-J. J. Beales, Jr., San Anselmo, Cal.; KZC-850-J. J. Beales, Jr., San Anselmo, Cal.; KZM-700-D. Lombard, Malden, Wash.; KZN-1,875-C. M. Rice Jr., Worcester, Mass.; KZY-2,600-A. Galloway Jr., Grand Rapids, Mich.; WAAB-450-R. M. Sanford, Atlanta, Ga.; WAAF-425-S. W. Wilkinson, Knoxville, Tenn.; WAAH-105-E. Dahlgren, Rice Lake, Wis.; WAAK-900-C. M. Rice Jr., Worcester, Mass.; WAAL-450-J. K. Stafford, Decatur, Ill.

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# Radio Digest Illustrated

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

Vol. 1 Chicago, Saturday, July 8, 1922 No. 13

## Some Comparisons for Radiophones

The Growth Estimated in Figures of Other Industries  
THE Copper and Brass Research association shows there are ten million automobiles in use in the United States today and about six million phonographs. The typical phonograph year was in 1914 when the output reached 514,000 machines with a value of fifteen and a quarter million dollars. It is not impossible, with the government interest behind Radio development, but what approximately six million receiving sets will be sold and in use within the next five years. With the estimated value of a receiving set placed at \$50 there will be spent fifty million dollars annually during the next five years for new installations.

## Vision and Power by Radio

### Fuel Transportation May Soon Be Obsolete

HOW SOON may we expect to see landscapes or persons at a distance by means of Radio? Will the Radiophone or its allied devices bring forth from out of the ether waves which will be seen by the eye, things many miles from where one views them? This is the substance of a prediction made by scientists. Tesla refers to the coming science as "television." Many of the scientists are working overtime to perfect devices for transmission of electrical power by Radio. With power sent through the air, your automobile, airplane or ship at sea could travel without the necessity of carrying a stock of fuel. Coal may soon be burned at the mines, generating electrical energy which in turn will be broadcast to run the world's machinery.

## A Corrective for Juvenile Dangers

### Radio Has Drawn the Attention of Youth

IT IS with pleasant thoughts that we look upon the popularity of Radio. A good many hundred thousands of the youngsters of primary school age in the United States, boys and girls alike, have taken considerable interest in Radio to the betterment of their entertainment. The newly popularized science has acted as a corrective to many juvenile dangers.

Radio tends to establish a community interest among groups of boys and girls with common tastes, and so to use the gang spirit, in itself is a good thing, for normal, constructive ends.

It is quite evident that for every aerial put up there will be one less window broken, one less fence torn down, and one more convert to science, the modern savior of humanity.

## Decorative Receiving Sets

### Things of Beauty as Well as Joy

ABOUT the only thing that stands in the way of procuring a handsome Radio receiving set is the price. When the person first becomes interested in Radio he will purchase the parts for a receiving set and build an outfit or partially assemble it and then set it up in the most conspicuous place in the house.

The general tendency in Radio construction is toward the decorative. It is a house instrument and consequently it should fit in with other pieces of furniture, like the phonograph and the piano. Some of the manufacturers have realized this and are building outfits with external appearance that equals the finest finish on the phonograph. In most cases efficiency is not sacrificed in the least in order to achieve the decorative.

At present the main thing is the price. Just to try out the new creation most beginners buy sets reasonable in price regardless of how they look, with the promise in mind that they will procure better sets at a later date. It looks as though there will be a lot of higher priced sets with handsome cases or stands sold in the near future. Fine sets, like "Rolls Ruffs" and "Fierce Sparrows," will find a ready market in the people who take pride in their homes.

## Ye Ed Asks 'imself

Question.—Explain the operation of a Radio transmitting wave.

Answer.—The operation of a Radio wave is best understood by a comparison of a pool of water into which a stone is dropped causing ripples to be generated in such a pool gradually dying out in strength and height, as the body of water absorbs them. This comparison is similar to a discharge taking place in the ether surrounding the earth causing ripples or waves of current to be generated in the ether. It must be understood in this comparison, however, that the Radio waves travel with the rapidity of light and are invisible. Therefore, the waves which are generated in the ether cannot be easily distinguished.

In the early days of Radio transmission practice a system known as the "spark" method was adopted. In this method the oscillations were sent out at the rate of 500 groups per second. In the present so-called continuous wave system now much in use the waves are transmitted continuously. In the present system of transmitting the voice by Radio telephone it is necessary to modulate the frequency of the voice upon the continuous wave system and it is in this way that a carrier of the human voice is provided at Radio frequency; in other words, the frequency of voice averaging only 1,000 periods per second is placed upon the Radio frequency wave and is transferred from the transmitting set to the receiving set only by this method. It has been found impossible to transmit the human voice upon a current of its own frequency, as the energy required for doing so would make the cost of transmitting and receiving apparatus prohibitive.

Question.—Will it be possible in time to eliminate the telephones now in use in the wired system by use of Radio through aerial signals?

Answer.—One of the principal reasons why this cannot take place at the present time is the difficulty in sending out telephone messages which would be secret in their reception. A device has not as yet been placed on the market which would make the sending out of messages in this manner an entirely secret process. It might be stated in this connection, however, that considerable progress has been made in the sending out of secret messages for telegraph purposes.

Apparatus has been designed not only for transmitting but also receiving telegraph messages at high speed. This system operates on a code plan and means is provided for rapidly changing the system of transmitting and receiving the code.

It will be clear that it would be extremely difficult to adopt this system, however, for sending out telephone voice currents. It is claimed, however, that certain wave filters have been designed which will transmit carrier currents with modulated voice current thereon that can be sent out at a specified frequency and only be received by stations that are equipped with suitable wave filters for receiving this particular type of wave frequency. However, this would be only a start on the problems involved in making the universal transmission of telephone voice currents similar to the multiple system of present wire telephony.

It would also be necessary to equip the receiving sets with relays so designed that they would respond only to a prearranged signal or system of signals, so as to notify the party called that the message was about to be delivered by Radio. All receiving sets necessarily would have to be equipped with transmission sets in order that response could be made to the message received. The operation of a transmission set has not been brought down to that simplicity which is found in the present receiving set, and in order to make such a set suitable for universal use with the ordinary unskilled operator, considerable changes would have to be made in the present complicated method of transmitting voice frequency. While it is somewhat difficult to conceive of a transmission set of this simple design at this time a few years ago it was just as difficult to picture the simple receiving set which is now used and which is capable of receiving signals over a thousand miles.

Question.—What are the principal parts of a Radio receiving set?

Answer.—A receiving set is composed necessarily of three things: the aerial or antenna, the ground connections and the set itself.

The set itself may consist of a simple coil for tuning. This tuning coil is absolutely essential in bringing in a particular type of wave length; in other words, if a three hundred sixty meter wave length is sent out the tuning coil must be capable of adjusting the set for the reception of such a wave length. Ordinary sets are equipped with tuning coils suitable for wave lengths from 200 to 750 meters. By means of loading coils, commonly called inductances, in the primary and secondary circuits of the sets, this wave length range may be increased as high as desired.

The function of another essential part is known as a detector, is similar to the function performed by an ordinary vacuum tube; namely, that it permits a high frequency current to only flow in one direction, and this form of suitable pulsations is similar to the ordinary pulsating current used for wire telephony. In other words, the ordinary telephone receiver is capable of receiving this rectified pulsating current.

There may be incorporated in such a set a transformer suitable for different frequencies. This transformer is wired into the set so that by means of storage batteries additional current is provided. This method of furnishing additional current in a receiving set is known as an amplifying tube. Sets may be equipped with one, two or three stages or more degrees of amplification.

—N. A. Firthman.

## RADIO INDI-GEST

### Suggestions to Radio Ponzis

In many districts the farmers are depending upon Radio for their price quotations. The first thing we know, some sharp buyer will broadcast prices about two points below the market and buy up everything in sight before the fan-farmers get wise.—Daily News.

### You'd Need a Load Coil to Get 'Em

Prospective Purchaser: "How far is the lot from the centre of the town?"  
Modern Real Estate Agent: "Oh, just a couple of wave-lengths."

### Scrub Their Teeth, Too!

Some expert suggests soaking poor crystals in oil to revive their sensitivity. Soon we shall see ads enquiring whether our crystals have had their vitamins to-day.

### Suggestion for Saving Money



### Cat Whiskers Are Real Goat Getters

"What's the small wire you have fastened to the crystal?" asked Dad.  
"Oh, that's a cat whisker," says Jimmy.  
"A cat whisker! Uh huh—that explains why our cat has been whining so of late. Have you been pulling out her whiskers?"  
"Oh, no, Dad; that's just a name for that small wire. It is a fine bronze wire and looks like a cat whisker, and hence the name."  
"Oh, I see. My! You surely have funny ideas and funny names in this Radio stuff. Pipe leads and cat whiskers."  
"No, ground lead, Dad; not pipe lead."  
"Oh, that's right."  
"Jimmie, you and your father come to dinner now. I have called you both for the very last time." Mother.—Indianapolis News.

### The Radio Widow

BY GEORGE MITCHELL

I've been a widow all my life;  
That is, since I have been a wife,  
Communing with myself, the time,  
In solitary pantomime.

Golf claimed him almost every day,  
And, as he nibbled on his way,  
I followed in his gallery  
Or, on the club house porch, drank tea.

At night, Bridge took him from my side;  
I couldn't play it—though I tried;  
But sat at home with ill-content,  
The while he gambled with the rent.

He gave up both. Said he: "I'm through,  
I'll stay at home alone with you."  
But Radio's got him. Fickle men!  
And I'm a widow once again.—Judge.

### Didn't Know It Was a Sport



Well, how come  
Radio shoes  
Radio hats  
Radio ties  
Radio sets  
and I didn't know it was a sport.

### Call in the Radio Inspector

If the old-fashioned lady who wore a coil of wire around her waist and called it a bustle, or around her head and called it a rat, should attend a Radio concert—would she be a broadcasting or a receiving station?—Chicago Daily News.

We imagine she'd have to get a license as her diameter might cause a lot of interference.—Lee Tron.

# Characteristics of Vacuum Tube Amplifiers

By Benjamin F. Miessner

IN MY preceding installment of this series, some causes of distortion by tube characteristics in audio frequency amplifiers were explained. It will be remembered that the points stressed for minimizing this distortion were, (a), to keep the normal grid potential at the center of the straightest portion of the curve, and (b), to keep the impressed voltages within the limits of this straight line portion. In addition to these precautions, there are others of some importance which should not be overlooked. The circuit characteristics of the amplifier should be such that currents of all frequencies may flow or be transformed with the same degree of freedom. That is, all frequencies must be amplified the same amount.

Ordinarily in the usual types of amplifier circuit both very low and very high frequencies are neglected, leaving the middle range over amplified. Unless the coupling transformers are very large and carefully designed, the coupling between primary and secondary may be very much less on frequencies below, say 100 cycles, than 1,000 cycles.

On the other hand, if the distributed capacity of the windings is high, the higher frequencies above 3,000 cycles, will be suppressed by capacity conduction. For good results in speech amplification, the circuits must transmit current frequencies from about 100 to 3,000 cycles. For musical amplification the range must be much greater, from say 50 to at least 10,000 cycles. Resonance effects which might either over or under amplify certain small bands of frequencies, depending on the nature of the circuit, should be prevented.

### Choosing of Transformers.

Another point of importance lies in choosing the transformers to fit the tubes with which they are used. In general, for highest amplification the impedance of the primary winding should match the impedance of the tube over the operating frequency range. Inasmuch, however, as the tube impedance is constant with frequency while the transformer impedance is variable, this impedance matching must be a compromise between the extreme values for the extremes of frequency so that the middle range is again of necessity favored. The secondary windings of the transformers should deliver the highest possible voltage for highest amplification.

Another point of importance in minimizing distortion is brought out by a study of the dynamic characteristics of vacuum tubes. Without entering into a lengthy discussion concerning this phase of amplification, it will suffice for practical purposes to state that there is always a certain amount of curvature in every tube's characteristic which causes some distortion, and that this can be compensated for by making the impedance of the output circuit of the tube as high as possible. But since highest power amplification demands matched impedance and minimum distortion requires highest possible impedance, a compromise must be reached based on other practical considerations.

A typical two-stage audio frequency amplifier is shown in Figure 28.

### Matching Impedances

Here an input transformer is used whose primary impedance matches the impedance of the source of current to be amplified and whose secondary gives the highest possible voltage. In this way the small currents in the input circuit are used most effectively to impress a high voltage across the first tube. The primary of the second transformer is connected in series with the plate circuit of the first tube.

So long as the plate current is constant no voltage is induced in the secondary or impressed on the input of the second tube. But when this steady plate current is being modulated by variations of input voltage across the grid and filament, the primary current variations induce voltage variations in the secondary. These voltage variations, if all distortion reducing precautions have been taken, will bear a close resemblance to the original variations on the input circuit with the exception that they will be considerably amplified by the action of the first tube and transformer.

### Cascade Amplification Enormous.

These amplified voltages are impressed across the input of the second tube, where in they undergo a second amplification. In such a cascade system of amplification it is possible to produce enormous magnification of energy. In small Radio receiving amplifiers of two stages the energy amplification may easily reach 200 per stage, so that with two stages the total amplification would be 40,000. When very careful precautions are taken to prevent all transfer of energy from the output back into the input of such amplifiers and all tendency to oscillate is thereby eliminated, truly amazing amplification may be secured.

Thus with only five stages we will have an energy amplification of (200)<sup>5</sup>, or 320,000,000,000. For all practical purposes, however, it is very difficult to obtain good

results with more than three stages in any one frequency range. Ordinarily two stages of audio frequency are as many as may be used with satisfaction. These will transform a signal that is inaudible or barely audible in the telephones into a strong, clear signal.

### Use of Same "A" and "B" Battery.

As shown in Figure 28, the filaments of both tubes may be energized by the same "A" battery, and likewise the plate circuits by the same "B" battery. The grid potential is adjusted by means of a potentiometer connected across the "A" battery.

Sometimes this grid potential is obtained by connection to a suitable point on the filament resistance, or if the tube characteristic permits, directly to one side (usually the negative) of the "A" battery. These methods, while oftentimes

be used. Chief among these are reactance and resistance. A reactance or impedance coupled two step amplifier is shown in Figure 29.

Here the alternating or varying currents to be amplified are passed through the inductive reactance L1 which has a low resistance and high reactance. If these currents consist of a continuous modulated current, alternating or varying voltages will be set up across L1, due to the modulation, while the direct component flows through with little opposition. In order to impress these voltage variations upon the grid of the first tube without the direct voltage due to the DC drop across L1 a blocking condenser C1 is inserted in the grid lead.

This condenser should be large enough to convey by electrostatic action the impressed voltages throughout the range of

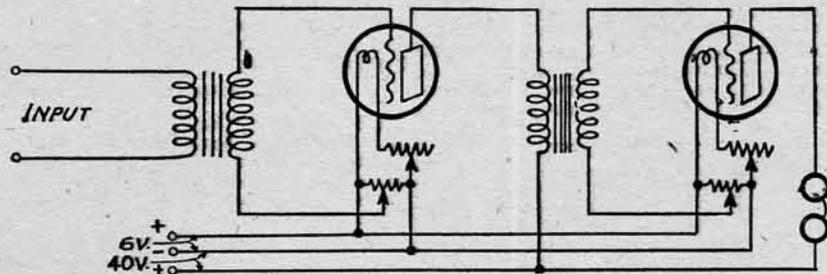


FIG. 28

giving good results, do not provide the accurate control really required for best operation. When so used, the only variation of grid potential obtainable must be secured by filament current variation with the rheostat and immediately we have two variables instead of one, and the grid potential variation is merely incidental to the variation of filament current.

It would be much better where simplification of controls is desired to omit filament current control and provide only grid control, as the latter is of much more importance.

audible frequencies required. In practice a capacity of .01 microfarad has been found about right. In order to secure a correct operating grid potential and to prevent the building up of a charge on C1 by grid rectification, the high resistance R1 is provided.

### Value of High Resistance.

The value of the high resistance R1 is governed largely by the capacity of C1. It must be small enough to permit the leaking off of any uni-directional charge that may tend to accumulate on C1 and small enough to prevent appreciable short-

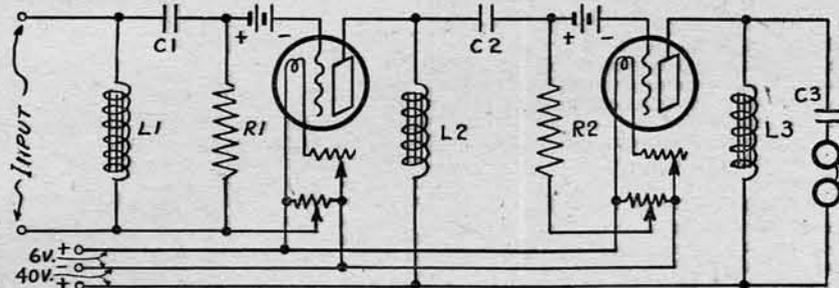


FIG. 29

### Control of Grid Potential.

Control of grid potential and amplification by filament current control may be likened to the control of the speed of a locomotive by regulating the temperature of the fire beneath the boiler.

In Figure 28 the telephones are shown connected directly in series with the plate circuit of the second tube. While this is the general practice with small receiving tubes it is sometimes desirable or necessary to use an output transformer. In that case, the primary should match the last tube's impedance and the secondary should match the impedance of the telephone, loud speaker, or other final device to be operated by the amplified energy.

circuiting of the voltage applied to the grid. A resistance of about one-half megohm has been found satisfactory in practice.

The grid potential may be secured by grid batteries as shown in connection with an "A" battery potentiometer, or with the smallest tubes these grid batteries may be omitted. The reactances L2 and L3, like L1, should have a low enough resistance to take care of the direct current flowing and the highest possible inductance in order to produce the highest possible voltage amplification.

Condenser C3 is provided to keep the direct component of plate current of the last tube out of the telephone and to permit

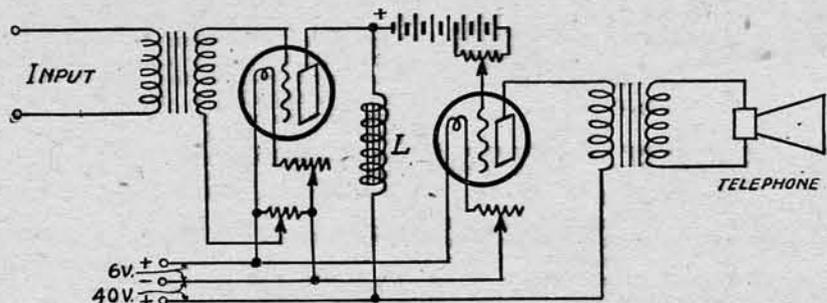


FIG. 30

When the larger tubes are used for power amplification, greater negative grid potential may be required than that available on the filament heating "A" battery. In this case, a fixed battery of about the correct voltage may be connected directly in the lead to the grid element and the potentiometer across the "A" battery may be used to secure a continuous variation of potential somewhat above and below that fixed voltage by adding or subtracting the "A" battery voltage on the potentiometer to or from the fixed voltage of the grid or "C" battery.

### Impedance Coupling.

Instead of transformers as a means of impressing the voltage amplified by one tube onto another, other methods may also

the desired alternating component to flow unhindered. It should have a large value, say about one microfarad.

### "C" Battery Gives Grid Potential.

Instead of using the condensers and resistances in the input circuits of the tubes, another scheme may be resorted to for maintenance of proper grid potential. This plan provides a "C" battery in each grid connection large enough to counteract the large positive potential on the plate of the preceding tube and to provide just the right potential for proper operation.

This circuit is shown in Figure 30. If desired, of course, input and output transformers may be used in impedance coupled circuits. These are shown in Fig-

ure 30 as a variation from that given in Figure 29. The same general reasoning is carried out in this circuit as in preceding types.

### Resistance Coupling

A third form of coupling may be provided for certain amplifying requirements by a non-inductive resistance connected in the plate circuit of an amplifier tube. When applied to a two step set, the coupling resistance would replace the coupling impedance of L2 of Figure 29 and L of Figure 30. Otherwise the circuits would be the same. This coupling resistance should have a value equal to at least double the plate resistance of the tube in whose plate circuit it is used. For small receiving tubes a resistance of about 50,000 ohms is suitable. This may consist of a graphite rod, or it may be made by pencil marking between conductors on a piece of insulating material.

### Comparison of Methods

Of the three above described methods of coupling in cascade amplification, the transformer provides highest amplification and the resistance, lowest. However, the transformer has a limited frequency range which causes a general over-amplification of mid-range frequencies and neglect of the lower and upper frequency extremes. The resistance coupling provides a perfectly flat characteristic so that all frequencies are amplified alike, but the amplification provided is quite low, so that about two to three times the number of tubes are required for the same amplification given by transformer coupling.

The impedance coupling provides medium amplification with a somewhat flatter frequency characteristic than the transformer coupling, but not so good as the resistance type in this respect.

Both resistance and impedance couplings require the use of "C" batteries of about 20 volts or otherwise blocking condensers and leak resistances, as shown in Figures 29 and 30, which add some complication to a set not required by the transformer coupling. For general use the transformer type coupling is preferred as the distortions are not extremely great and because the amplification is high.

*Editor's Note.—Radio frequency amplification will be discussed by Mr. Miessner in the next article of his series. Radio frequency amplification is very important in strengthening weak signals before rectification and audio frequency amplification.*

### What's in Your Phones

Telephone receivers are delicate mechanical organisms. Although they are clothed in mystery, they should not be opened up for inspection, dropped, or otherwise mishandled. They might be likened to the carburetor on a motor car—simple to take apart, but oh, putting them together again!

The casing of a receiver is usually made of some insulating composition or of some non-magnetic and light metal such as aluminum.

On the inside there are two electromagnets wound with a great many turns of very fine wire. These magnets, or pole pieces, are fastened on the ends of two legs that project from a ring of soft iron. A thin iron disk rests on the edge of the receiver casing and is held in place by the receiver cap. This iron disk or diaphragm as it is called, is usually tinned to prevent corrosion, and when in place, it rests close to the magnets.

Unlike the ordinary electro-magnet, the pole pieces of a receiver are made of hard steel and are permanently magnetized. This causes the diaphragm to be always under a tension. The windings of the magnets are connected in series, and the two remaining ends are connected to two binding posts on the back of the case.

There is a physical law which states that the greatest effect will be produced in a magnet when there are the greatest number of ampere turns within a given space. As the amperes, or current, flowing in a receiving set is infinitesimally small, there must be a great many turns in a small space on the magnets to secure the best effect. And to get this great number of turns within the small space allowed within a receiver very fine wire must be used.

It is this magnetic effect, and not the resistance caused by the great length of fine wire, that makes for sensitivity in receivers. Bear this in mind, when making a purchase, that because a pair of phones are marked 3,000 ohms it does not necessarily mean that they are more sensitive than a pair of phones that are more carefully and accurately constructed, and which are rated lower.

### Good Winding Varnish

A good grade of low capacity winding varnish may be made by dissolving scrap celluloid in acetone. Keep acetone away from flames, as it is very explosive.

# Radio Telephony for Amateurs and Beginners

## Part VII—The Batteries

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:

- VIII. Receivers and Loud Speakers.
- IX. Crystal Detector Receiving Sets.
- X. Vacuum Tube Receiving Sets.
- XI. Amplifiers.
- XII. Useful Information.

THE previous discussion set forth clearly the need of batteries for the proper functioning of the vacuum tube. The two types of batteries used in Radio work are the "A" battery, commonly termed the filament battery, and the "B" battery, or plate battery.

#### The "A" Battery

The "A" battery, used for heating the filament in the vacuum tube, is for most makes of tubes specified as a 6-volt storage battery. The ordinary tube requires about 6 volts at approximately one ampere. Dry cells supplying this circuit would last only a short time, hence a storage battery is generally employed. Storage batteries of standard commercial make may be used, although special Radio batteries, such as are shown in Figure 1, are to be preferred. A properly made Radio "A" battery should give excellent service for years, if given ordinary attention, such as is required for a lighting or starting battery.

The requirements of a Radio "A" battery are various:



Fig. 1

- (1) The battery should be easily portable.
- (2) The discharge rate should be uniform.
- (3) Terminals should be adapted for permanent acid-proof connections.
- (4) Parts should be readily accessible.
- (5) The filler openings should be large enough to facilitate the use of a hydrometer for testing purposes.
- (6) The plates must be porous, yet very hard.
- (7) The charging rate should be suitable for home-charging and for service station charging.
- (8) It should be clean and give off no noxious fumes.
- (9) It should require but little attention.
- (10) It should be capable of undergoing complete discharge without injury.

#### Capacity Storage Battery

The capacity of the storage battery is a matter of relative convenience—too great a capacity means too heavy to be portable. The size usually used is rated at 60 ampere hours and 6 volts. The

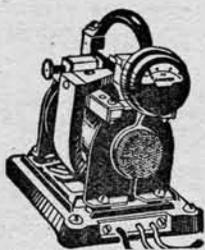


Fig. 2

voltage of the battery diminishes gradually during discharge. To alleviate the situation, it has been found that two batteries, each giving six volts and of similar capacity, give good results with a double-throw switch for alternately putting either battery in circuit. Maximum

service for minimum outlay is found in the portable special Radio battery, or preferably a pair of them.

A run-down, or discharged, battery may be recharged with a simple home recharger, or may be sent to a service station. A battery under ordinary usage should be recharged at least once a month. If, however, it is subject to heavy duty, hydrometer tests should be made at least every two days to ascertain the condition of the battery. When the specific gravity falls off to 1.1 on the hydrometer scale, or when the voltage per cell on discharge falls to 1.7 volts, the battery should be recharged.

#### Recharging Sets

Recharging sets are designed for either direct or alternating currents, the latter class embracing the vibrating reed type, and the vacuum tube type. Figure 2 is an illustration of a commercial magnetic rectifier for use on alternating current circuits. The vacuum tube type has a vacuum tube rectifier for rectifying the current, which is stepped down through



Fig. 3

a transformer. For Radio work, the two-ampere Tungsar rectifier, such as is illustrated in Figure 3, will charge a six-volt battery at two amperes, or a five ampere outfit will charge a six-volt, three-cell battery at five amperes. The action of the bulb in this type of rectifier is quite similar to that of the two-element vacuum tube, previously described.

A small quantity of distilled water should be added to the battery every two weeks. Ordinary drinking water will not do, as it contains matter injurious to the battery. Pour in just enough water to cover the plates, making sure not to overflow the cells, as this will cause the electrolyte to bubble out and may short circuit the battery.

#### Temperature of Batteries

A storage battery should never be subjected to excessively cold temperatures. A battery, when discharged, will freeze much quicker than a fully charged one. Storage batteries may be left idle indefinitely without injury, if a few simple precautions are heeded. An idle battery slowly discharges and should be frequently recharged during the winter to prevent freezing. Freezing may be avoided by storing the batteries in a place where the temperature never gets cold enough to reach the freezing point.

Before storing away the batteries, see that they are well cleaned. Keep all moisture away from the exterior and from the



Fig. 4

inside of the battery compartments to eliminate the possibility of short-circuits.

#### The "B" Battery

In addition to a storage battery for heating up the filament of the vacuum tube, there must also be provided a high-voltage battery. Figure 4 shows a typical commercial vacuum tube "B" battery. This so-called "B" Battery, to distinguish it from the "A" or 6-volt battery, serves to force current across the electronic path between the heated filament and plate of the vacuum tube. It should be noted that the polarity of the "B" battery should be as shown in Figure 5, with the positive side towards the plate. No plate current can flow and the tube will be inoperative, if this polarity should be reversed. Caution should also be taken to make sure that both the "A" and "B" batteries are connected correctly, because if the latter should be connected in the filament circuit, the tube will immediately burn out.

With highly evacuated or "hard" tubes, such as those used for amplifier circuits, the "B" or plate voltage is not critical and may be anywhere from 22 to 45 volts and up. The gas content or "soft" tubes,

such as those used as sensitive detectors, the plate voltage is generally taken at 22½ volts. The principal requirement for a "B" battery is such that it will give

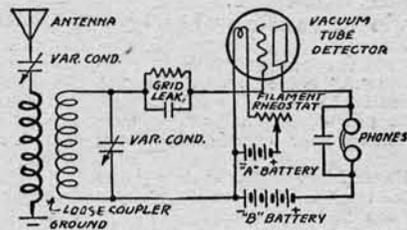


Fig. 5: VACUUM TUBE RECEIVER, SHOWING BATTERY CONNECTIONS

a high voltage at a very low amperage. Inasmuch as the actual drain on the battery is quite small, it will generally last from six to eight months.

#### Type of "B" Batteries

Originally "B" batteries were made up of a number of flashlight cells connected together to furnish the required potential. At present, there is a great variety of types of "B" batteries on the market, the most common being special dry "B" batteries, which come in compact units of 22½ volts each. Two types of "B" batteries are used, namely, the fixed voltage type, and the variable voltage type, such as is shown in Figure 4. As its name implies, the fixed voltage type is a small battery, delivering 22½ volts and it cannot be varied by tap switches, but only by use of a potentiometer. In the variable voltage type, the battery voltage is varied in steps in a number of ways. Taps from individual cells brought out to contacts of a switch, such as is shown in Figure 6, constitute one way of obtaining careful adjustment of plate potential. Fig-



Fig. 6

ure 7 shows another method of adjustment by the use of a potentiometer. The potential applied to the plate is the voltage between the negative side of the filament and the positive side of the "B" battery.

If the negative side of the plate battery is connected to the positive of the filament battery, the total plate potential will be the sum of the "A" and "B" battery voltages together. If the negative side of the plate battery is connected to the negative of the filament battery, the potential of the plate will be that of the "B" battery alone. Referring to Figure 7, it will be apparent that if the potentiometer can be adjusted so that any desired amount of the filament battery voltage may be added to that of the "B" or plate battery to give the proper potential for good detection.

#### "B" Battery Units

"B" battery units are made both in small sizes and in large sizes. The most popular for amateurs is the small size, although the larger size will be found more desirable if the receiving set is being used regularly. The small size batteries are usually equipped with a number of voltage taps, as shown in Figure 4, to give any potential up to 22½ volts, making it satisfactory for use with any of the various types of vacuum detector tubes. The large size "B" battery, generally has a high voltage rating of up to 48 or 50 volts, with voltage taps for varying the plate potential to suit requirements. This arrangement gives a wide range for plate voltage control. The lower voltage taps make it possible to use this size battery on a detector tube requiring 16 to 22½ volts, while also using it on a

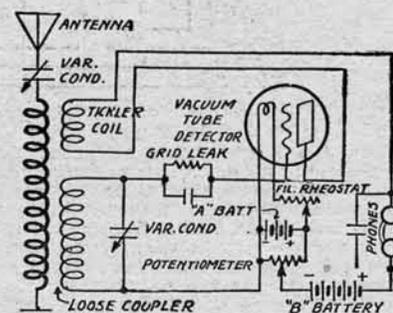


Fig. 7: VACUUM TUBE RECEIVER, SHOWING METHOD OF ADJUSTING PLATE POTENTIAL BY POTENTIOMETER.

vacuum amplifying tube requiring 45 to 50 volts.

In addition to the common "B" battery, made up of dry cell units, there are also high-voltage, low-capacity storage bat-

teries available for use on receiving sets which are used a great deal. This type is more economical than the dry battery type, inasmuch as they may be readily recharged when run down. The dry battery type when discharged is worthless for further duty.

#### Using a Condenser Series

A series of condensers if connected by a switch lever will give the amateur experimenter much more satisfaction than a single fixed condenser. To construct the series as shown in the diagram it is necessary to make three condensers as in Figure 1. Condenser No. 1 has two plates of conducting material, copper, zinc or tinfoil, separated by three sheets of insulating material, bakelite, formica,

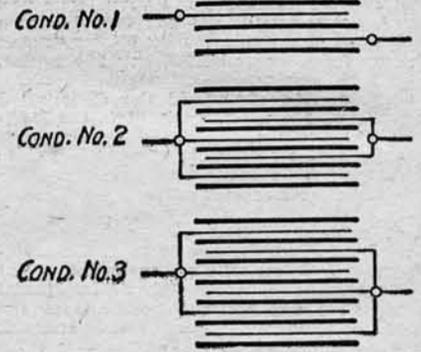


Fig. 1

mica, waxed or oiled paper. The wire from the detector in this hook-up, Figure 2, leads to one of the plates, and the wire leading from the other plate is connected to the wire attached to the slider of the tuner and to the ground.

The No. 2 condenser has four plates separated by five pieces of insulation and is connected in the same way as No. 1 condenser.

The No. 3 condenser is made up the same as the first two, the only difference is that it has six conducting plates separated from each other by seven sheets of insulation. Be sure that the plates do not touch each other and that the lever of the switch

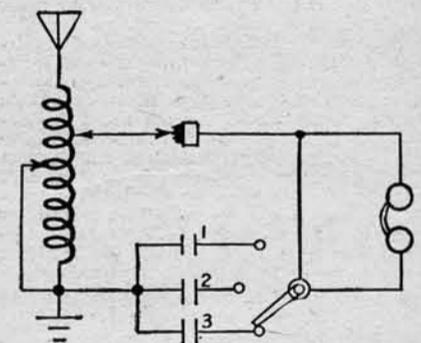


Fig. 2

does not touch more than one switch point at a time. I used tinfoil for the conducting material and waxed paper as the insulating material, but any of the other materials mentioned may be used.—Edwin Rust.

#### Testing a Fixed Condenser

In order to test out a small fixed condenser, a pair of telephone receivers and a battery will be all the testing apparatus necessary. The condenser, to be tested, is connected in series with the 'phones and the battery. The tip of the telephone cord is touched to a terminal of the condenser, and if the condenser is all right, there will be a very faint click in the 'phones. A loud click in the receivers would indicate a short-circuit in the condenser. This latter condition is generally caused by one of the plates from one side making direct contact with a plate of the other polarity. In this state, the condenser can hold no electric charges.—P. J. C.

#### Protractors Used as Scales

Scales for mounting on Radio panels can be made from protractor scales. These scales present a neat appearance and are quite inexpensive. Being usually nickel-plated, they will match up well with the contact points and switch knobs. Some protractors come with their center portion removed, while others must have the middle section taken out before they can be used for this purpose. Three small holes are drilled along the outer edge of the circumference to take the round-head screws for fastening the improvised dial to the panel.—P. J. C.

# Simple Instructions for the Beginner

By Harry J. Marx

## Making a R. F. Transformer

There has been a consistent popular demand for a simple Radio frequency transformer which can be made without difficulty at home. The complicated calculations of this type of transformer has made it difficult to present a simple article on the design of this piece of apparatus. The transformer described is flexible enough to permit variation in range covering the normal conditions usually found in the average receiving station. The novice will feel amply repaid for any time and trouble spent in the construction of this comparatively simple transformer.

Radio frequency amplification is the one way in which the advantages of the loop aerial can best be utilized. It will strengthen signals enough for phone reception for considerable distances, and with a step or two of audio frequency, following the detector, will satisfactorily operate any loud speaking device. This would not necessarily be true of reception from a detector alone or even with two step audio frequency amplifier. The impedance of the audio frequency amplifier is often too great for the weak signals received alone.

### Parts Required

The following parts are needed in the construction:

- Hard rubber spools as shown in Figure 1.
- 2 brass brackets as shown in Figure 2.
- 1 wooden shaft as shown in Figure 3.
- 2 round-head wood screws.
- No. 40 enamel covered copper wire.

A number of these spools should be turned up to permit an assortment of windings. The two small holes indicated on the one side are for the wire to pass through at the start and finish of the winding.

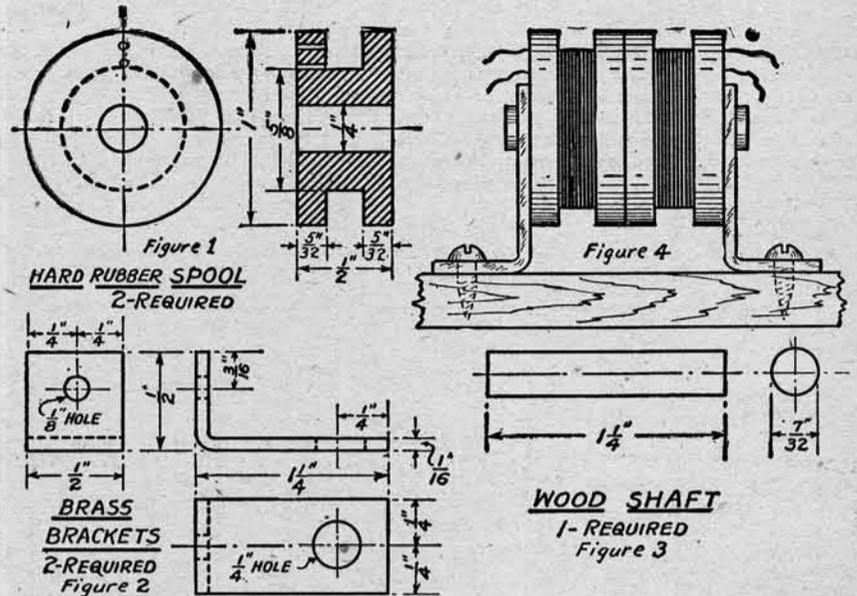
### The Windings

The number of turns for primary and secondary of the transformers necessary to cover the variations in wave length range will mean that about nine of these spools should be wound for the following number of turns, namely: 50, 60, 70, 80, 90, 100, 120, 150, and 200 turns. The combinations will usually work best as follows:

Primary—50, 60, 70, 80, 90, 120, 150.

Secondary—70, 80, 90, 100, 120, 150, 200.

This will permit a range up to about three thousand meters. These number of turns have been approximated but are not necessarily the best for variations in design. It will be difficult to give accurate figures due to the different types of circuits that are used by the different amateurs. It will therefore be necessary to experiment with these combinations in order to get the best results. Furthermore, it is advisable to shunt a .0005 mfd. variable condenser across each of the coils. This will permit a finer control of the adjustment to the proper wave length desired. It has been found best to connect a potentiometer across the "A" battery to permit accurate adjustment of the potential of the grid. This will give the most efficient performance and maximum amplification. After the spools have been wound, a layer of cord is wound over the



**Vacuum Tube Hook-Up**  
In Figure 5 is illustrated a hook-up, using a loop aerial with amplifier vacuum tube, Radio frequency transformers and vacuum tube detector. Note that there are sixty volts on the plate circuit of the amplifier tube, but the plate circuit of the

condensers are used for the transformer—one each on the primary and secondary, and one is shunted across the loop aerial. Although not shown, a .001 mfd. phone condenser can be connected across the receivers. A 45-volt "B" battery is used for the plate circuit of the amplifier vacuum

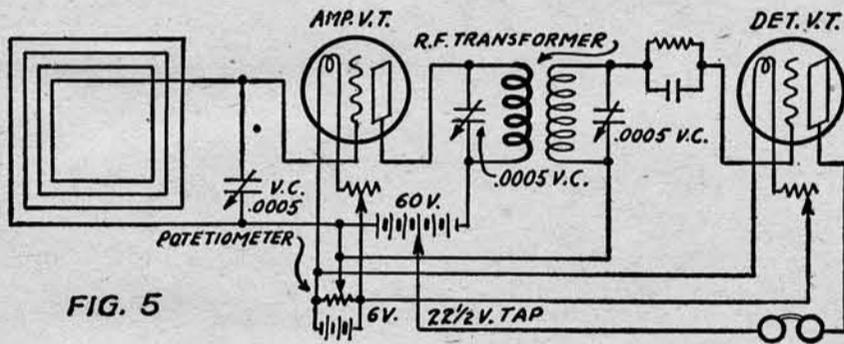


FIG. 5

The spools are turned from 1/2 inch stock which should be preferably hard rubber or bakelite. Fiber can be used, but is very difficult to turn as it wears the edge of the cutting tools very rapidly.

wire and fastened, and the spool is then dipped in paraffine and this is left to harden, after which the units can be assembled as desired, as illustrated in Figure 4.

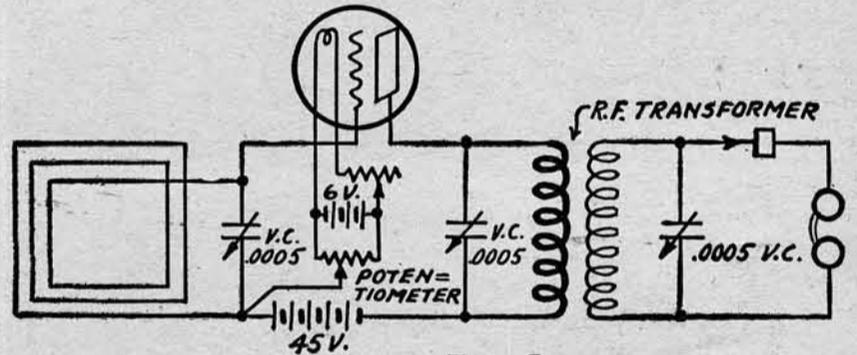


FIG. 6.

detector tube connects to the 22 1/2-inch volt tap on the plate battery.

### With Crystal Detector

A crystal detector can be used with one or more steps of Radio frequency amplification. This form of diagram is shown in Figure 6. Two 23-plate variable con-

tube. As has been stated above, a potentiometer is connected across the filament battery.

The use of these Radio frequency transformers need not necessarily be limited to loop aeriels. They can be used for any regular Radio amplifying circuit that has heretofore been given.

## Do You Know What Static Is?

By Letson Balliet

EVERY once in a while we hear an experimenter say: "There is too much static in the air," but if you ask him: "What is static?" he will say: "Electricity!" But ask him "what is electricity?" and he says "I don't know." In other words "static" is simply an "excuse" with most people for a difficulty they do not know how to surmount.

Static fills a need. It explains why paper sheets stick together in printing shops, or why carbon papers stick together when removed from a typewriter; why, when a person grasps your hand you sometimes feel an electric shock; why sometimes you can light the gas by walking across the floor and touching the gas tip; why a woman's hair snaps when she combs it; why moving belts will draw fire from your finger tip; why the telephone hums, or refuses to work; why the lights of St. Elmo appear on the spars of ships; why the lightning exists, and a lot of other things. Taking it all together, it's a very convenient word to have around. It explains so many things. What would the experimenter do for an excuse when he fails, if he didn't have "static"?

### Static Is Ether Waves

But what is it? It is ether waves, from unknown sources.

We have static light and color waves in the lightning, the lights of St. Elmo and Aurora Borealis. We have static magnetic waves in the papers that stick together. We have static heat waves demonstrated when lightning strikes resistance. We have static Hertzian or Radio waves. All are related, and get away with the general term of "static electricity."

They are simply a mixed up jumble of waves, that have all kinds of wave lengths and depth, that "jam the ether" with waves that are at discord with known waves or vibrations. A flash of lightning in South America or China, a volcano on

some star, an exploded planet, a meteor, an earthquake under the sea, a wind over the ocean, the friction of two air currents in the air, or between two clouds, or a number of such things may make ether waves or vibrations. In some kinds of weather there seem to be more waves than in other weather. At intervals the wave lengths seem to be in tune with the printing presses, or with your body or other machinery. At other times there are fewer waves in that wave length but may be affecting some other apparatus.

### Difference in Wave Lengths Fine

Sometimes the difference in wave-lengths may be in fractions of one-millionth of an inch, and the inventive genius is being taxed to the utmost to produce instruments delicate enough to tune out waves of all lengths but those desired.

Brushes of very fine copper wire, wired to the ground, will often carry off the static of the printing press, if the brushes brush lightly the paper as it passes through the press. And even so, there may be but one or a very few of all the wires in the brushes, that are in molecular tune to catch the particular static wave that bothers the press. That is why one wire will not do what a wire brush will often do. The temper of a piece of steel, the tension of a wire, or even the temperature of the steel may make a different molecular tuning that is susceptible to static waves that are always existing.

To theorize farther means only to hunt out examples that seem to support this theory. There are likely a number of cases where this theory might not seem so applicable. But the generally accepted theory by scientists is that "static electricity" is unknown wave lengths in the ether, of unknown origin, coming into atmospheric and material conditions that are "in tune" with the waves, and thereby vibrate with them till they are detected.

### Storage "B" Battery Best

The "B" battery is an efficient and well built battery, and is usually made in blocks of fifteen cells for the 22 1/2 volt units. In the larger sizes, up to ninety volts, as many as sixty separate cells are used. While the unit block "B" battery possesses many advantages of compactness, light weight, etc., still it has many faults.

If one cell goes dead, as happens occasionally, the voltage of the whole unit may be expected to drop, and the efficiency of the battery will be cut down until the troublesome cell is located and taken out of circuit. Again, loose connections, defective cells, etc., may cause noises and no end of trouble in receiving and amplifying circuits.

The storage "B" battery does away with many of the troubles. Unlike the block "B" battery, it does not "wear out" after a few months' use, but will improve to a certain extent with each charge. There is no need to throw it out after it has finished its "shelf" or guaranteed life, inasmuch as it has none.

The cells used in this "B" battery are commonly known as lead cells and are of the general type used in automobile ignition and starting batteries.

### "All-American" Products

Radio and Audio Frequency Transformers. Variable Condensers, 50 Watt Tube Sockets. Grid Condensers.

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35 South Dearborn Street CHICAGO

Headquarters for

## Radio Supplies and Equipment

Radio Department  
**COMMONWEALTH EDISON ELECTRIC SHOPS**  
72 West Adams Street  
Chicago, Ill.

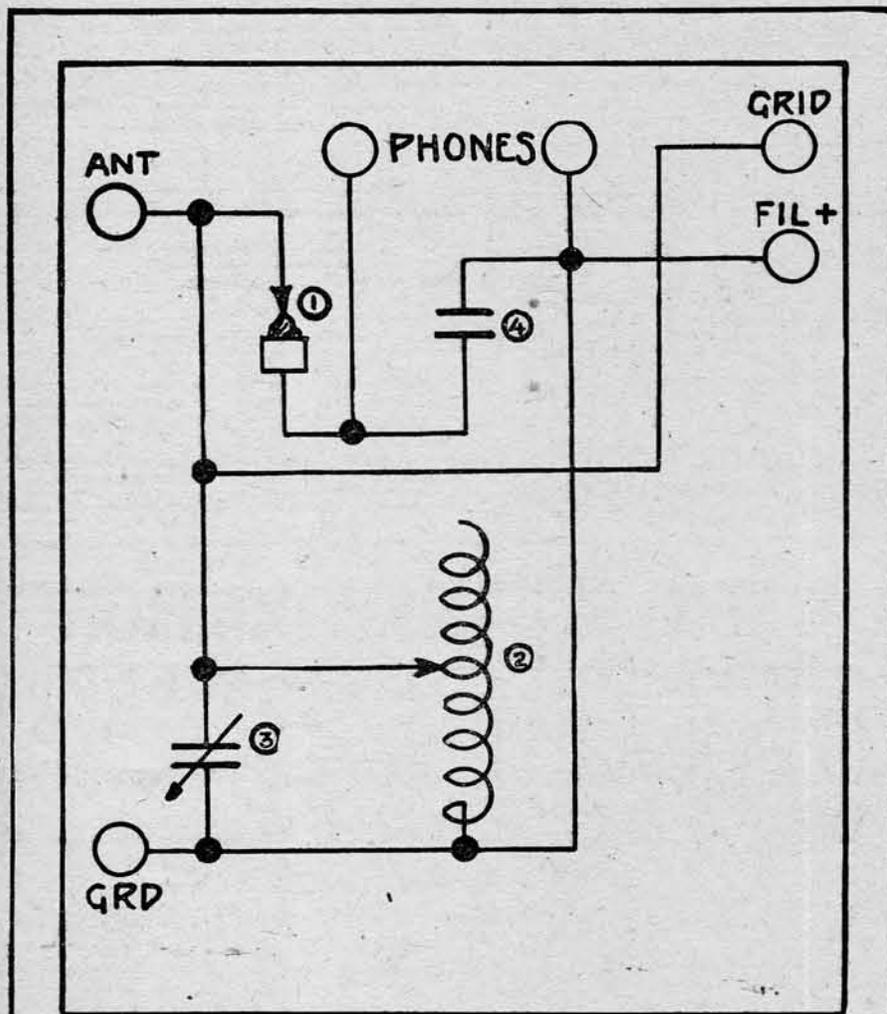
## Radio Capital Wanted—

by a nationally known Radio engineer. Necessary to manufacture and merchandise several important Radio inventions. Among these is a patented one control receiver, using no aerial or ground and with super amplification on special vacuum tube circuit. Persons capable of investing \$10,000 will be communicated with. Address Box 107, care of this paper.

# Panel Units for Your Receiving Sets

By Harry J. Marx

This series will consist of a description of individual panel units which can be assembled at the option of the fan to make up any desirable type of receiving set. For example: The first of the series is a crystal detector tuning panel. This, in itself, is a complete receiving unit. It can, however, be connected with an audion detector panel if the tuning unit is desired. A number of different types of units including loose couplers, variocoupler, variometers, honeycomb coils and other forms of tuning apparatus will be shown made up into tuning panels. Separate panels of both Radio and audio frequency will be illustrated. The novice can therefore assemble any number of stages of Radio or audio frequency with either a crystal or vacuum tube detector. The standard size of these panels will be eight inches by ten inches, although these dimensions can be altered to suit the requirements and design of any particular apparatus that may be used. The distinct features of merit are the advantages in assembling these units as desired and then strapping together parallel binding posts on the adjacent sides. Under each panel will be given a brief description of the parts indicated by the numbered circles, giving as far as possible the capacity, resistance, etc., when necessary. It must not be overlooked, however, that the design of the tuning apparatus depends entirely upon the antenna characteristics of the receiving station. Therefore for tuning coils data, the reader is referred to the article on tuning apparatus design given on page 13 of the ninth and tenth issues of RADIO DIGEST.

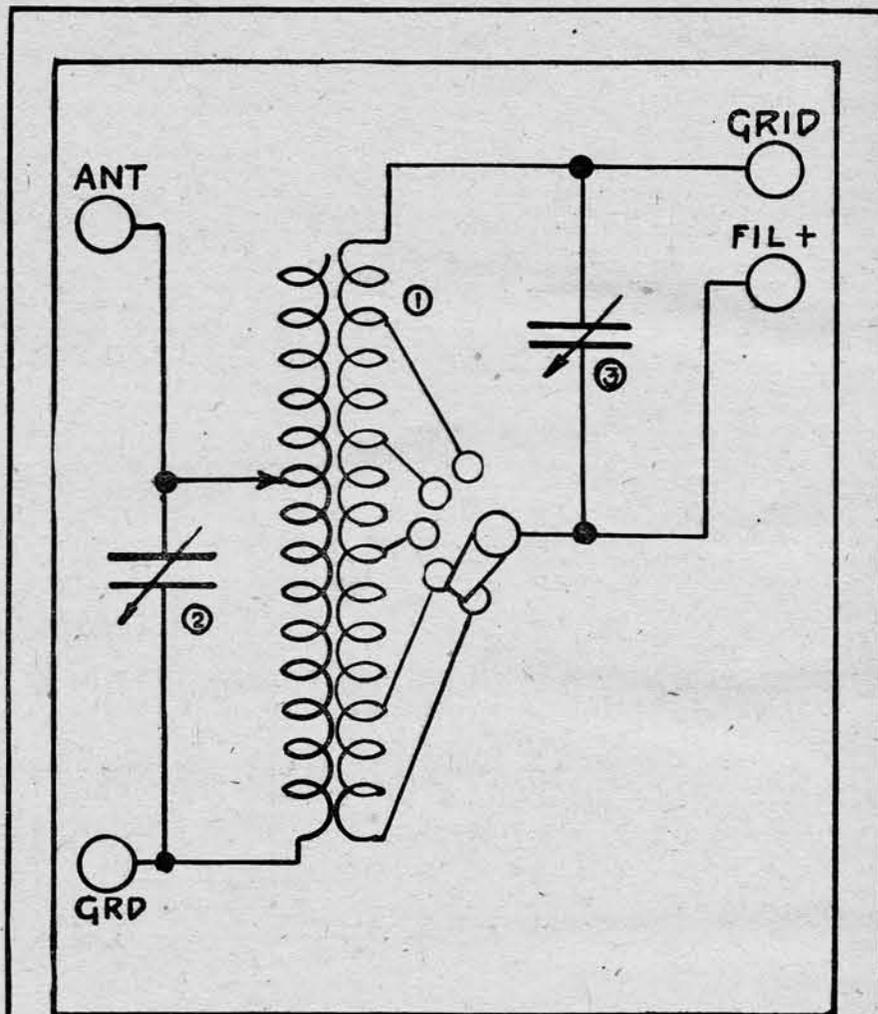


CRYSTAL DETECTOR  
TUNING PANEL.

RADIO DIGEST

H.J.M.

S-4



LOOSE-COUPLER  
TUNING PANEL.

RADIO DIGEST

H.J.M.

S-5

#### PARTS REQUIRED FOR CRYSTAL DETECTOR TUNING PANEL

- 1 Panel, 8"x10"x 1/4"
- 6 Binding posts
- No. 1—Crystal Detector with Galena Crystal
- No. 2—Single slide tuning coil
- No. 3—.001 Mfd. variable condenser
- No. 4—.001 Mfd. fixed phone condenser

The two binding posts on the left hand side are for the aerial and ground connections. The two posts on the top center of the panel are for the phone connections when the panel is used for a complete crystal detector unit. The two binding posts on the upper right hand side are to be used for connection to the vacuum tube detector panel when desired. Under these conditions the crystal detector should not be in use—that is to say the cat whisker should not rest on the crystal.

#### PARTS REQUIRED FOR LOOSE COUPLER TUNING PANEL

- 1 Panel, 8"x10"x 1/4"
- 4 Binding posts
- No. 1—Loose Coupler with slide contact on the primary coil and tapped switch on the secondary
- No. 2—.001 Mfd. variable condenser
- No. 3—.0005 Mfd. variable condenser

The two binding posts on the left hand side are for the aerial and ground connections. The slide controls the variation in the primary inductance. The primary condenser No. 2 controls the finer wave length adjustment. The tapped switch on the secondary of the loose coupler permits the adjustment for the secondary wave length by variation in the induction of the secondary coil. The variable condenser No. 3 controls the finer adjustment in the secondary circuit. The two binding posts in the upper right hand corner are for connection to the vacuum tube detector unit directly to the grid and the positive side of the filament battery.

#### QST NEWS FLASHES

**LONDON, ONT.**—Railway officials in this city are seriously considering the use of the Radiophone as an auxiliary dispatching utility, which might gradually be developed to supplant both telegraph and ordinary telephone dispatching. The advantages of Radio were brought to the attention of local railroad officials and divisional managers by a brakeman on a Grand Trunk local train running between London and Sarnia. The brakeman has installed a complete Radio outfit, both for sending and receiving messages, on the baggage-coach, and communicates with his family at home, and with his amateur

Radio friends in London and Sarnia without any difficulty while the train is traveling at a fast rate of speed.

**CHICAGO.**—Lawrence R. Schmitt, well-known as Radio inspector for the ninth district with officers here, has resigned to become Chicago manager of the Ship Owners Radio Service, Inc. He is to be succeeded by E. A. Beane, who will be installed July 17. Mr. Beane was formerly with the "ether cop" office of the first district at Boston.

**CINCINNATI, O.**—"Labor's Appeal to the American People," was the subject of an address delivered Tuesday night, June 20th, at WLW, the Crosley Manufacturing Company station here, by Samuel Gompers, president of the American Federation

of Labor. He declared that during his career as a leader of union labor he had addressed many large audiences, but believed the one he was talking to then was the largest that had ever heard him.

**SEYMOUR, IND.**—Radio fans in this city are finding much difficulty in using their sets to advantage while the large transmitting stations are in operation. The licensed transmitters have certain times for sending out various information and concerts and while this is being done fans who own receiving sets only are unable to tune out the large nearby transmitting sets. A meeting of owners of receiving and broadcasting sets has been called to make arrangements whereby both may find success.

**NEW YORK.**—Fire alarms by Radio may be an outcome of the rapid growth in the use of this method of transmission in New York City, according to a reporter of firemen's activities. The men in many of the firehouses have received permission from the department to install receiving sets at their own expense, and though up to the present these have been used for amusement only, the firemen are ready to respond to any call to duty which may reach them in this way.

**SEATTLE, WASH.**—The girth of the world is now one-tenth of a second, the time required for a wireless wave to make the circuit. It may soon be possible for an operator to speak as Columbus sailed, into the West and hear his own voice from the East.

# Questions and Answers

## Some Aspirations

(272) AJM

I have been a close reader of your paper and believe it fills a long felt want; the illustration and description of standard sets is well worth the price of your paper several times; you are to be congratulated on your innovation. I am taking you at your word. I am in the position of a man who intends to purchase an auto, and does not know the difference between a Ford and a Pierce Arrow; with one exception—I want an outfit that I can add to or change if I see fit, that will pick up anything from Denver to Mass. Some expectations I will admit.

I have not been able to pick up anything except KYW, this station comes in loud; in fact on most occasions we can hear distinctly 20 inches from the head phones. I have Cunningham detector and amplifiers, all-American transformers 10 to 1, 18 volts on the detector and 67½ volts on the amplifiers. While KYW comes in loud on most occasions there is a disagreeable rumbling somewhat like a phonograph; there is no squealing or howling, I have a Remler potentiometer connected across the "A" battery also a Remler grid leak and condenser; I have no phone condenser. I have a set of Brandie's phones.

I am enclosing a sketch of my house and vicinity; you will see that there are trees on all sides, at from fifty to a hundred feet away, some of which are higher than my present aerial; the present aerial is only temporary, and was erected only to try out my first outfit. I am ready to erect another, and had contemplated to erect one seventy-five feet high in place of the present forty-two foot one; would you advise one, two, three or four wires? I would not be adverse to using two aerials if same would justify the expense; i. e., one of a single wire and another of two or more wires; what do you advise? I have also built a Reinhart tuner as described in QST. I tried out same and KYW came in clear as a bell but not loud enough to hear unless I used the head phones; with the other outfit we lay the phones on the table, and can hear distinctly on most occasions twenty feet away, but there is more or less rumbling. I beg your pardon for a long drawn out letter, but as you invited me to tell you my troubles, I am taking you at your offer.

I have numerous books, papers, magazines, etc., but the more I read the less I know; in fact I don't know anything about Radio, and possibly am like a great many others, am grouping around in the dark. Please remember my aspirations; to have a future set that will pick up everything from the broadcasting stations, within reason.

A.—In the 10th issue we gave a diagram of a hook up for switching over from long to short wave-lengths with one step Radio-detector and three steps audio frequency amplification with telephone jacks for plugging in on different stages. It's a good one and would be just the thing for you. If necessary add another stage or two of Radio frequency. The rumbling you mention may be from poor plate batteries, poor connections or induction from an alternating current line. A phone condenser would help a little. Your aerial should be two wires, no more, space 4 feet apart. Two aerials wouldn't help unless you want to get the benefit of directional effect. For coil data on your tuner, see article in the 9th and 10th issues of the RADIO DIGEST.

## Grebe Set

(273) WRT

I should appreciate very much to have some questions answered regarding receiving apparatus.

1. I have a Grebe CR8 receiver. It, at times, produces a very sharp clicking sound as if a connection in the battery circuit were broken and made quickly. Can you suggest what it is?

2. Does it make any difference whether the lead from the secondary to the filament is connected to the positive or negative side of the "A" battery?

3. Does a counterpoise give good results with a spark transmitter?

A.—1. Check over all your connections—see that the condenser plates don't touch at some places. Your grid-leak may have too high a resistance. Does your tube make good contact on all four terminals?

2. Connect it to the negative side.

3. Yes.

## Amplification

(281) FWL

Here is a bunch of questions to answer if you will be so kind.

A. Which is more efficient—the variocoupler or honeycombs?

B. Does it make any difference which terminals of the primary of an amplifying transformer are connected to the input or which of the secondary terminals go to grid and negative "A" battery?

C. When using R. F. amplification is selectivity so greatly increased as to make tuning different?

D. What is the purpose of the stopping condenser?

E. Is it practical to use the low voltage of a step down transformer on the exciting coil of a Magnavox?

F. I have a Rectigon charger. How much acid should I add to my storage battery, if any, when charging?

G. Do you think the iron ore deposits here interfere with reception?

H. How many watts are required to send CW telegraphy 500 miles?

A.—A. Variocoupler for short wave lengths. Honeycomb for long wave lengths.

B. No.

C. No. R. F. amplifying transformers, however, work best within a certain range of wave lengths, depending on design.

D. Depends on where used. Usually to collect small charges for simultaneous discharge.

E. Yes, if rectified after stepping down.

F. Don't add any! Distilled water enough to cover the plates.

G. To a certain extent, yes.

H. 20.

## 500-Mile Range

(287) ACD

Please tell me what I would need for a vacuum tube receiving set that would enable me to hear music and lectures for about five hundred miles away, allowing for a mountainous country. What kind of wire would be best for an aerial?

A.—You would need a short wave regenerative set, two steps of Radio frequency amplification, and detector. Copper wire is the best for an aerial, No. 14 gauge stranded.

## Honeycomb Coils

(297) HR

1. I have been reading your RADIO DIGEST magazine for some time and would like to ask some things about the honeycomb coil set. I have a honeycomb

set which uses one coil for different wave lengths and use a vacuum tube. The number 35 coils will get 485 meters as clear and loud as any set. But when I use it for 360 meters I can only hear just plain enough to tell what they say. The number 50 coil is the same. Should get a number 25 or 75 coil for 350 meters?

2. I am using a fifty feet two wire aerial. Should I have four wires or one single wire for 360 meters?

A.—1. Try a 25 coil for 360 meter stations.

2. Your aerial is O. K.

## Loop Aerial

(311) HBL

Will you please advise as to the following:

1. Can a loop aerial be used for long distance receiving?

2. What kind of receiving outfit (including aerial) would you recommend for Radiophone reception here?

A.—1. Yes, if loop is big enough.

2. A short wave regenerative set using a detector and at least two stages of amplification. Aerial should be outdoors if possible, 50 ft. high and about 150 ft. long including the lead-in ground wire.

## Lightning Rods

(318) JCC

Please answer the following questions:

1. Have an aerial of 2 wires 100 feet long well insulated on my roof but have lightning rods on house. Will this make any difference in the operation of the aerial?

2. Will these wires make a good ground for the set? There are four grounds with about 12 feet of the rod wire in moist ground.

3. About 400 feet away from my aerial are some power lines carrying 2,200 volts. Will this affect my aerial?

A.—1. No, not noticeably.

2. Yes, excellent.

3. Not if your aerial is at right angles to the wires.

## Receptions

(453) CPS

Will you please tell us who WAAF is, location and schedule? We received this station very plainly May 13th, 10:30 P. M., at Macatawa Park, Michigan.

We also say you have the best Radio publication on the market at the present time, and wish you all kind of good luck in your undertaking.

A.—Chicago, Ill., Union Stock Yards, 250 miles. No regular schedule.

## Dry Cells on Phone

(684) EDF

How many 1½-volt dry cells will the 3,000 resistance phones carry with safety?

A.—Don't quite understand what your idea is. Do you mean how many dry cells in the plate circuit of the vacuum tube to receiving set? If so, 70 can be used, making a total of 105 volts.

## AERIAL WIRE

FOR SALE—17,500 ft. 7x22 Tinned Stranded Copper Wire; all new stock. While the stock lasts, will sell at the following prices: 75c per hundred feet in less than 500 ft. lots; in lots of 500 ft. or more, 70c per hundred feet. Will cut to any length desired. Send your order at once, and take advantage of this bargain. Prompt service. Address Box 2, care Radio Digest.

# RADIO SALES & SERVICE CORPORATION

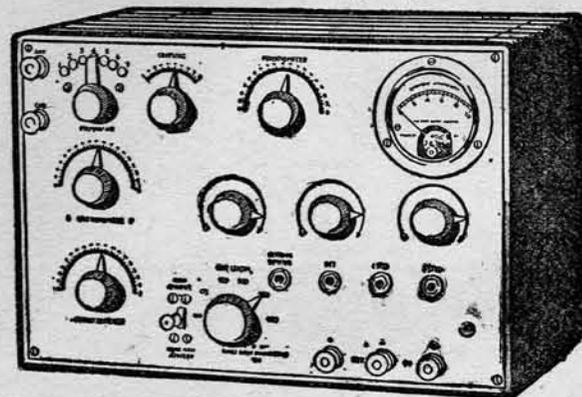
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Automatic filament control. Provision for Detector Tube.
7. DIAMOND-LATTICE VARIOMETER ..\$8.00
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Diamond-Lattice superior to any other types of variometers available. New application of radio inductance. Minimum interturn capacity. Extremely sensitive. A wonder-working device.

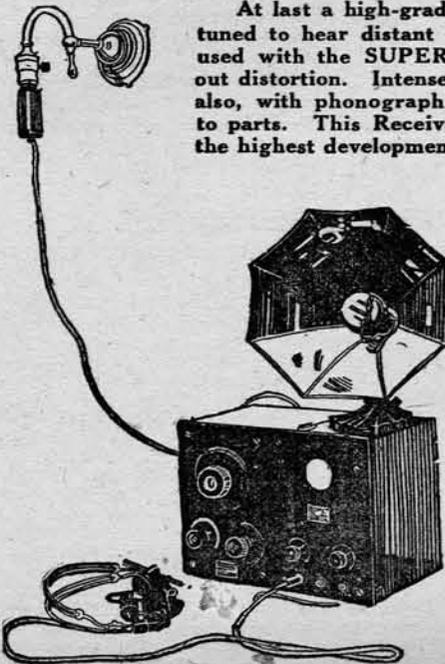


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9. HILL VARIABLE CONDENSER .....\$2.00  
Highest insulation resistance. Fine adjustment, wide range.
10. A GENERAL LINE OF STANDARD HIGH-GRADE RADIO APPLIANCES.

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At last a high-grade perfected functioning three stage Radio Frequency Receiver. Easily tuned to hear distant points such as Newark and Schenectady. Wonderful results when used with the SUPER ANTENNA. Perfect modulation of music, speech, or signals without distortion. Intense selectivity. This set is furnished in beautiful black walnut cabinet, also, with phonograph cabinet and equipment; hinged top permits view of interior and access to parts. This Receiver is undoubtedly six months ahead of anything on the market and the highest development of the art.



Order Your

*Super Antenna*  
—TRADE MARK—

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NOW

Just use nearest lamp socket; no outside antenna necessary for your receiving set. Listen to the broadcasting from any room in the house. It is foolproof, fireproof and shockproof. This is the original unit designed by the country's foremost engineers. Results are equal or better than the outside antenna. Use it with your Westing- house or any other set. Price.....\$2.80

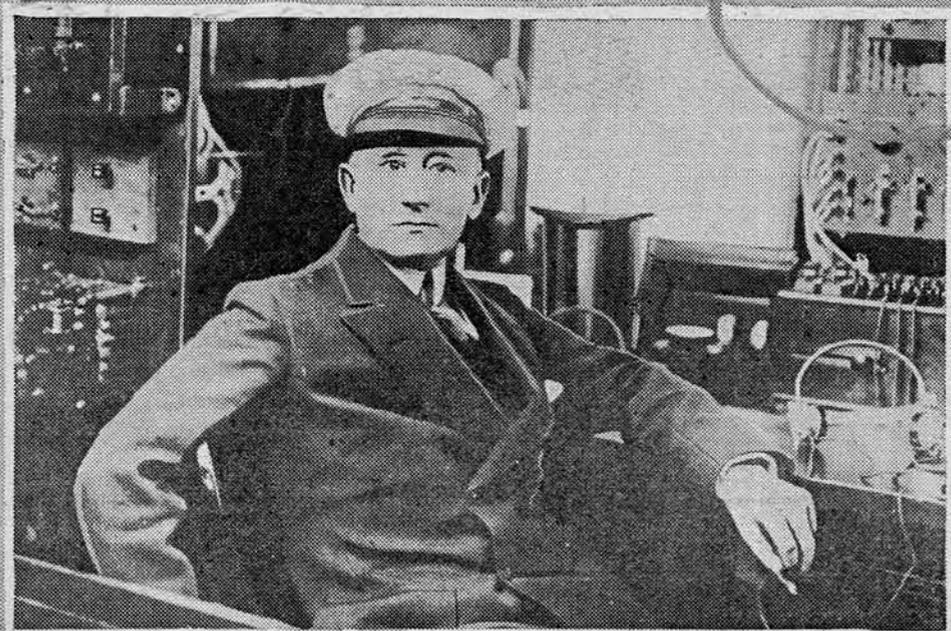


# Radio Illustrated

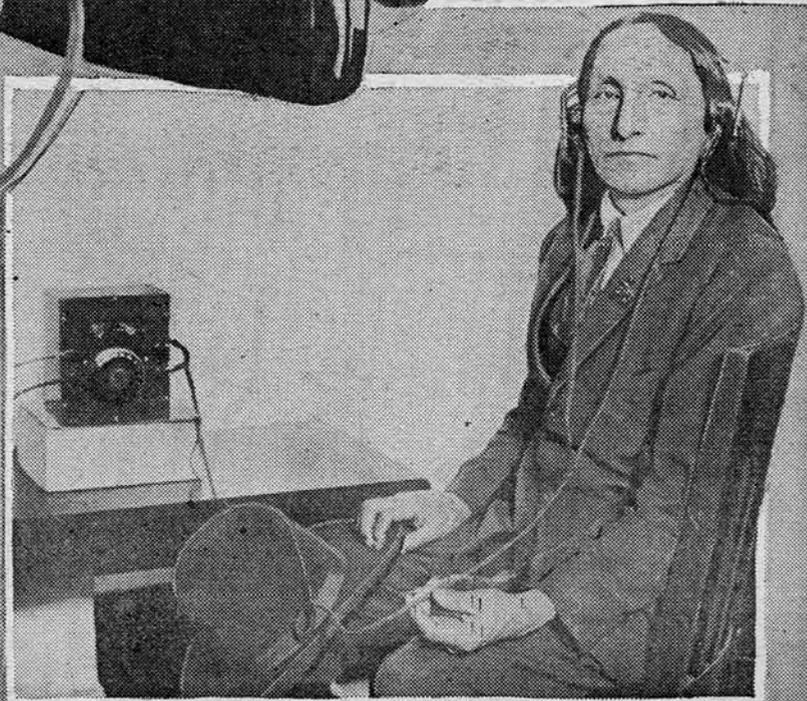


One of the loud speaking horns used in conveying messages from New York and San Francisco to the employees of the Western Electric Company at Chicago. The lady, Miss Alice Cernak, is eating her lunch in the bell of the horn, which shows the approximate size  
© U. & U.

Radio has become so popular that parents give their children sets for birthday presents. The picture in the center shows Miss Rita Rogan, who seems to be well pleased with her birthday present  
© INT.



To keep up with his experiments Marconi has installed an elaborate laboratory in his yacht "Elettra." He has denied rumors of his attempting communication with Mars.  
© K. & H.



This is quite different in receiving messages than in the old days when the Indians used smoke and fire. Charging Hawk "listening in" on a Radio set  
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