

RADIO AGE

The Magazine of the Hour

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Station XMAS

DECEMBER 1923



IN THIS NUMBER

Building the Haynes Receiver

By Frank D. Pearne

How to Make a Combined Amplifier and Loud-Speaker

By Carl Masson

Learning the Code

(Second Article)

By Felix Anderson

What the Broadcasters Are Doing

Complete Corrected List of Broadcasting Stations

More Good Circuits



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RADIO AGE

The Magazine of the Hour

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Volume 2

DECEMBER 1923

Number 11

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Junior Heterodyne

ONE of the best writers on radio subjects has prepared an article for our January issue which is entitled, "The Junior Heterodyne." It will be illustrated with some of those drawings which have won this magazine a great following and which have induced some other periodicals to try to emulate us. More power to you, brothers, it is all for the good of radio.

We shall also offer an interesting article on simple experiments in radio control. Something that will appeal to the inventive reader.

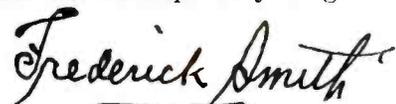
In this issue we are publishing a newly revised list of broadcasting stations with the wave lengths. This is a new list, received just before going to press, and was obtained from the United States Department of Commerce. This list is as complete and correct in every detail as can be obtained and we believe it will justify the expense and labor devoted to it. Please remember that it is not the list "authorized last August" but this week's—today's—roll of broadcast stations.

If you want to have the next issue of RADIO AGE sent to you free, or if you want one number added to your subscription period, find an error in the list and tell us about it. We want you to kick about it, if you find something to kick about. That applies to every department of the magazine.

May we modestly call your attention once more to the quality of the draftsmanship devoted to producing your isometric diagrams? A new artist in this line joins our staff in the next issue.

If it appears in RADIO AGE, it is *original* and it is *dependable*.

Let our hookups be your guide.



—Editor, RADIO AGE.



Radio was the chief element in electing Senorita Carmen Fernandez Ramos, the most beautiful girl in Cuba. The campaign conducted by Radio was heard in both the United States and Canada. Story on page 31.

RADIO AGE

"The Magazine of the Hour"

M. B. SMITH
PUBLISHER

PUBLISHED MONTHLY

FREDERICK SMITH
EDITOR

A Two-Step Amplifier and Loud Speaker Combined

By Carl Masson

Illustrated by Felix Anderson

EVER since broadcasting stations have been in operation, radio has been the ideal source of entertainment in many a family circle. The broadcast programs for this winter promise to be unusually interesting and to get the full pleasure of them, a two-step amplifier and a loud talker would be a worth while addition to any single tube outfit. The author describes herewith a combination of the two, which the average radio man can construct at home with a few tools, plus a little work.

The cabinet is the first thing to consider. This may be made of most any kind of wood about three-eighths inch in thickness. I have found that for some reason or other amateurs very rarely work to given dimensions, and therefore I have decided to omit them, leaving them to the constructor's own judgment according to various conditions. I would suggest as overall dimensions, 16 inches in height, 12 inches in width, and 12 inches from front to back.

Tin Horns

After the cabinet has been assembled, the loud speaker comes next in consideration. In spite of the failure demonstrated by the application of the tin horn to the phonograph, some manufacturers of loud speakers still use tin for their horns. Tin horns yield tinny sounds. As

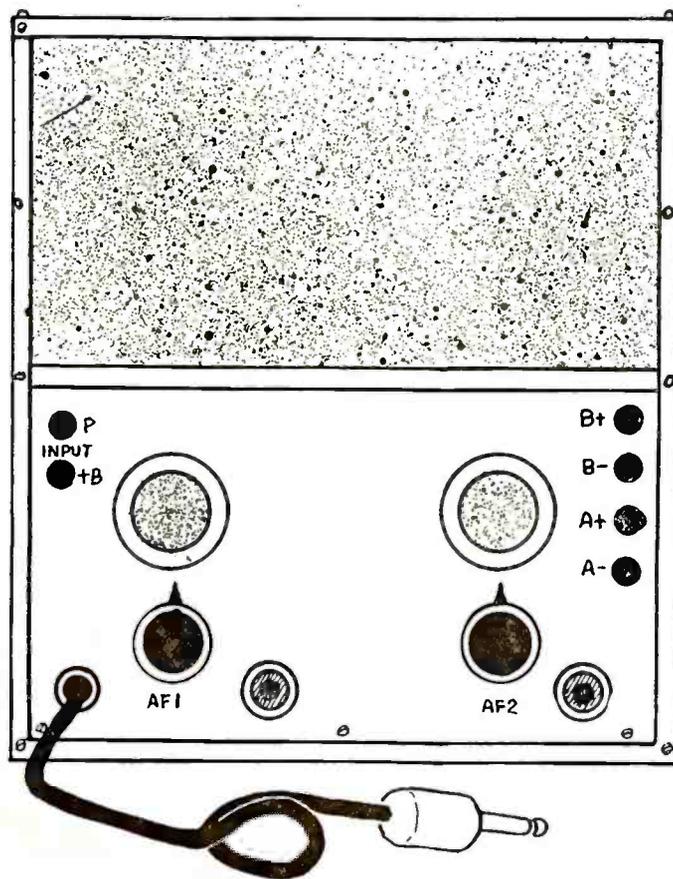


Figure 1. This is the front panel view of the neat-appearing, loud speaker and two-stage amplifier, described by Mr. Masson.

one manufacturer has put it: "Would you make a violin out of tin?" What a big difference the wood horn made in the phonograph! The wooden horn also makes an equal difference in radio, because of the rich, mellow and undistorted tone derived from it.

The loud speaker occupies the upper half of the cabinet, as shown in the drawings. It should be made of some kind of hardwood so as to get clear, true tones. It consists

of four pieces of wood, shaped as shown in the drawings. The size depends upon the dimensions of the cabinet, and the entire horn should be about two inches less in length. Make all joints fit exactly, finish the inside smoothly, and use screws and glue in assembling the parts. The end for the phone should be about one and one-half inches square. The drawing shows the position of the horn in the cabinet. The bottom is purposely horizontal so that the sound will pass direct into the ears of the listener. A piece of fine screening stretched over the front of the horn adds neatness to the cabinet, and a frame over this with screws, as shown, support the horn.

Fitting the Phone

A loud speaker unit phone on which has been placed a soft rubber ear-cap, is wedged at the end of the horn as shown. Tighten the wedges as much as possible to make sure that the phone fits snugly. A phone of the mica diaphragm type serves very well in such a loud speaker. The phone cord is connected to a plug and passes through the front of the panel as shown.

Now comes the amplifier, which occupies the lower part of the cabinet. The panel is of bakelite or any other good insulating material. The layout is as shown in the

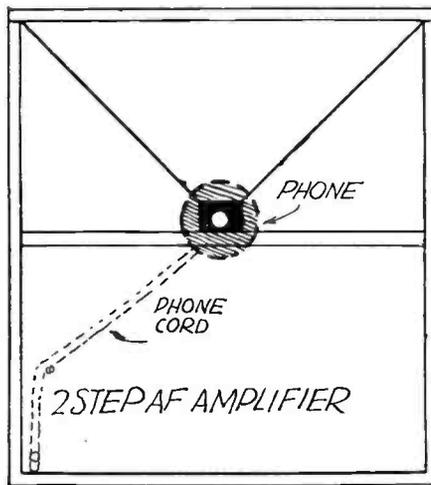


Figure 3. The front view with panel and screen removed showing how the speaker tapers down to the phone. The phone cord from the single phone unit is led down the inside back of the cabinet and across the bottom of the cabinet, out through a hole provided in the panel for it. The plug shown in Figure 1 can be inserted into either the first or second stage of amplification.

drawing on page 12. Binding posts are provided for A and B batteries and also for the input. There is one jack of the double circuit type, and one of the single circuit type. Of course, the transformers are of the audio frequency type and the tubes are of the amplifying type. Solder all connections and avoid parallel wiring whenever possible. A coat of stain completes the amplifier.

Connect the phone binding posts of your set to the input binding posts of the amplifier. Plug your phones into the first jack, and tune in to the desired station. When you have it reasonably clear light the filament of the second amplifying tube, and plug in the loud speaker to the second stage. Thus the entire family can enjoy the wondrous programs which broadcasters so kindly provide at great expense, and which all was made possible by the radio engineers and

the scientists of the world who labored years to put radio where it is today.

First Radio Home

Radio is fast becoming indispensable as a household service, not unlike permanent features such as light, power and heat. Radio receiving sets are now considered by architects as fixtures, and the details of wiring, battery space and antenna installation are being written into specifications.

One of the first radio homes—that is, with facilities for radio built into the house—is that of L. E. Whittemore, Secretary of the Governmental Inter-Department Radio Advisory Committee. Before construction was begun, Mr. Whittemore explained his radio requirements to the architect, who included in the plans all radio facilities required by this engineer and enthusiast.

A nonmetallic conduit pierces the study wall for a lead-in wire; another goes below to a special space in the cellar reserved for the batteries, while a third is for the ground lead. Another piece of conduit pipe will carry leads from the set to a floor or wall socket in the living room, where a loud speaker may be installed if desired.

Besides fixtures for erecting an aerial on the house top, the owner plans to install two 'single, vertical loops in the north and west wall spaces of his study, the wires terminating in special sockets for an antenna plug connected with his set. This feature will give him certain directional selectivity, as he can use, at will, the loop facing east and west or one at ninety degrees to it.

How Many Sets?

The question: "How many radio receiving sets are there in the United States?" may soon be answered, if a scheme under consideration by officials of the Department of Commerce works out satisfactorily.

As an experiment, the radio section of the Bureau of Navigation permitted the two local Class B broadcasters in Washington (WCAP and WRC) to request all residents of the District of Columbia who have receiving sets to

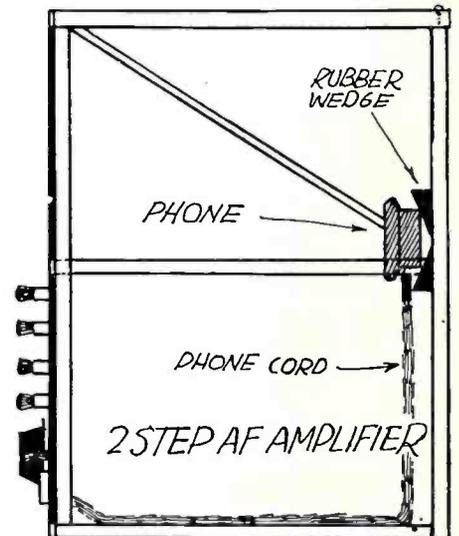


Figure 2. The sideview of the amplifier loud speaker reveals the method of wedging the phone of the mica diaphragm type to the lone arm of the loud speaker.

report to the Department of Commerce by dropping a postal card. This self-taken census will give an accurate return, it is believed, as well as save the government considerable time and money by eliminating the need for enumerators.

Those possessing receiving sets have a certain pride therein, it is said, which should hasten the reports. The radio section will classify and enumerate the cards, but that will be enough, it is pointed out, considering that no added personnel is available.

If the test radio census of the district proves accurate, the plan will be extended through all the states, in an effort to learn just how many sets there are in operation and what percentage are tube and crystal sets.

The latest authoritative estimate as to the number of receiving sets in this country on June 1, 1923, was 2,250,000, but it is not exact and is not official. Later predictions state that by June 1, 1924, a million more sets will be in use, making the total three and a half millions.

Results of the first day's mail following the broadcast of the census announcement brought the department forty-six postals.

The sole purpose of the census is to ascertain the number of receiving sets in the country and to gain an idea of the popularity, value and extent of broadcasting. There is no intention to levy a tax on receiving sets, as is done abroad, officials declare.

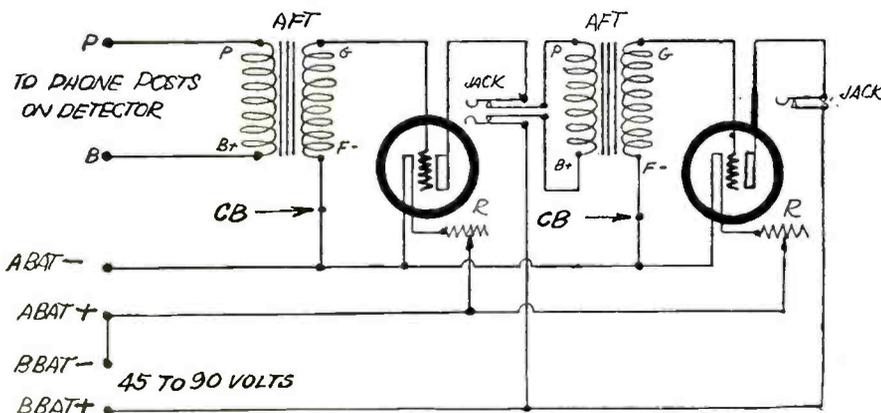


Figure 4. This shows the circuit diagram of the two stage amplifier used in the combination loud speaker amplifier. If WD 11 or other small, dry-cell type tubes are used, a C battery of one and one-half to three volts should be inserted at the point marked CB, with the negative side of the battery going to the transformers.

If your newsdealer has sold out his supply of RADIO AGE you are likely to miss just the hook-up that you have been looking for. To avoid any such chance fill out the coupon in this issue and send in your subscription. Then you will be safe. And don't forget that with each subscription at the special price of \$2.00 a year, or \$1.00 for six months, we send you free the popular Reinartz Radio booklet FREE. Address Radio Age, 500 N. Dearborn Street, Chicago, Ill.

Building the Haynes DX Receiver

By FRANK D. PEARNE

A GREAT deal of interest is being shown in the new Haynes DX receiver, and as many of our readers are looking for information regarding it, an explanation and description at this time is opportune. This circuit is the result of several years development on the part of A. J. Haynes, of New York City, who started out to make up a good arrangement combining all the well-known advantages of the different types of tuners in a simple way.

Adding to it gradually, eliminating unnecessary apparatus from time to time, he finally gives to the public a circuit which is extremely simple of operation even in the hands of a novice, but which still has all the desirable characteristics of the more complicated sets in use today.

As an example of what may be expected from such a receiver, Mr. Haynes says that when using a single wire aerial approximately thirty-five feet high and one hundred twenty-five feet long, located in a suburb of New York, stations in St. Louis, Chicago, Louisville,

Fort Worth, Minneapolis and Havana, Cuba, were all heard in one evening. This certainly is a record for such a simple contrivance. Nothing of any importance to good selective tuning has been omitted and still a casual glance at the drawing gives one the impression that there is nothing to it.

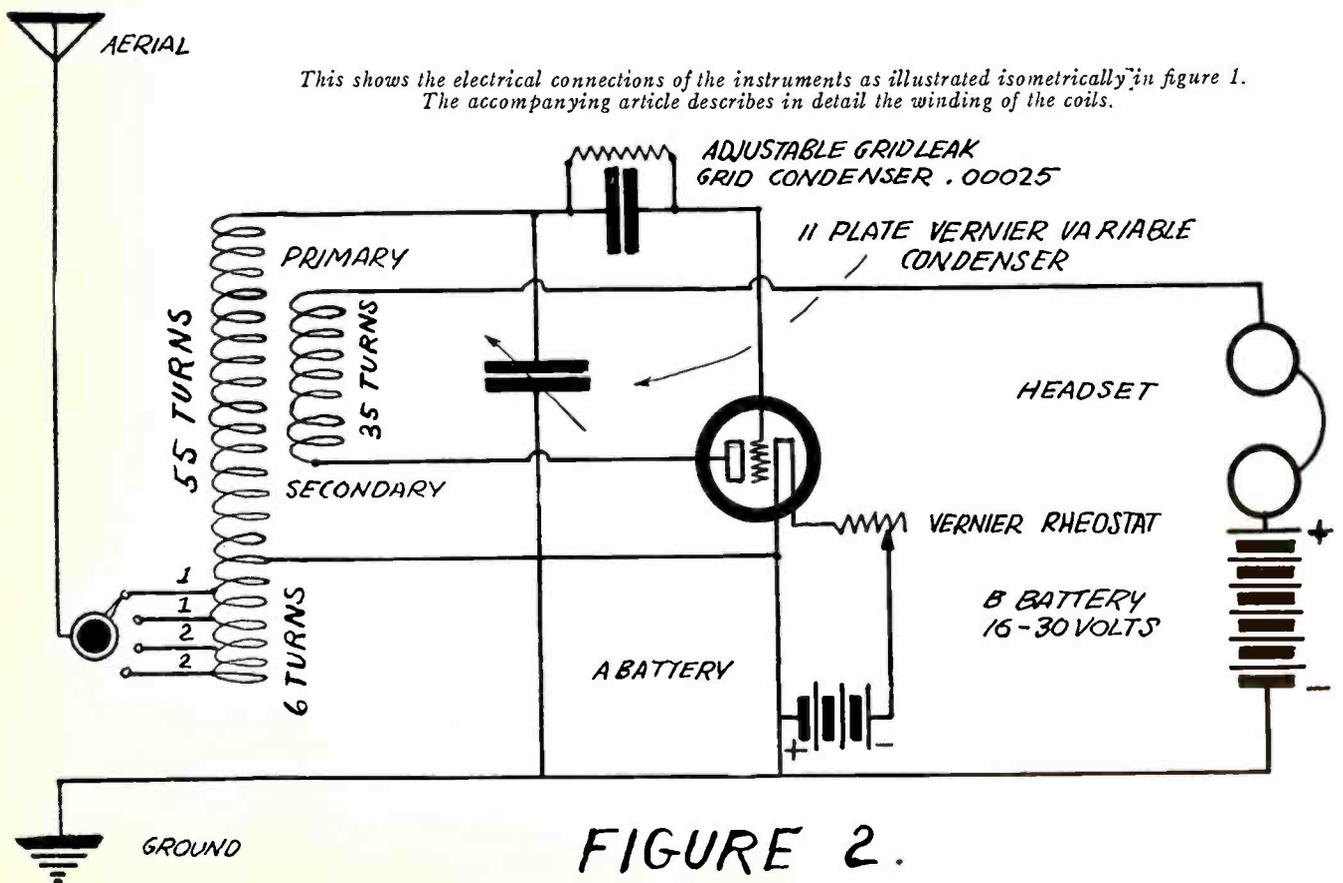
Carefully studying the circuit, one is reminded of the well-known Reinartz hookup, but in this case the plate circuit inductance is not adjusted by means of a switch lever cutting in more or less turns, but in this case the more accurate and closer tuning tickler coil is employed. Also the step-up ratio between the primary and secondary coils is considerably higher than that of the Reinartz. The primary and secondary combined, act as an auto transformer with the variable condenser bridged across the secondary, which makes a separate oscillating circuit of the part used as the secondary, which gives a very powerful impulse to the grid of the tube.

The entire inductance is made

in the form of a bank-wound variocoupler, giving the appearance of the well-known single circuit tuner so far as the adjusting controls are concerned. One can almost trace the gradual development of this circuit by giving it a little thought and to those familiar with the standard circuits of today, it is an easy matter to see that only the best of each of them has been used in this arrangement. Figure 1 is the general panel layout showing the approximate location of the parts. No baseboard is necessary if a panel mounting type of socket is used.

The Variocoupler

The variocoupler used by Mr. Haynes is of the 180 degree type and is bank-wound. Just why this bank winding is used, he does not explain, but probably it is necessary to get the required number of turns on the primary winding. Bank-wound coils are, as a rule, only used for purely mechanical reasons, such as space considerations, etc. They produce large values of inductance with very small coils and are gen-



erally used for long wave reception. The 180 degree couplers, without any winding on them, can be procured at most any radio supply store and the builder is advised to secure one of these and do his own winding.

As the signals are received at radio frequency and these high frequency currents travel on the outside of the wire, it is necessary to use wire as large as possible and still be able to get the required number of turns on the tube. It should not be smaller than No. 20. Figure 3 shows the method of winding the bank-wound coil.

Two holes are punched in the tube at "A" and "B" to serve as an anchor for the end of the coil. The end is put down through hole "B" and brought up through "A," leaving the end of the wire long enough to make the final connections after the winding is complete. The first and second turns are wound side by side and the third turn is wound on top of these, in such a way that it lays in the groove formed between 1 and 2. At the completion of the third turn, the wire is again brought down to the tube and the fourth turn is wound next to turn 2. The fifth turn is then wound on top and in the groove formed between turns 2 and 4, etc. After winding 55 turns, a tap is brought out to be connected to the ground when the set is wired. Put on the 56th turn and bring out another tap; also a tap is brought out from the 57th turn. After this, wind 4 more turns, bringing out a tap every 2 turns. Thus the primary coil is tapped at the 55th, 56th, 57th, 59th and 61st

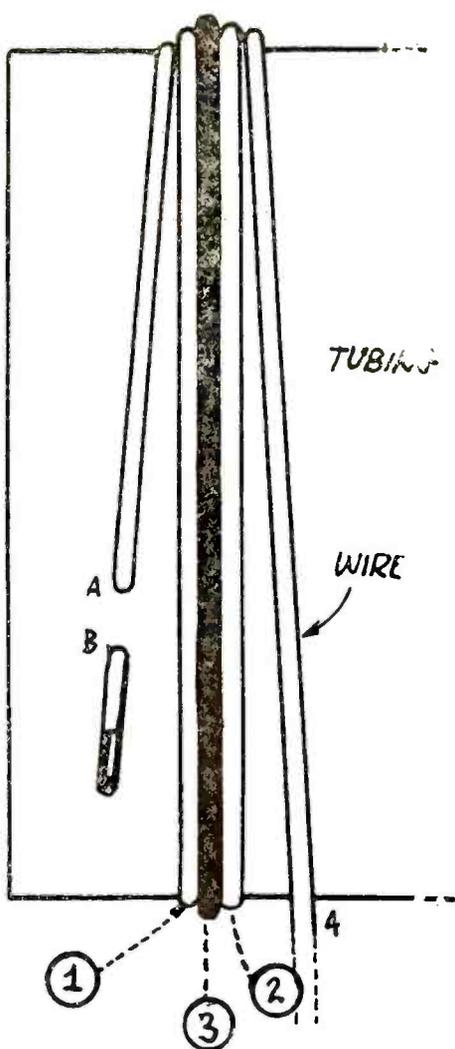


Figure 3. This illustrates the winding of the bank-wound variocoupler primary of the DX receiver. Two holes are punched at A and B and the first turn is put on as shown at 1. The second is wound immediately alongside of 1, and the third shown at 3 is wound on top of these two in the groove formed by the wires 1 and 2. The fourth turn is wound alongside the second, and fifth is wound in the groove made by 2 and 4.

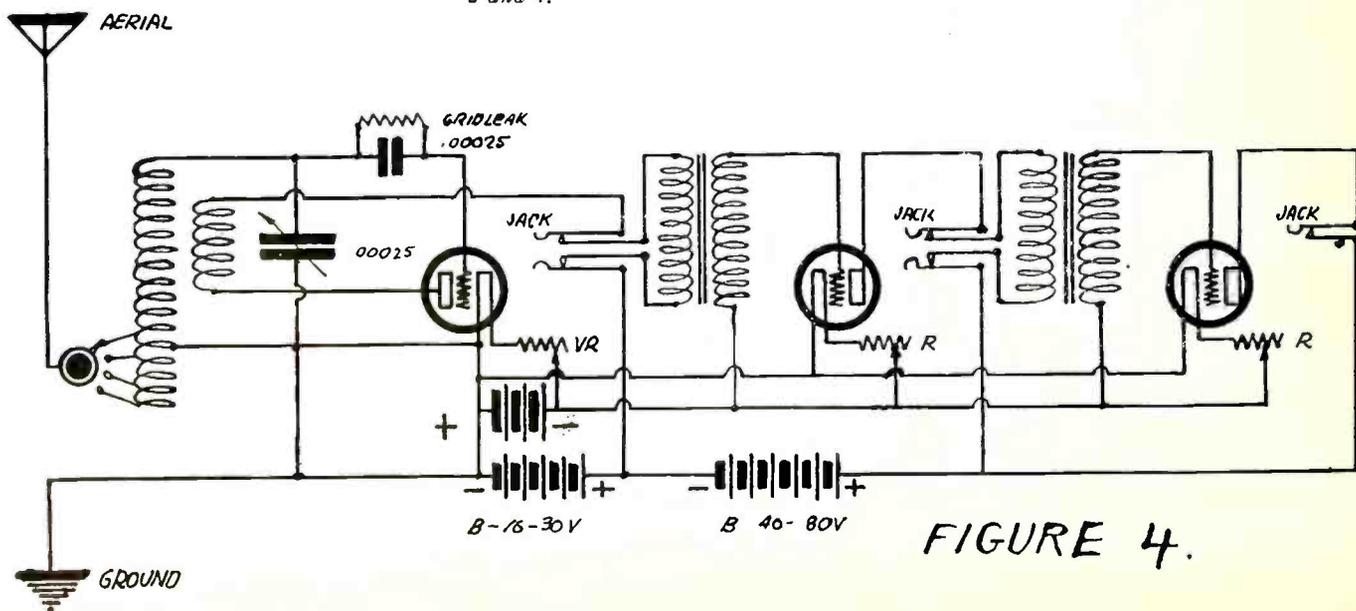
turns. However, the 61st turn will not be a tap, but will be the end of the coil. This completes the winding of the primary and secondary.

The rotor is wound with 35 turns of wire. The exact size of this wire cannot be given, as the winding space on these different types of couplers will vary to some extent. If it is found that there is plenty of room, use No. 18 wire, but nothing smaller than No. 20 should be used. This part of the apparatus used is the only part which differs from the standard apparatus used in any ordinary receiving set.

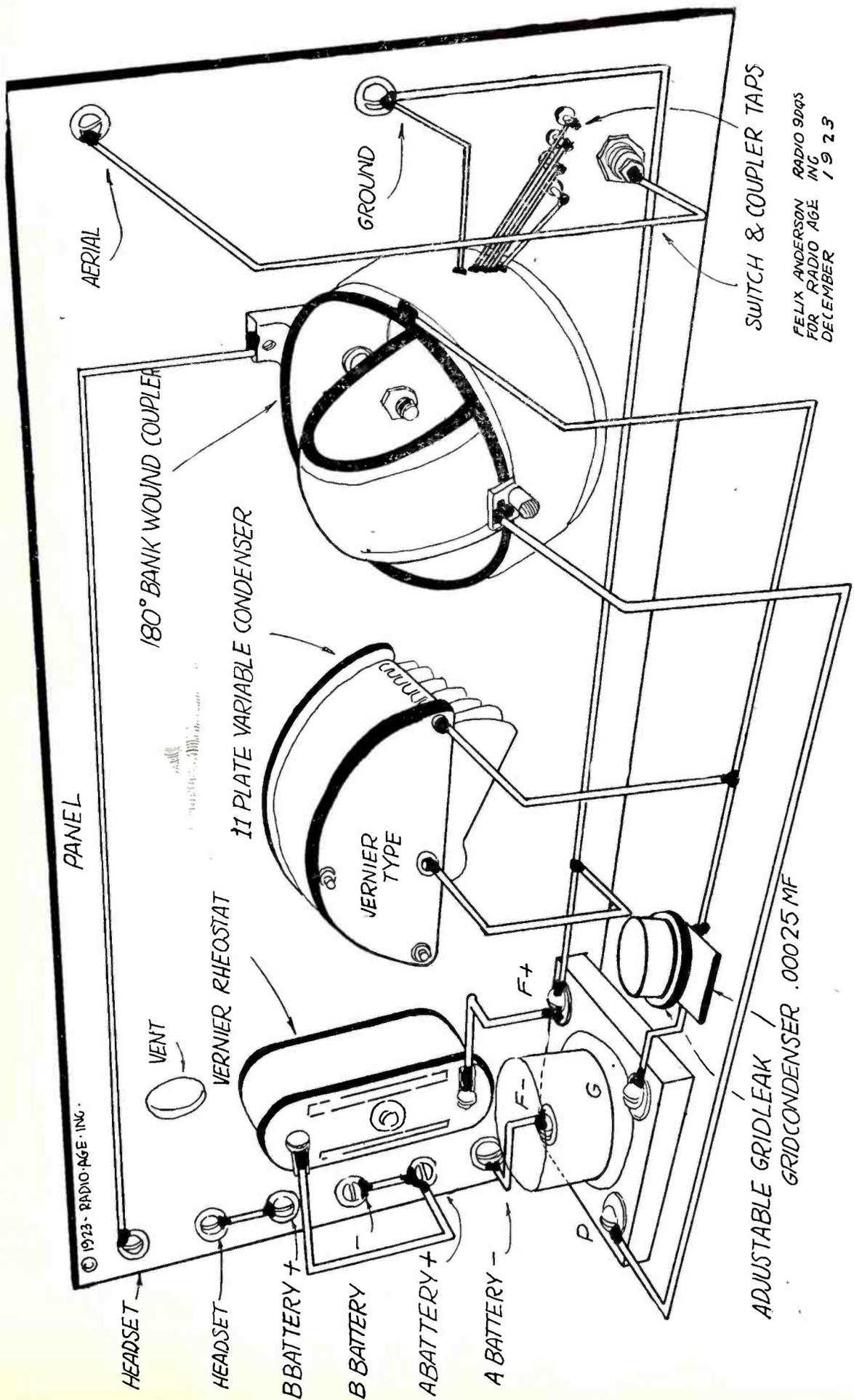
The condenser should be an 11-plate variable, vernier condenser and should be the best that can be obtained. Remember, that this set is a combination of all the good parts of several different types and to get the maximum results, the best of apparatus should be used. The grid condenser should have a capacity of .00025 M. F. and must be of the mica insulated type. For the grid leak it is suggested that a variable be used, because of the different characteristics of the detector tubes which may be employed.

This is more important than one might think, as every time a tube is replaced, it will be found necessary to adjust the leak to that particular tube. Of course some results will be obtained with a fixed grid leak, but if one wants the best reception possible, this resistance should be variable. To get the greatest volume, the detector tube should be either a UV-200, or a C-300, but a WD-11 or WD-12 may be used in case one does not care to use a storage

(Continued on page 41)



HAYNES RECEIVER AT A GLANCE



FELIX ANDERSON RADIO 9095 FOR RADIO AGE INC DECEMBER 1923

FIGURE-1

Principle of the Crystal Detector

THE crystal detectors are the simplest of all radio detectors used at the present time. Unlike the vacuum tube, it does not in most cases require a local battery for its operation and the initial cost is practically the last cost, says Beverly B. Dudley, Chicago member of the American Radio Relay League. The crystals are inexpensive, easily obtained, and can easily be replaced with little trouble, should the old ones become inoperative or dirty. Their disadvantages are threefold. They are critical to adjust; they are not as sensitive as vacuum tubes; and thirdly, they cannot be made to oscillate for the reception of amateur continuous wave signals.

The Contact Point

Essentially the crystal detector, sometimes known as a mineral detector, consists of a crystal upon which a contact of copper or steel wire is made. It is this contact that permits the reception of signals, inasmuch as this contact is a rectifier of the radio frequency currents. Crystal detectors consist, in the commercial form, of a base, a metal cup in which the crystal is mounted, a wire contact, known as the cat whisker, a holder for the wire, and binding posts for convenient connections. The crystals used most commonly at the present are: galena, radiocite, silicon, carborundum, and bornite, in the order named. The first two require a light copper or phosphor bronze contact, while the rest

work better with a heavier steel, needle-point contact.

The radio frequency energy in the receiving set, before it reaches the detector, is a weak, alternating current, similar to the house lighting current, but where the house lighting current alternates its polarity 120 times per second, this radio frequency current alternates its polarity 1,000,000 times (or more) per second: i. e., where the house lighting current has a frequency of sixty cycles, the radio frequency currents have a frequency of 500,000 cycles per second.

Current Reverses

A current of this frequency cannot be heard for several reasons. When one of the groups of alternations acts on the telephone receiver, it causes no motion of the diaphragm, because each variation of the current in one direction is followed by the current flowing in the opposite direction, so that the telephone diaphragm has not enough time to start moving and resulting effect is no motion at all. Something that allows the current to flow through it in one direction and stops the current from flowing in the opposite direction is needed in the circuit, to actuate the diaphragm. The detector does this.

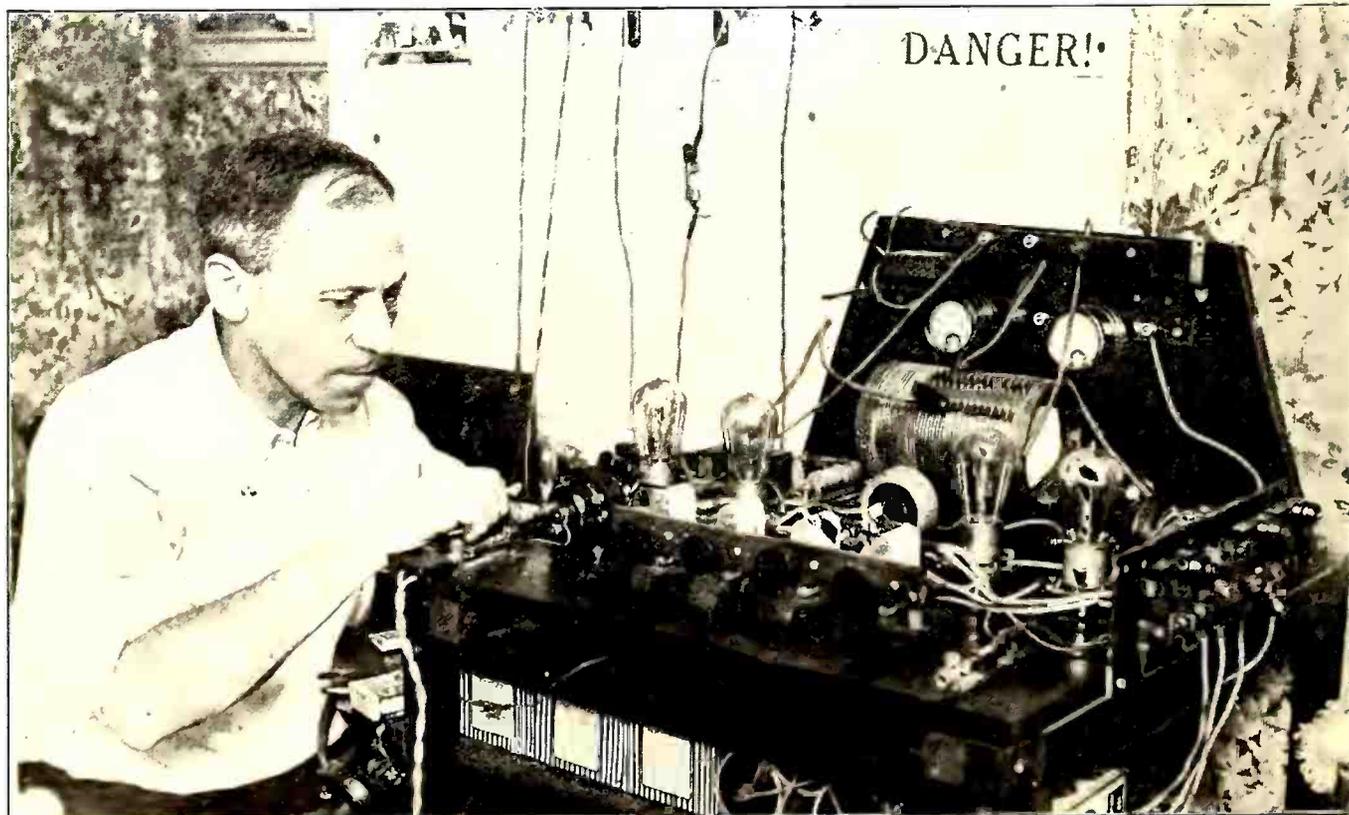
At the contact between the crystal and the cat whisker, current can flow through in one direction, but not in the other. Such oscillations pass through the detector, which suppresses half of

these oscillations. This current is still vibrating much too fast for the telephone diaphragm to follow, but the successive impulses of current flow through the telephone receiver, and the impulses in any one group are all in the same direction so that their effects add and produce a motion of the diaphragm. The motion of this diaphragm causes sound waves which vary in pitch and intensity according to the rectified current passing through the windings of the receiver.

Hayes to Seattle

The Department of Commerce has designated Harold D. Hayes, of San Francisco, as assistant radio inspector to succeed Louis E. Richwien, of the Seattle office, who died recently. Mr. Richwien, who was transferred from Baltimore in 1922, served until recently at the headquarters of the Seventh District at Seattle, as assistant to Supervisor of Radio, O. R. Redfern.

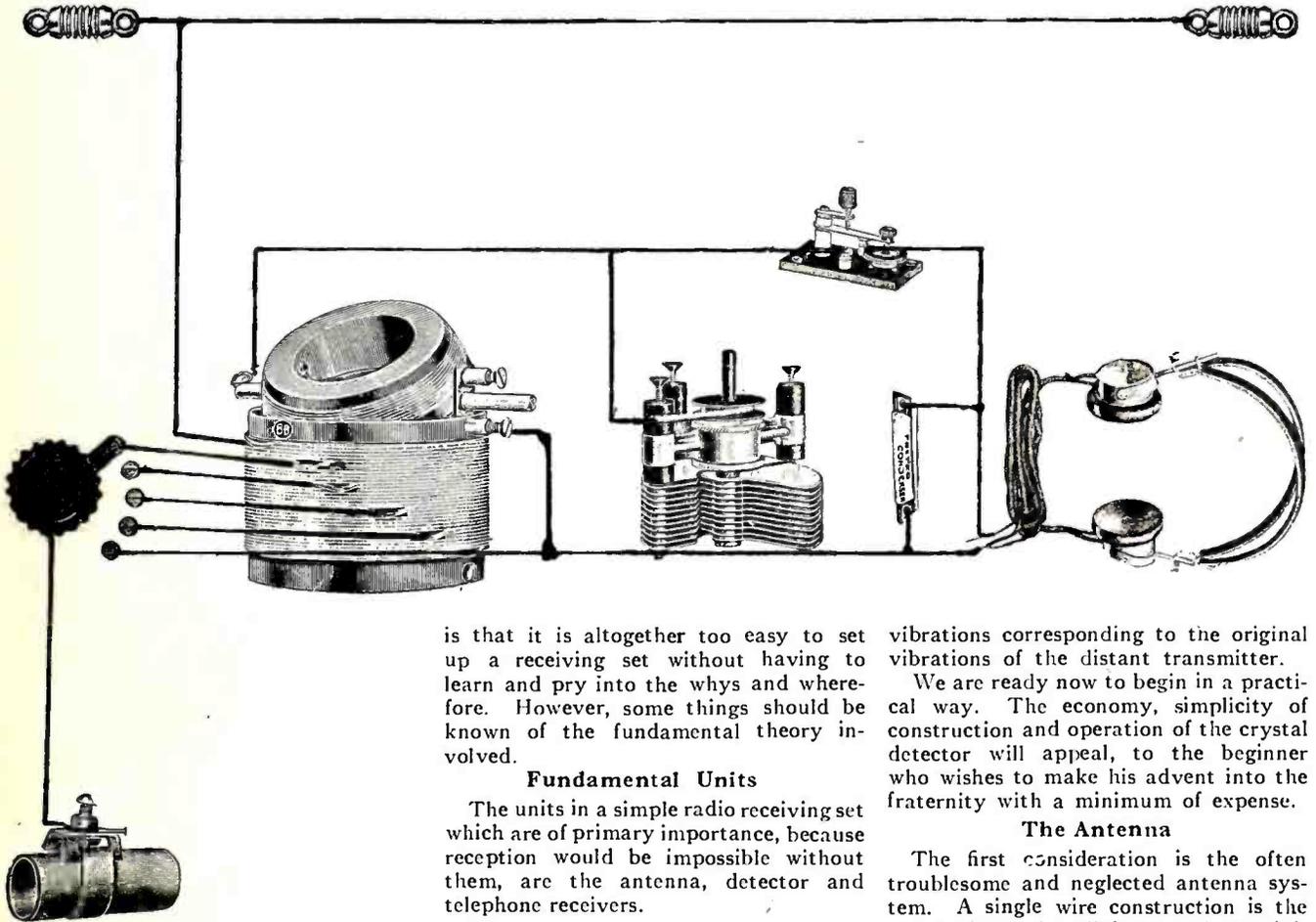
Temporarily, Mr. Hayes is serving as an assistant inspector at San Francisco, but he will shortly go to Seattle. Inspector Hayes is well-known in California, having founded the Y. M. C. A. Radio School in Los Angeles in 1912, one of the first radio schools to be established. 1917 he joined the Naval Reserve and served until after the Armistice as a lieutenant in the United States navy.



Leo Johnson, popular radio amateur, snapped as he was busy in his station, 2CTQ, Bronx, N. Y. Mr. Johnson's home is visited daily by many fans who want his expert advice. The transmitter covers long distances, largely due to its excellent construction. (Kadel & Herbert.)

A Selective Type of Receiver Employing a Crystal Detector

By J. A. Callanan



is that it is altogether too easy to set up a receiving set without having to learn and pry into the whys and wherefore. However, some things should be known of the fundamental theory involved.

Fundamental Units

The units in a simple radio receiving set which are of primary importance, because reception would be impossible without them, are the antenna, detector and telephone receivers.

That you may understand a little about the operation you must know that the human ear is able only to respond to a rate of ten thousand vibrations (waves) per second, and that as radio vibrations are many times more frequent the ear could not of itself hear the signals carried. There is, therefore, the necessity to break up their speed.

The antenna acts as a sort of collector against which the advancing vibrations crash, inducing in it a feeble voltage which maintains an electric current of high frequency. This circuit which is induced in the antenna overflows to the detector circuit where it is rectified.

Here we note that the function of the detector is to rectify these high frequency vibrations to permit of the electrical current flowing in one direction only. All forms of detectors operate on this principle. That is to say, they change the alternating nature of received vibrations to a pulsating, direct current. We see then, as a matter of fact, that the detector in spite of its name does not really detect the signals transmitted but merely alters the form of vibration. Rectified current is stored in a fixed condenser. As soon as this condenser has accumulated the charge of a single "wave train" it will discharge into the telephone receivers wherein it will cause

vibrations corresponding to the original vibrations of the distant transmitter.

We are ready now to begin in a practical way. The economy, simplicity of construction and operation of the crystal detector will appeal, to the beginner who wishes to make his advent into the fraternity with a minimum of expense.

The Antenna

The first consideration is the often troublesome and neglected antenna system. A single wire construction is the accepted type for efficiency and selectivity. Its height is generally not important and its length should be from one hundred to one hundred and fifty feet, including lead-in. The fundamental wave length of this type is from 4 to 4.2 times its total length in meters. It should be well insulated from supports by means of porcelain cleats and kept away from other objects so that its small energy may be conserved and delivered to the receiver. Among these are trees, tin roofs, steel structures, iron pipes, etc. It should run at right angles to service lines carrying high tension currents.

All receiving circuits require a connection with the earth which is known as the ground. This connection from the set can be made with a radiator, cold water pipe or any such object which eventually makes good contact with the earth. This is an important feature and must have careful attention.

Municipal regulations and restrictions are enacted and must be complied with as must also the requirements of Fire Underwriters in the matter of antenna systems. In view of this the following outline is important for consideration of any one who plans the erection of an out of door antenna.

Rules for Aerials

Antenna shall not cross over or under

AS WE contemplate the increasing popularity of radio communication an outstanding fact is notable in the growing tendency of the experienced amateur to detach himself from the inexperienced. This is not as it should be. It is necessary for the common good that the new fellow should be offered not only the fraternal hand but a helping hand as well.

It is granted that radio has been developed almost entirely by the youth of the nation. Credit is due them for a great part of the speed of advancement the science has attained. Boys know more about such things than anybody else and we want to encourage all of them to go in for it.

It is our purpose to meet in a simple way the needs of those lads who look wistfully through the supply catalogues, but get no further, feeling that the cost of having a receiver is beyond their means or that their electrical and mechanical knowledge is insufficient to cope with the construction of apparatus so wondrously portrayed.

Radio reception is what the beginner of today usually starts with, because of its simplicity. The truth of the matter

electric light or power wires of any circuit carrying a current of more than six hundred volts, nor shall it be so located that a failure of either antenna or service lines can result in a contact between them. It must be constructed in a strong and durable manner. Splices and joints, unless made with approved clamps or splicing devices, must be soldered.

Lead-in wires must be of approved metal, which will not corrode excessively; copper, copper-clad steel, etc., and in no case can they be smaller than No. 14 B S gauge. They must not come nearer than four inches to electric light and power wires unless separated from them by a continuous and firmly fixed non-conductor in addition to the insulation on the wire. They must enter building through a non-combustible, non-absorptive insulating bushing.

Lead-in wire must be provided with an approved protective device connected as near as practicable to the point of entry to building.

The ground wire may be bare or insulated and of like metal and gauge and must run in as straight a line as possible to a permanent ground as already cited. These details cover the spirit and intent of regulations governing erection of antenna systems and must be complied with to hold insurance valid.

The wiring diagram for the contemplated circuit is offered in a pictorial plan which is easily executed. First, we must be concerned with the units which are to be connected after construction.

Variocoupler

It would be much better if the builder of this Variocoupler would purchase a bakelite tube and wooden rotor for his work. However, this description is written for the novice and therefore only the most easily obtainable material is cited.

A card board tube can be used and is to be given two or three coats of shellac varnish for form and prevention of moisture absorption.

Drilling

Make the form four inches in diameter and three and one-half inches long. Drill two holes at one-fourth inch from each end of the tube with a number twenty-eight drill, repeating on the opposite side. These holes are indicated in both Figures 1 and 3 and are used for holding the bearings on the inside of the tube. With No. 24 double, cotton covered wire begin the winding at one eighth of an inch below these holes. Bring out a loop at every eighth turn until five loops and two ends are available. These are to be connected to switch points. When the winding is completed give it a good coat of shellac varnish.

The rotor can be made of a smaller card board tube which can revolve inside the larger. This must also be given several coats of shellac to prevent warping from moisture. A three-sixteenth inch hole is drilled through the center at opposite sides, as indicated

in Figure 2. These holes are to allow the shaft to pass through the center as in C. Wind forty or fifty turns of the same number of wire taking care to leave sufficient space in the center between the winds of either end to permit the shaft to be run through the tube without contacting the winding.

The shaft is to project far enough outside of tube at one side to extend through a panel, allowing length enough for fastening of an insulating knob. It need only extend at the opposite side to reach through a bearing.

Two pieces of brass one-thirty-second of an inch thick are to be placed inside the tube and the shaft passes through them also. These are shown at arrow points C in Figure 2. After the shaft is located in the proper position through tube these two pieces of brass are forced up against the sides of tube and soldered fast to the shaft, see again C Figure 2. This fastens tube firmly to the shaft.

Next we make a pair of brass bearings shown at D, Figure 4. These are made of strips one-half inch wide and one-sixteenth inch thick, and bent in shape as indicated in drawing. Holes are to be drilled in the part that is bent over to allow for fastening them to a base after the coupler is assembled. These bearings should be held in position inside the tube and marked with a sharp, pointed instrument through the holes in

the side of the tube. The bearing is then removed for drilling of holes at points marked. Use a number 33 drill for this, and tap them out with a 6:32 tap.

Bushings

The holes for the shaft as shown are to be drilled with a three-sixteenth inch drill and located just high enough above the edge of the tube so that shaft will not rub on the edge of tube. Two bushings of fibre or brass tube should be placed on shaft, between the rotor and bearings, to prevent the rotor moving back and forth after assembling parts. These must not be long enough to force the tube out of shape but just right to permit rotor to be turned easily by the shaft, without moving back and forth. The bearings are fastened to the side of the tube by means of 6-32 brass machine screws as in Figure 3. The part of the bearing which is bent over must be turned in toward the center of the tube, otherwise the coupler cannot be assembled.

Solder Your Leads

After the variocoupler is put together, two flexible leads are soldered to the ends
(Continued on page 38.)

Inductance A

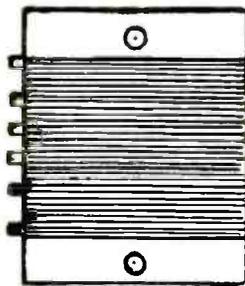


Fig I

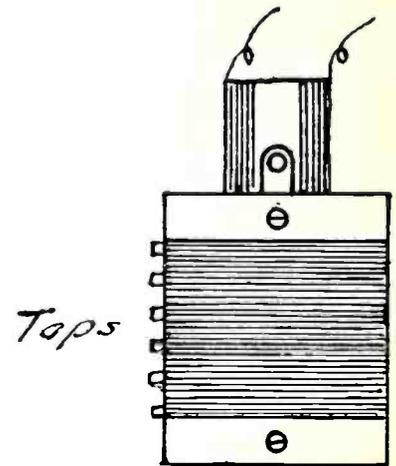


Fig III



Rotor B

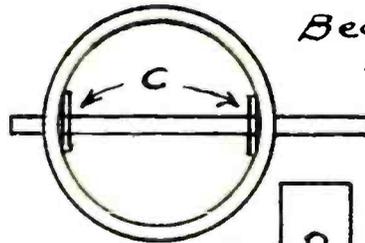


Fig II

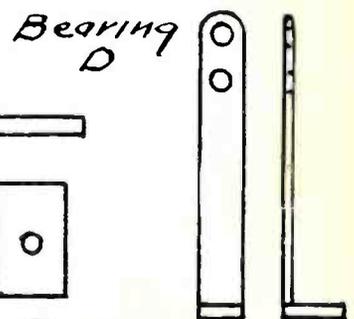
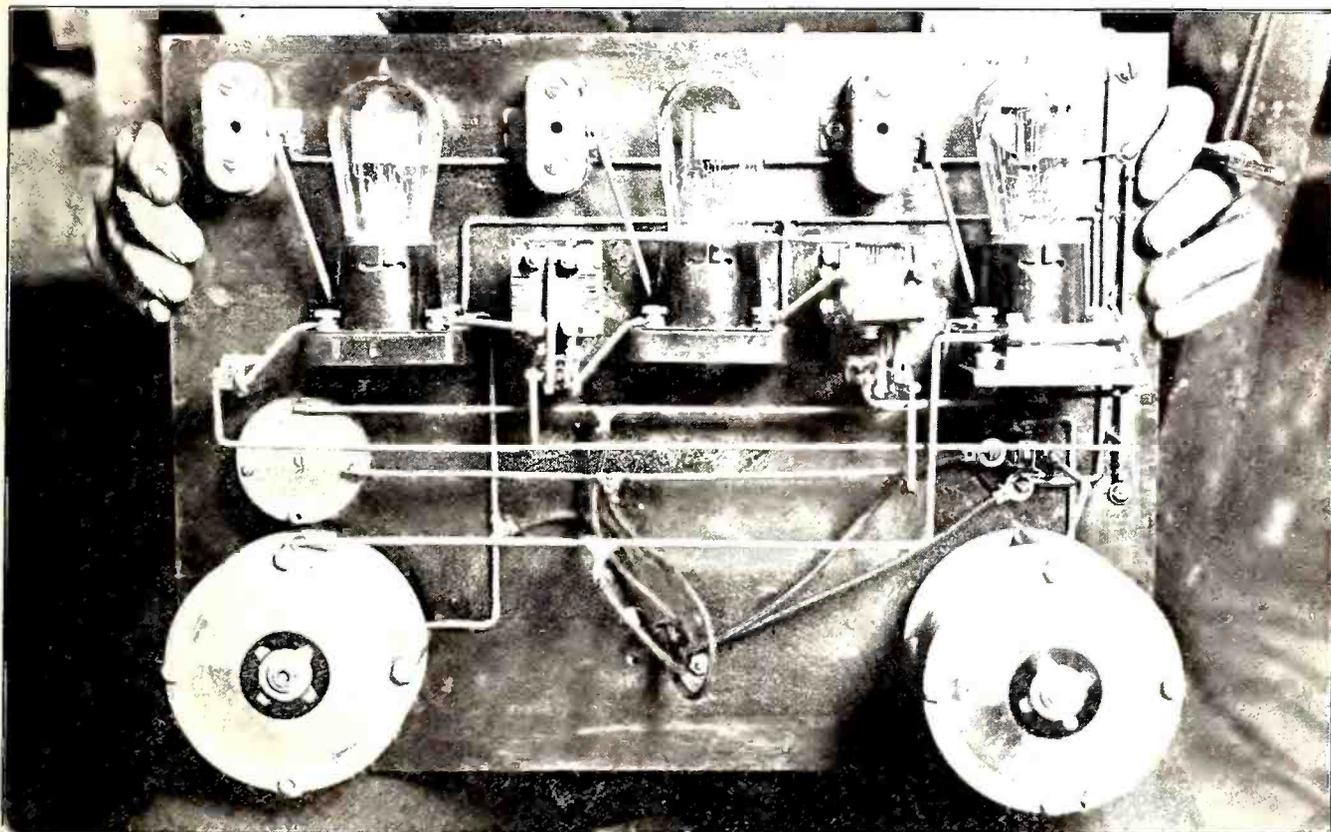


Fig IV



For neat workmanship and arrangement, look at this three-circuit regenerative receiver, built by Sidney Kasindorf, New York. He has received some remarkable long-distance programs and messages with this outfit. (Kadel & Herbert.)

One Aerial for the Many Is General Squier's Vision

THE near future will see small compact and portable radio receivers, practically self-operating, in every home, according to Major General George O. Squier, Chief Signal Officer of the army, and one of the most advanced thinkers along lines of radio development. There will be no outside antenna, no complicated wiring, and no batteries in the ideal "fool-proof" set soon to be sought by up-to-date householders who will demand radio "service," just as they do telephone service today.

General Squier believes what he terms the second stage of radio development has arrived. When an invention first becomes popular, there is always a lot of energetic mechanics or electricians, both professional and amateur, who delight to tinker with the new apparatus. Some of these constructors have aided in the perfection of radio receiving sets, the general points out, but today the chief demand is for efficient sets which will be practically self-operating and will approach the ordinary telephone receiver in simplicity, taking their power and broadcasts from a single source or at least a central distributing point.

It would be impossible for every ten-

ant in a thousand, or even a five hundred, apartment building or hotel to have an individual antenna. The roof of the hotel would be literally covered with aerials. The elimination of lead-in wires and batteries is also desirable, so that sets can be taken from room to room and plugged in. Naturally some local company, probably the power company, must furnish either the broadcasting by wired-wireless and at the same time the power for operating the tubes of subscribers, or erect its own main antenna on the outskirts of a city and distribute the broadcasts by wire locally. This scheme would involve combining General Squier's wired-wireless system of transmitting over light or power lines and regular radio transmission.

That broadcasting would not operate so successfully over a telephone system, was quickly shown by General Squier when he pointed out how the system of phone wires was constantly being broken down and rebuilt between different points whereas the light wires remain a stable net work running to each and every hotel, home, hall and store.

General Squier anticipates the development of local broadcast distributors who will collect radio entertainment

and news for re-distribution or who will establish wired broadcasting for local subscribers. Coincident with the establishment of this system, will come the standard receiving set capable of being moved about the house and plugged in like a vacuum cleaner or electric fan, he believes.

Some listeners-in are already using the electric companies' lines to receive on instead of aerials, through a special condenser plug. Many possessing tube sets are utilizing inside loops. Practice is tending toward simplification and reliability in service the general insists. There will always be many real fans who want to build and rebuild their sets, but others are not mechanics and prefer ease in operation, reliability and compactness, to continual experiments.

"Hideous skylines covered with wire spider webs and rooms criss-crossed with wires will soon disappear," General Squier said, calling attention to some of the larger hotels and steamships which have already undertaken to serve their patrons with continuous radio broadcasts, from a central system. "The indispensability of broadcasting will make consolidation and simplification a necessity," the general concluded.

Radio 'Round-the-World

By Washington Radio News Service

WASHINGTON, D. C.—As a means of direct communication and for the entertainment of people of practically every race, radio is rapidly taking a place in world affairs unprecedented and unanticipated by forecasters, not excepting the visionary Jules Verne, who predicted several time and space eliminators.

Many new commercial radio circuits have been opened within the past two months, while further construction is announced nearly every week. Broadcasting, born in the United States as recently as September, 1921, has spread rapidly, and is coming to be a necessary feature of practically every country, stations being operated either by the governments or private companies. But America still leads in commercial radio enterprises, broadcasting, and in the manufacture of equipment which goes to forty or more countries.

Sweden

A combination to control broadcasting in Sweden has been formed, but until the Swedish law forbidding private indi-

viduals the use of radio receiving sets is modified by the Riksdag, general broadcasting cannot progress very far. The king has authority to permit the use of receiving sets, and to date 300 such permits have been issued, it is understood.

A change in the existing law granting private use of sets will be presented to the parliament early in 1924, the Minister of Communications announced recently.

Judging from the importance of some firms in the broadcasting combination, called the Svenska Rundradio Aktiebolag, it is believed it will be able to secure sole rights to broadcast in Sweden for ten years. The capital stock of the organization is said to be about 300,000 kronen; headquarters will be in Stockholm. It is the plan of the company to license receiving sets, the king to fix the rates, suggested as twenty crowns a year. An amount equal to five per cent of the fees will go to the government. The gradual building of governmental sending stations is planned, each station to be at the disposal of the broadcasting company for five hours a day, for which the company will pay the government.

Wave lengths and interference are to be controlled by the government. On its part, the company binds itself to broadcast news, weather reports and various kinds of entertainment, also urgent and important news, free of charge to the government.

This company also plans to sell apparatus and parts. Discussion as to the kinds of apparatus to be licensed for reception is under way, the marine authorities insisting that the construction of the public sets should be such that listening-in on naval communication is impossible.

Norway

Work on a new government radio-telephone station at Vardo, on the North coast of Norway, to cost approximately 95,000 kronen, is reported as underway, by Consul Ifft, at Bergen. It is expected that this station will soon be in communication with the telephone broadcasting stations at Ingo, Tromso and Spitzbergen. The main object is to maintain communication with the fishing fleets.

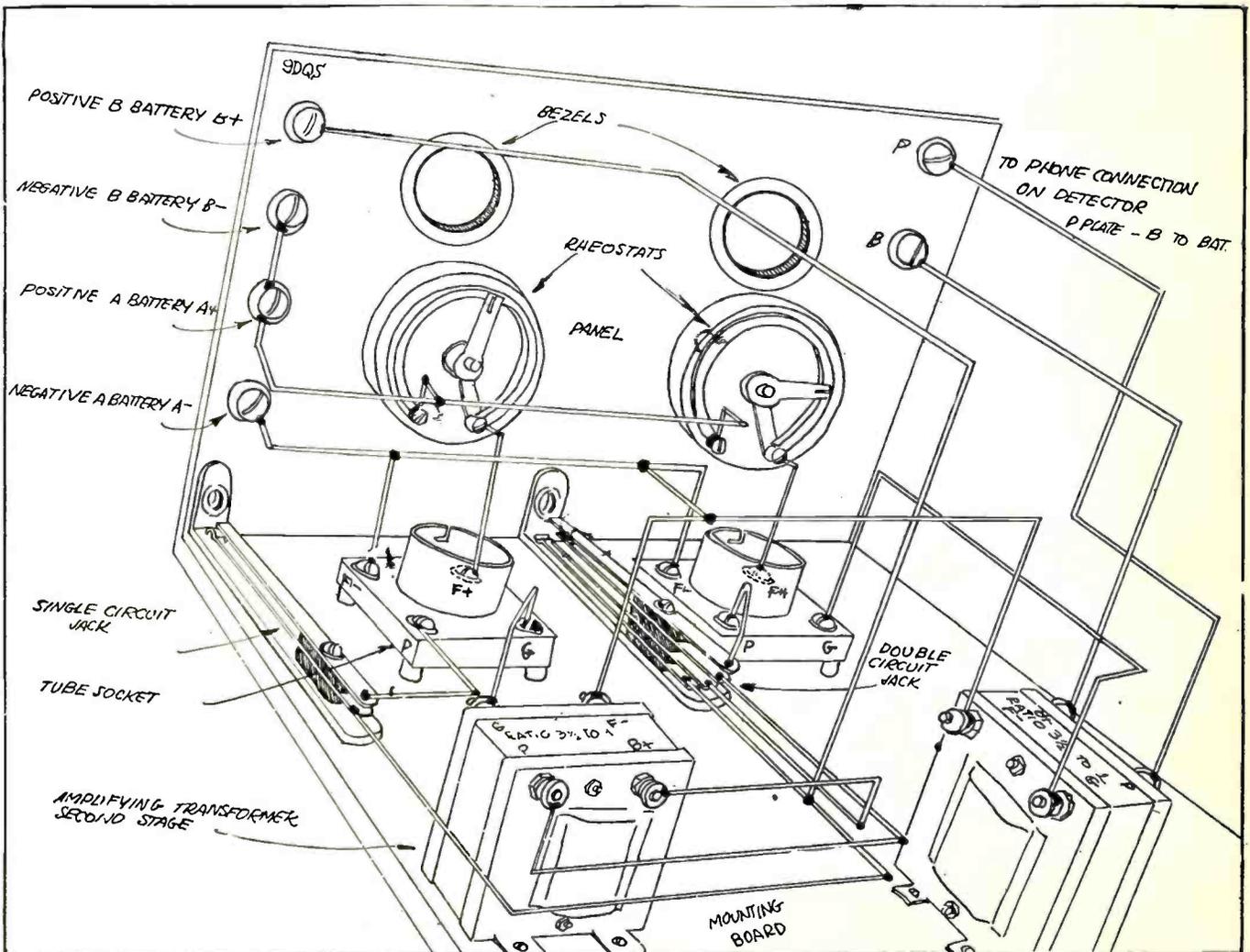


Figure 5. This illustrates the panel arrangement and wiring of the two-stage amplifier used in the combination loud speaker and amplifier described on page 18. Full instructions concerning the construction of this unit appeared in the August issue of RADIO AGE.

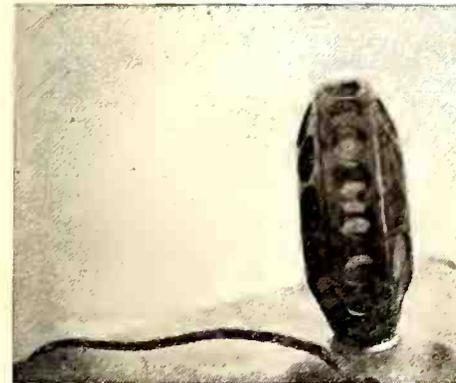
What the Broadcasters are Doing

(News for this department is solicited from all stations)

University Extension

In order to further extend the use of radio so that it may be put to utilitarian uses, Westinghouse Radio Station WBZ, at Springfield, Mass., has arranged with the Massachusetts Division of University Extension for a number of courses in which the successful student will obtain a certificate of perfection at the completion of the course. Two courses have been arranged at the beginning—one intended primarily to interest men and boys, the other intended to interest women. If the original courses are received with enthusiasm, other courses will be offered from time to time.

For the men a course is being given in Radio Reception and Transmission. It is sufficiently elementary to appeal to those radio enthusiasts who are interested chiefly in the results that they can get with their own sets, and who do not care to go very deeply into technical details. At the same time, it will be broad enough to furnish a sound foundation for a more advanced and technical



When Lloyd George was in the United States he had an opportunity to discover how great a medium for reaching the masses the broadcasting station has become. Speeches made in New York, Chicago and other cities were broadcast to hundreds of thousands at a time. The above photograph was taken at the Metropolitan Opera House, N. Y. The former British premier's speech was broadcast from that auditorium by station WEAJ. (Kadel & Herbert.)

study of the subject. If a sufficient number of people show interest in this first course, a second and more advanced one may be given later in the year.

The course consists of ten lectures, one to be broadcast from WBZ, by Edward H. Goodrich, of Springfield, each Wednesday evening, from 7 to 7:20 p. m. The first lecture was given on Wednesday evening, October 3.

For women, the division is broadcasting a course in Household Management, consisting of eight lessons and given each Tuesday evening from 7:40 to 8

All radio users within range of this station are, of course, welcome to become part of the audience at these lectures. If, however, one wishes to take an active part in the course, he may enroll as a university extension student by sending to the Radio Station, Westinghouse Company, Springfield, Mass., his name, address, age and occupation, with the registration fee of \$1. This application and payment constitute an enrollment and entitle the student to receive any study material that may be sent out by mail, and to submit lesson papers to a

WCAP Has Jazz Tube

The national craze for jazz may effect vacuum tubes: This is the latest development in radio broadcasting news. When a radio transmitting tube shows unmistakable signs of becoming converted to jazz music and develops a blue light which dances in perfect cadence and absolute abandon to the "blue" notes of a moaning saxophone, what chance has the advocate of grand opera broadcasting radio engineers and operators ask?

Such is the situation at the Chesapeake and Potomac Telephone Broadcasting

time it broadcasts the music of Le Paradis Orchestra, or the Metropolitan Theatre. On all other occasions the tube maintains a solemn dignity befitting the occasion, and performs in a highly efficient manner, it is said.

The engineers who carefully avoid discussing the ethics of the equipment, rise to the defense of the tube to say that the blue light is probably caused by a small amount of gas which is present in some quantity in all vacuum tubes. When the tube is working, the gas becomes ionized, and if present in sufficient quantity, gives off a bluish light. The vividness of this light, it is explained, is increased with the modulation and with the changes in volume of the music. When a heavy chord is struck, the light visibly brightens, with the result that during a jazz piece the blue light keeps absolute time with the music, bringing out the beats, thus emphasizing the syncopation.

"That's as it should be," say the lovers of jazz, "even a radio tube gets a thrill out of popular music." The students of Wagner, Beethoven and Liszt, however, scoff at the idea, claiming "that jazz gives the tube the blues."

Birds in "Bird City"

Radio rooms on vessels must be used solely for the transaction of matters affecting communication and not as aviaries, if the suspension of the radio operator on the vessel "Bird City" is taken as an example.

When a radio inspector visited this ship recently, he found that the radio operator had practically given over his shack and stateroom to a number of birds as a habitat which, despite the name of the vessel, is against the rules.

The inspector's report stated that when he entered the shack, he found a parrot roost suspended from the deck above. After a search, he found the parrot perched on a bus bar in the rear of the switchboard. Polly seed was all over the floor and chairs. In the sleeping quarters were found four canaries.

The shack, it is understood, was thoroughly cleaned and the bird tenants ejected from their quarters. When the

"Bird City" again goes to sea she will have an operator who is not a bird fancier.

Visitor at WSB

Atlanta, Ga.—An eloquent instance of radio's influence in obliterating sectional lines and creating a national community spirit throughout America is cited in a visit paid to station WSB not long ago by a Pennsylvania fan. Harvey S. Rahiser, a Pittsburgh, Pa., architect, who made the trip solely to further a friendship fostered via the ether for more than a year. The Quaker

important matter of double nomenclature up to The Atlanta Journal radio staff. After receiving and acknowledging a flood of suggestions that followed an appeal for help during a concert, "The Voice of the South" announced that the pair of Georgia baby girls would be named Radiora and Radianna. The radio twins bless the household of Mr. and Mrs. W. E. Neary, of Smyrna, Ga.

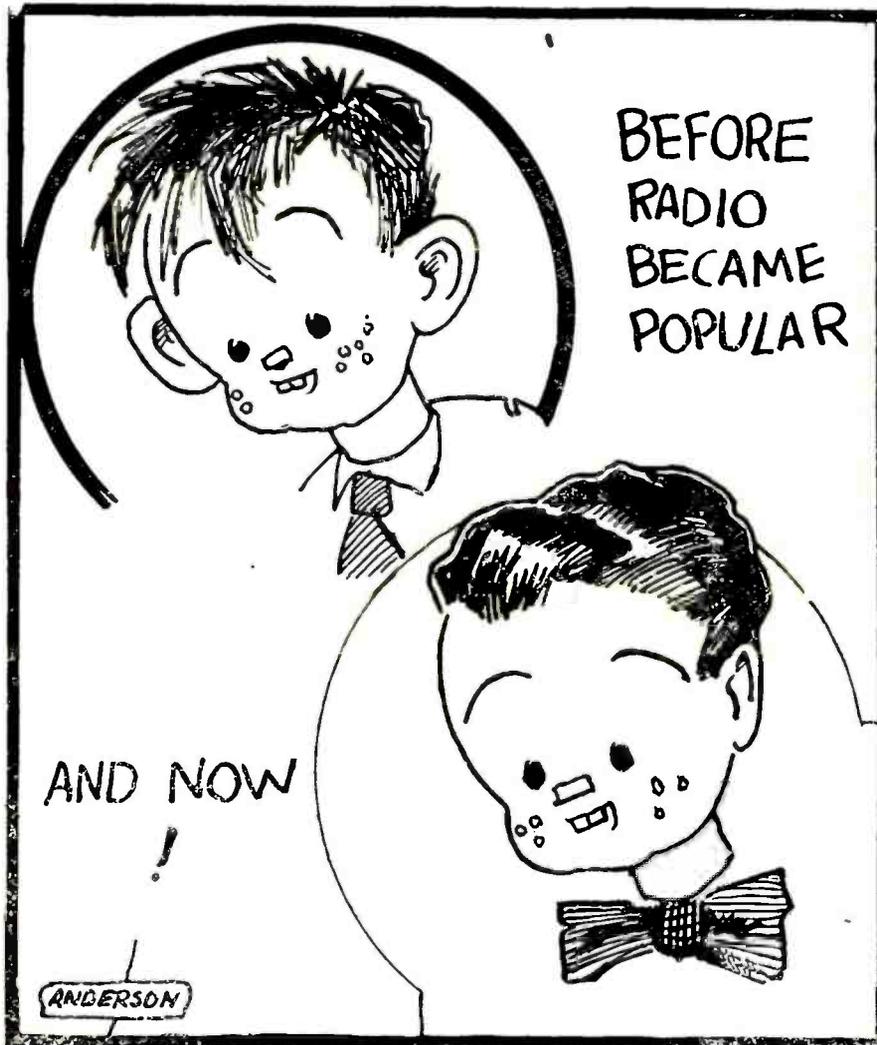
Atlanta Symphony

Atlanta, Ga.—The Atlanta Symphony orchestra, a newly founded civic institution, will soon be added to the attractions broadcast by Station WSB. Although identified as a musical center through the nation's only annual season of Metropolitan grand opera outside of New York city, Atlanta until now has never supported a real symphony orchestra. The organization will include the finest professional musicians in the south, is backed by a fund subscribed on a municipal scale and is expected to take rank with outstanding symphony orchestras of the country.

Entertaining Artists

The reception room at broadcasting station, WOC, at Davenport, Iowa, has been equipped with a loud-speaking horn, so that the waiting artists and friends of those on the program may enjoy the selections being broadcast from the studio adjoining.

The circuit is so arranged that the horn operates only when the door to the studio is closed, thus preventing any possible 'feed-back' on the microphone.



Radio is a boon to mothers of boys who formerly refused to comb their hair and possessed ears which stuck out far enough to flap and scare flies off their backs.

Junior, after wearing the headphones for a month or two, acquires one of those radio marcols from continued wearing of the headband and the tension of the phones brings his ears back into their proper place.

state fan was met by a delegation at the train, was officially welcomed by the mayor of Atlanta, listened at first hand to a concert in his honor, was dined profusely on fried chicken and left Georgia three days later singing the praises of the home of "The Voice of the South."

Radio Twins

Atlanta, Ga.—Already claimant for the title of "godfather" of the world's first radio-christened baby, WSB boosted the station's average still higher recently when the proud parents of twins left the

Cleveland to Guatemala

Puerto Barrios, Guatemala, which is in Central America, is rather distant from Cleveland, Ohio, yet it is interesting to compute that a recent concert from a Cleveland broadcasting station was heard there in a small fraction of a second after the notes were impressed on the broadcasting microphone in Cleveland.

The letter telling of this long distance reception was received by the Cleveland station WTAM, from W. E. Godman, resident of Puerto Barrios, Guatemala, C. A. The incident is even more amazing



E. F. Mac Donald, Jr., Zenith-Edgewater Beach Station WJAZ, reading the latest news into the microphone for the entertainment of Explorer Donald B. MacMillan, who is ice-locked near the North Pole in his little ship "Bowdoin." It was Mr. Mac Donald who equipped the "Bowdoin" with sending and receiving apparatus, with results that have interested the entire radio world.

because of the fact that the WTAM concert was received by Mr. Godman with such volume on a loud speaker, that a curious crowd gathered outside his home to listen to the music coming from a point more than 1,500 miles distant in a straight line.

The Bishop's Watch

Radio fans who tuned in Sunday night to listen to a lecture by Bishop F. McDowell at Orchestra Hall, Chicago, began deluging the Sunday Evening Club with complaints that they couldn't hear the lecture for the ticking of the bishop's watch.

During the meeting of the Sunday Evening Club, which was broadcasted from Orchestra Hall through Westinghouse station KYW, Chicago, Bishop William F. McDowell, given only a certain number of minutes to speak, had taken his watch and placed it where he could conveniently watch the time as it passed—unfortunately, the microphone seemed to be about the only place of advantage where he could put it, with the result that the ticking of the watch went out as loud as his voice. More than a million people all over the country were listening. Here are excerpts from a few of the many letters sent to Westinghouse Station KYW:

Redington, Nebr., October 23, 1923.
Station KYW,
Chicago, Ill.
Gentlemen:

We had the pleasure of listening in on your station Sunday evening, October 21, 1923, and wish to say your signals came in wonderfully strong. How strong you can judge for yourself, when you stop to consider we live 450 miles West of Omaha, and we could hear the watch ticking as distinctly as we could hear it had we held a watch to our ear.

With best wishes, I am,

Very truly,

FRED GILMAN.

Palmyra, Nebr., October 21, 1923.
Station KYW,
Chicago, Ill.
Dear Sir:

Your last announcement explaining the watch tick that I heard out here in Nebraska certainly took a load off my mind for I would have lain awake trying to figure out where the tick came from. Your station is O. K.

CHARLES H. HULL.

Protect Ships by Radio

The Canadian government is about to install a powerful direction-finding wireless station at Pachena, on the west coast of Vancouver Island, British Columbia, to protect ships of all nations entering

the Straits of Juan de Fuca en route to American and Canadian ports. Numerous shipwrecks have occurred in this district, and it is expected that the new radio beacon will enable vessels to determine their exact positions in foggy weather, avoiding many dangerous reefs thereabouts.

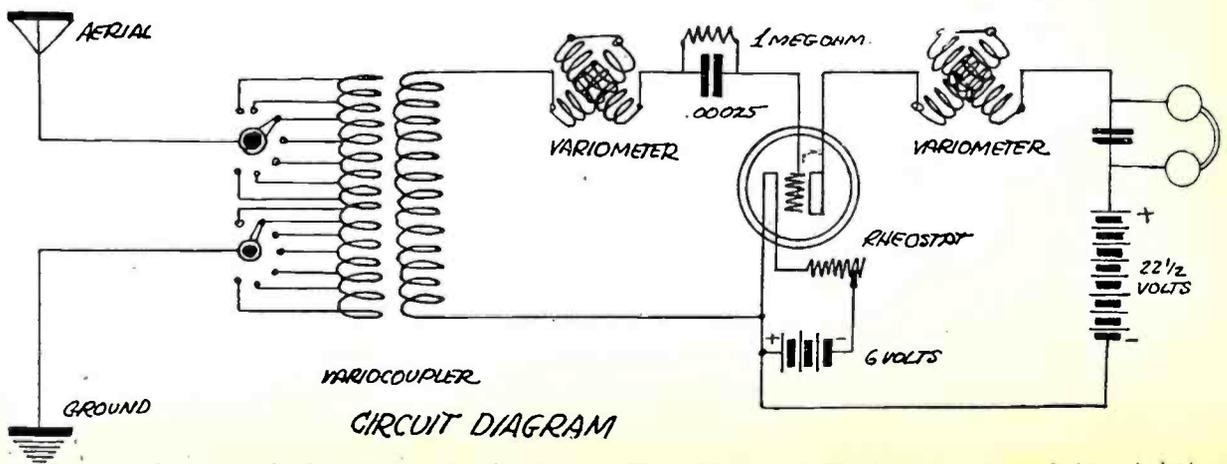
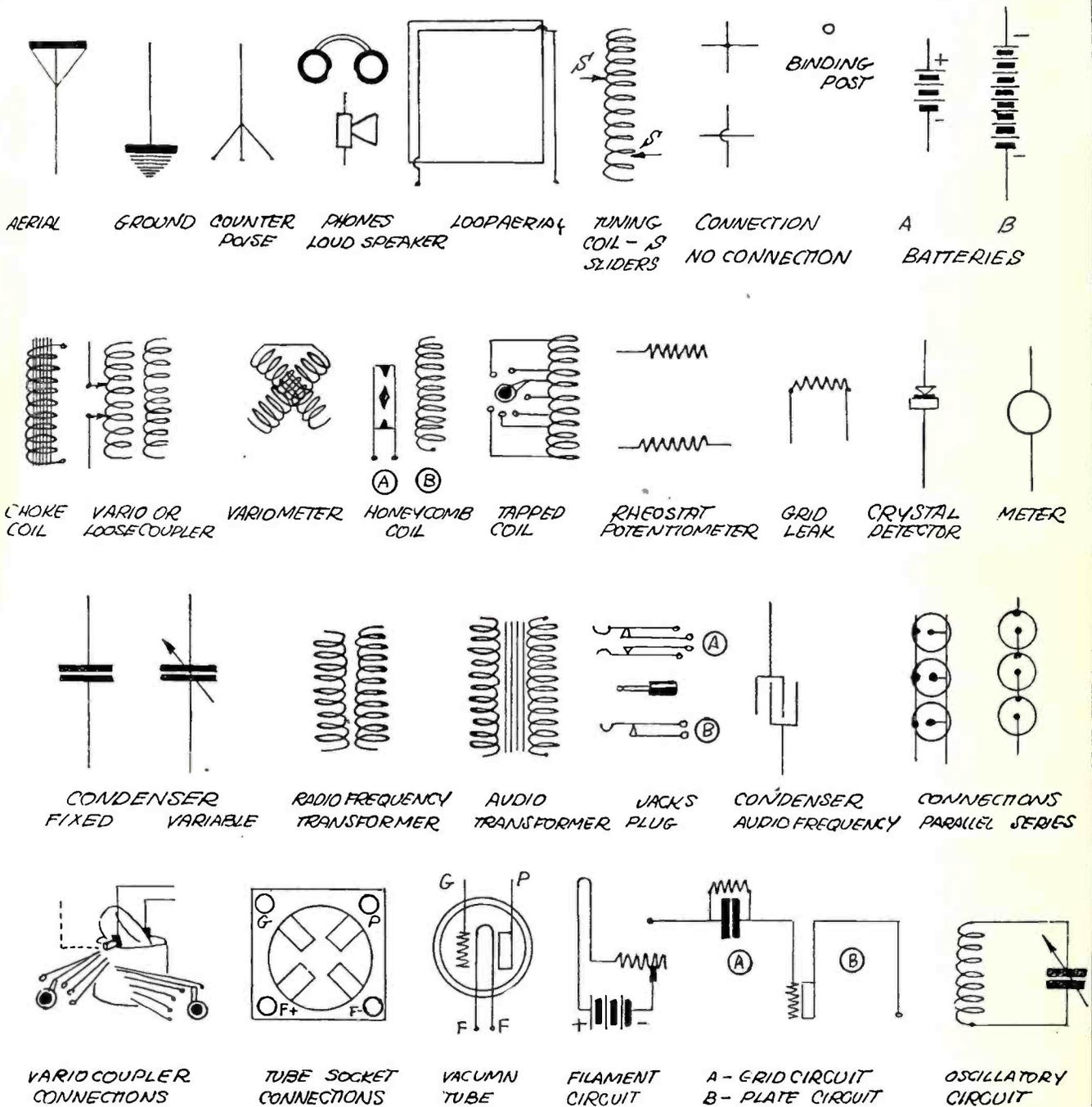
Bits from WGY

"Father is Scotch and takes the headphones off when the minister announces the offering," wrote eight year old Harold Midgley of Galt, Ontario, Canada, to WGY, the Schenectady, N. Y. broadcasting station of the General Electric Company.

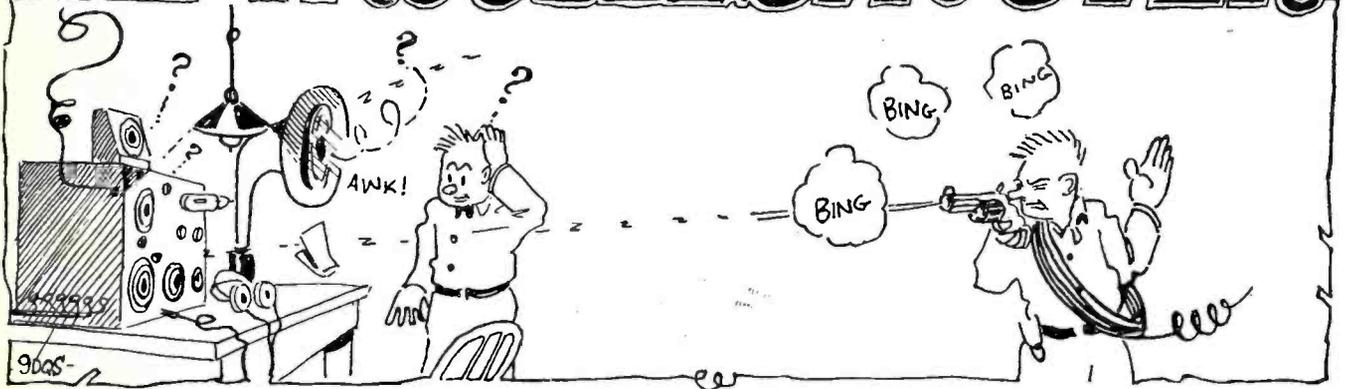
The radio storm created by WGY, in the production of "Peg o' My Heart," as a radio drama, was so realistic, according to Martin L. Wyman, Jr., of Gaysville, Vt., that his father took off his headphones, saying that he didn't care to listen in during a thunderstorm.

WGY indirectly controls the turning on and off of the street lights at Howard Beach, about twenty-five miles from New York. William L. Welling of that place reports that he depends on WGY for the correct time for the proper setting of the time clock which controls the operation of street lights in Howard Beach.

SYMBOLS USED IN RADIO AGE DIAGRAMS



THE TROUBLESHOOTER



The technical department sends out many replies to questions in each day's mail. In order to assure prompt service to our subscribers the direct reply method hereafter must be restricted to those fans who are on our subscription list.

Fans who are not subscribers may obtain this service by enclosing 50 cents with their question and the reply will be mailed at once, accompanied by circuit diagram where illustration is needed.

All inquiries should be accompanied by self-addressed and stamped envelope.

G. S. P., Moline, Ill.

Question: I am enclosing a sketched diagram of a long-distance crystal set taken from a publication of yours. I desire to use a WD 11 tube in this hookup, and I have sketched roughly on the diagram enclosed, the way I have figured out the connections for the tube. I have put a variable condenser, of .0005 Mfd. capacity in the aerial lead instead of a fixed condenser. I am not sure about the phone condenser insofar as the tube connections are concerned. Kindly check over the circuit, making any corrections you see fit.

Answer: The directions for converting the long distance crystal set into a tube set were printed in the October issue of RADIO AGE, but I am printing for your and other reader's convenience another diagram, showing somewhat different connections for the parts in this set.

E. A. B., Dwight, Ill.

Question: I am a subscriber to your magazine, from which I receive much benefit and enjoy every page. I am coming to your free service department for some advice. I have a honcycomb set with six-volt tube and one stage of audio frequency amplification, which gave excellent results for about two months, and then went wrong. I have tested A and B batteries and find them to be in good condition. I have tried different grid condensers, different type of tube and other coils, but with no appreciable change. The signals used to come in loud enough at times to be heard over the loud speaker but all at once they faded so that I can just barely hear them. Previous to this, when I touched the grid wire the set would howl, but now it just barely squawks; other times it seems absolutely dead. The set seems to oscillate O. K. but just has no pep. I have hooked-up just the detector alone in order to cut out the

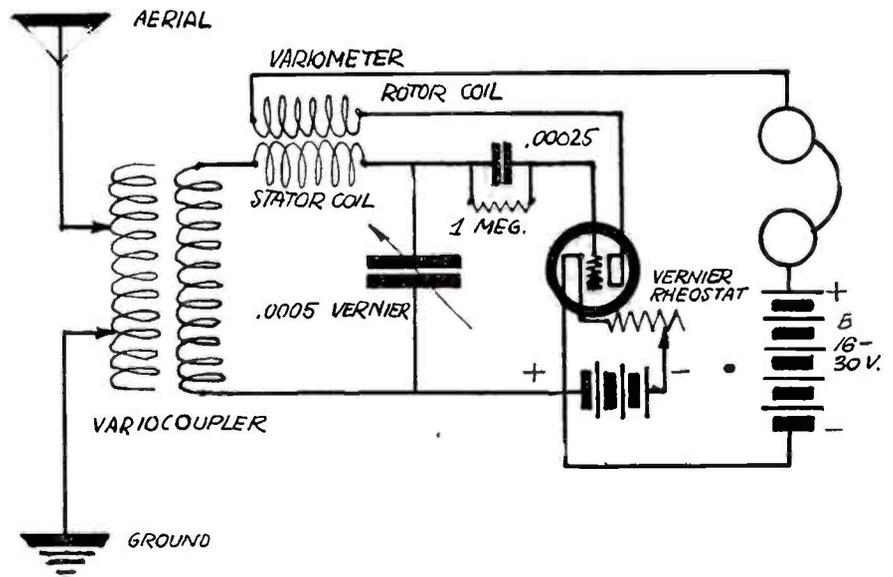


Figure 1. This is another arrangement possible, using the instruments of the long-distance crystal set in a one-tube hookup. The variometer is split and used in the circuit as shown. The set is highly regenerative and gives unusually loud signals.

transformer but it is just the same. If you can give me any information, I would appreciate it very much.

Answer: You seem to have gone over the set pretty thoroughly, and I can offer only a few additional suggestions to follow out in order to locate the limitations of the set. First of all, would advise that you give your antenna system a thorough going over from one end of the antenna down to the very set. If you are using the rubber covered lead-in type of wire, would advise that you test it for breaks, especially in the lead-in, where I presume you are using insulated wire. Try a different ground connection. Make sure that the positive side of the B batteries are connected to the plates of the tubes. Reverse the tickler coil of the set. Test your headset by placing the two tips across a dry cell

or flashlight battery. The headset should give a loud and firm click when the tips make contact. You might bend up the prongs on the tube socket to make sure they make positive contact. The July issue of RADIO AGE shows how to test condensers for short circuits, and I would advise your referring to this number and carrying out the test. Reverse the A battery connections, and test the B batteries with a volt-meter if you have one handy. If the 22 1-2 volt test lower than 16 volts or if the 45 volt batteries test lower than 36, they are just about useless as far as radio reception is concerned. If after you have carried out these suggestions, the set fails to work, would then advise that you disconnect the entire set and rewire it, thereafter trying it on a different antenna.

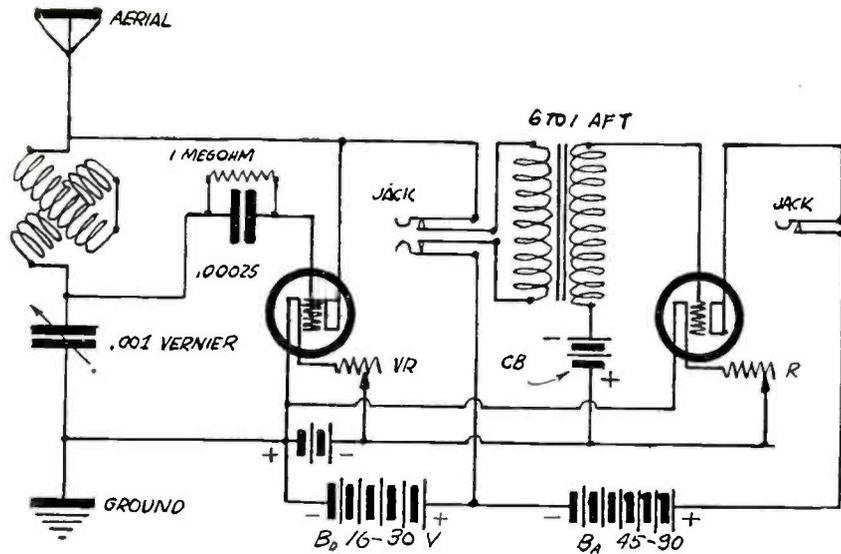


Figure 2. This shows the "First Tube Outfit" connections with the addition of a one-stage audio frequency amplifier. CB is a small flashlight battery, or dry cell, of one and one-half volts used as a grid bias, to assure the highest amplification factor when WD 11 tubes are used. L is the variometer. Full details concerning this set were given in the October issue of RADIO AGE.

G. L. T., Memphis, Tenn.

Question: With regards to the construction of the four-circuit tuner, as published in your August issue, the article says to use No. 18 sec wire. I cannot secure this kind of wire here but can get No. 20 or 22, enameled and cotton covered. Would this make much difference in results? It also says to use a 3 1-2 or 3 1-4x6 tube. Is it possible to bank wind coils A and B to save space?

Answer: It will be necessary for you to use the wire as specified in the data, inasmuch as the constants of the circuit have been carefully worked out, and any changes would bring about doubtful

results. The difference in inductive effects and distributed capacity will not permit the winding of the A and B coils in bank wound form, as you suggest. I would suggest that if you are having trouble in constructing the coils that you buy them already wound. The coils advertised elsewhere in this magazine will serve the purpose admirably.

H. H., New York City, N. Y.

Question: In your October issue, you show a diagram of a simple receiver. I am partial to this set, and would like to construct it and would like to have a copy of the circuit with the addition of one stage of audio frequency amplification. I am going to use WD 11 tubes.

Answer: This little set has proved itself a popular receiver among beginners,

due to the simplicity of construction and the long range it affords. Inasmuch as we have had so many requests for circuits showing the addition of audio frequency, I am printing in Figure 2 a circuit showing the addition of one stage of low frequency amplification, and in Figure 3 the set with two stages of amplification.

M. A. B., Pasadena, Calif.

Question: I have a two-tube Erla reflex circuit and one stage of audio frequency, which is made up of Erla parts with the exception of the audio transformer. I get a large howl that is very troublesome. I disconnected the .00025 fixed condenser across the 11 and 23-plate condensers and the howl stopped but now I cannot get any long-distance nor can I hear from the loud speaker. I like your magazine very much and take pleasure in recommending it to others.

Answer: Put the .00025 Mfd. condenser back where you took it, ground the transformer core, and place a .001 Mfd. fixed condenser across the primary connections of the audio transformer. If there are any wires in the amplifier that run parallel for any distance, change them, and if necessary, move the audio transformer clear of the rest of the parts of the set.

C. H., Milwaukee, Wis.

Question: I wish to build the Reinartz circuit, and would like to know what ratio of audio transformer to use on the first and second stages of the amplifier, and what resistance potentiometer to use on the set.

Answer: For the first stage of audio amplification use either a 6 1-2, 6 or 4 to-one ratio. If you want a clear signal at the expense of a little volume, use a 3 1-2 to-1 on the first stage. The second stage transformer should have a 3 1-2 to-one ratio winding. A potentiometer

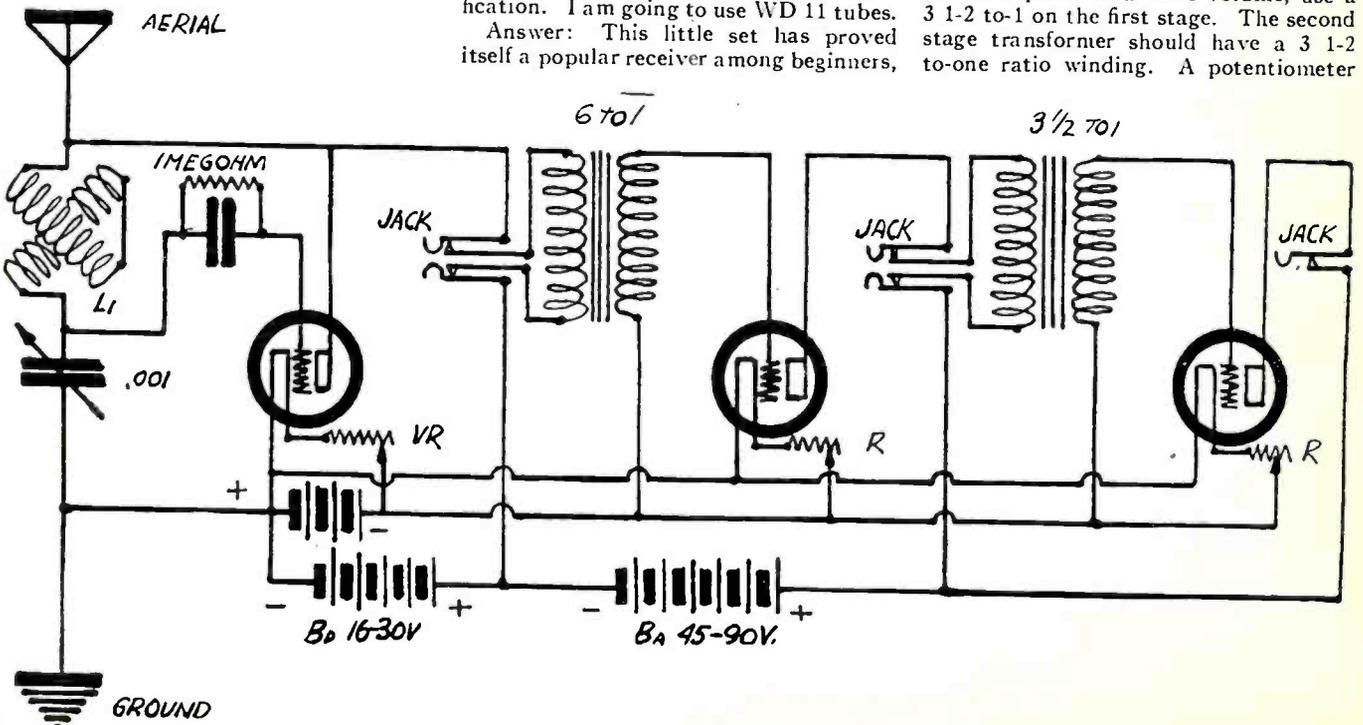


Figure 3. This shows the simple beginners' receiver, connected to a two-stage low-frequency amplifier. If WD 11 tubes are used, the C battery arrangement shown in Figure 2 should be added. This circuit is probably the simplest and most efficient tube set yet developed, taking into consideration the small amount of apparatus used.

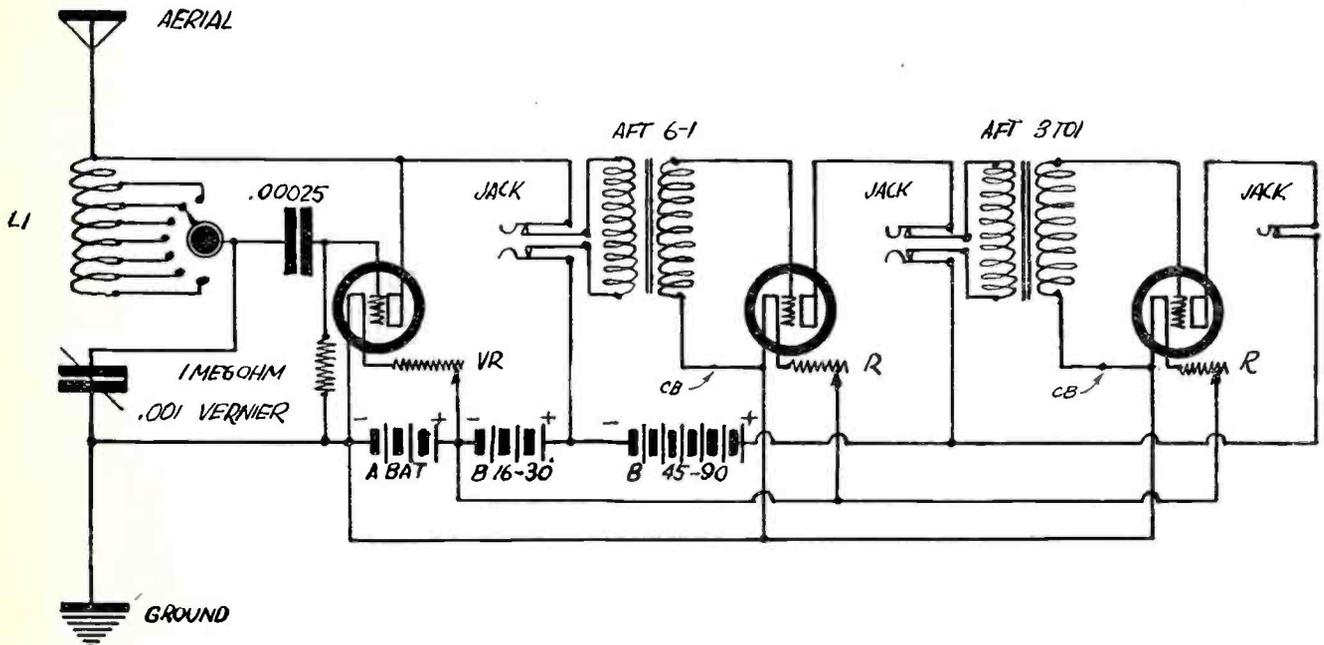


Figure 4. Two stages of audio frequency amplification are added to the Ultra Audion receiver described in the October issue as shown in the above diagram. If WD 11 tubes are used, C batteries should be placed at the points marked CB with the negative side going to the transformer—F. The battery should have a potential of from one and one-half to three volts, and should be used to gain the greatest efficiency from the tube.

having a minimum resistance of 200 ohms and a maximum resistance of 400 ohms will be satisfactory in this circuit.

H. W. H., Long Beach, Calif.

Question: My friends tell me that it is practically impossible to tune out interfering stations with my receiver, which is a set made by a well known manufacturer. If you could proffer any suggestions as to making the set more selective, it would be very welcome. If the set cannot be improved, would like to know if the parts in the set may be used in constructing a more selective circuit. I am not familiar with the reading and executing of circuit diagrams, and would appreciate your favoring me with clear photographs, sketches or other easily understood, not too technical data. Is it true that in assembling a Neutrodyne set that great difficulty is experienced in getting the proper results from the circuit? I am desirous of getting a set that is selective, not too difficult to construct. It is not necessary that it get long-distance, as I do not particularly care for long-distance, inasmuch as many good programs are offered here in Los Angeles.

Answer: H. W. H., we think you are the first fan who has come to us telling us that long-distance reception is not essential, and want to say that here at least is one bug who is trying to appreciate his local station, instead of trying to tune him out. I would suggest that you give the filter and wave trap a trial before you disassemble your receiver, as oftentimes the insertion of this tuned oscillatory circuit will clear up the trouble. The July issue of RADIO AGE contains data for the construction of such a filter. In this (July) issue you will also find an article which will assist you in learning to read and understand circuit diagrams, which will enable you

to appreciate the various merits of different circuits. If you are considering changing the circuit you now are using, we would advise your considering the Cockaday circuit, full description of which appeared in the August issue of RADIO AGE. The isometric drawing of both the Four circuit tuner and the two stage amplifier should eliminate

any doubt as to the connections. If you desire to learn what results other readers are getting with the circuit as regards tuning, would advise your referring to the November RADIO AGE, on pp. 20, the correspondence from F. A. F., of Memphis, Tenn.

L. K. G., Cheyenne, Wyo.

Question: I understand that a crystal set may be made more sensitive by the addition of a potentiometer and a local battery. Will you show how the con-

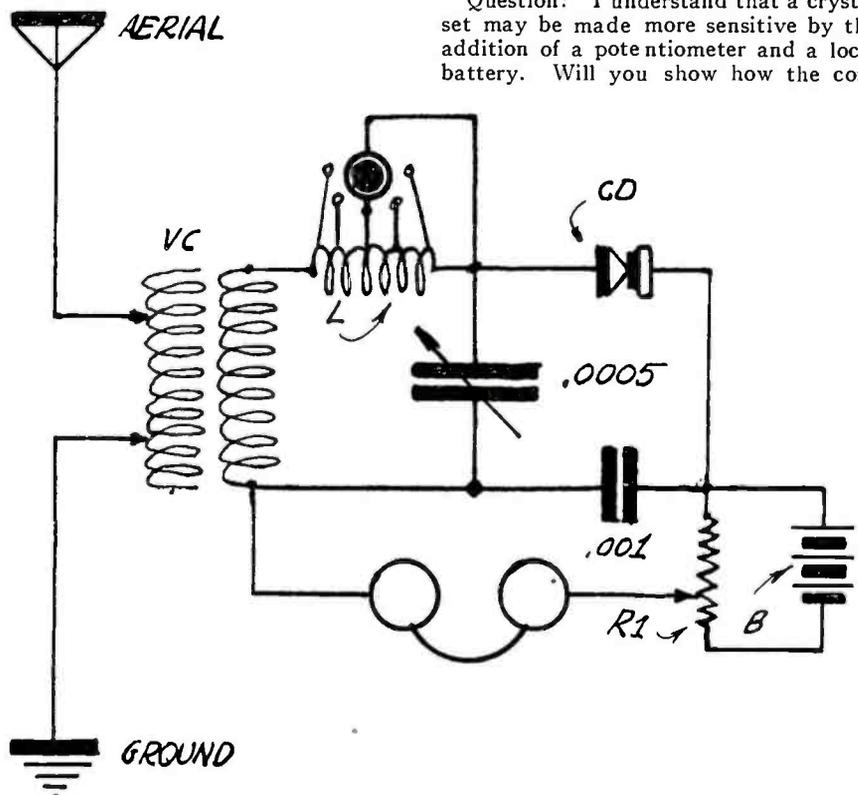


Figure 5. This shows the electrical connections of a sharp tuning crystal set, making use of a potentiometer and local battery to increase the efficiency of the crystal. VC is the variocoupler, L is a coil of 25 turns, tapped every fifth turn, CD is the crystal rectifier, and R1 is a potentiometer of the graphile type, having a maximum resistance of 10,000 ohms. The battery marked B should have a voltage of from two to four volts.

nections for this type of receiver may be made? What resistance should the potentiometer have?

Answer: I am printing in Figure 5 a circuit showing how this arrangement is used. Sometimes a small current passing through the detector circuit makes the set more sensitive to changes in frequency. The idea is an old one, dating back from the time when crystals were used exclusively. The carborundum, zincite and bornite crystals used in sets nearly always required the use of a local battery for this purpose. I have not heard of what results have been obtained when using it on broadcast listening, but the circuit was an efficient one at that time, and I see no reason why it should not prove an interesting experiment for the crystal set user who desires to improve his set.

E. E., Racine, Wis.

Question: I am using a six-volt tube set consisting of a detector and two-stage amplifier, which I operate from dry cells hooked in a series parallel circuit. I find that this method is very unsatisfactory, and I do not wish to purchase a storage battery as I have no means of charging it. My farm is wired, using a 32 volt lighting system, which I know is direct current, and inasmuch as it is necessary to use direct current, I would like to know how to wire up an arrangement to use this source for lighting the filaments of the bulbs. I intend to continue using the Block B batteries for plate potential.

Answer: I am printing in Figure 6 a circuit showing how to wire up an amplifier using the 32 volt lighting system you have. You will need seven resistance units, such as made by the Ward Leonard Company, three of them being of the 22 ohm type and two having 1.7 ohms resistance, and two having 3.5 ohms resistance. The connections must be made as shown or the circuit will not work. This circuit applies only to tubes drawing one ampere or more for filament current. The remaining connections of your receiver will be the same. The small fuse shown in the positive filament lead should be about 1.25 amperes, which will blow out if anything goes wrong, and will save your tubes from burning out. The use of No. 14 soft drawn copper wire is recommended for the filament circuit, with each wire insulated suitably with rubber covering or spaghetti tubing. All parts of the filament circuit should be firmly soldered, so that the resistance of the entire system is not raised.

F. J., New York City, N. Y.

Question: I have built a crystal set such as you described in RADIO AGE for January, and found it to be very selective. All in all, I have constructed about eighteen crystal sets, of all different circuits, but have never been able to get a DX station. I have concluded, after much experiment and reading, that the hookup, aerial and crystal are not of prime importance in the process of long-distance crystal receiving, and contend that it is in the ground connection the secret lies. I have not been

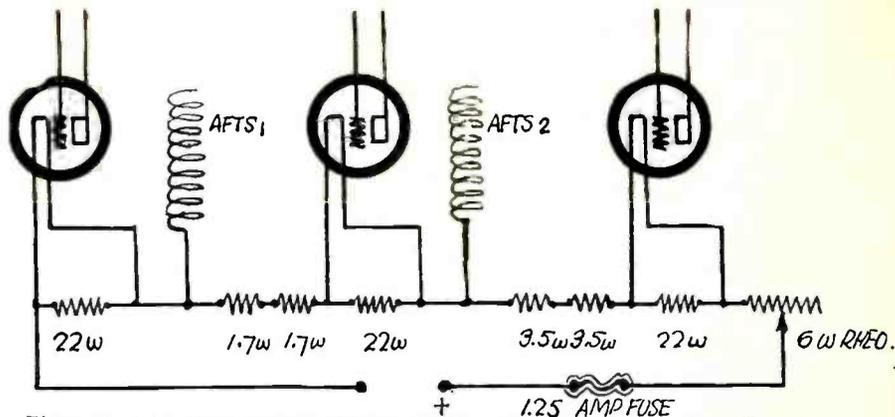


Figure 6. The direct current of farm-lighting systems may be used for filament current if the filament circuit is properly protected with adequate resistances. AFTS 1 and 2 are the secondaries of the audio frequency amplifying transformers of the first and second stages, respectively. The resistances, indicated by the jagged lines, must be placed as shown or the circuit will not work. The rheostat designated should have a resistance of six ohms, and the one and one-fourth amp. fuse shown should be used to protect the circuit, in event anything should go wrong. This circuit cannot be used with tubes drawing less than one ampere, as it will burn out the filament.

able to use a short ground as I live on the top floor of an apartment house. I have a lead from my set to a waterpipe, the wire being about five feet long, but the waterpipe runs around the house for about fifty feet before it enters the ground. I conclude that this makes my ground lead fifty-five feet long, which would be rather long. What is the longest ground lead you have ever heard of? Any information you can give me relative to making the crystal set prone to long distance signals will be appreciated.

Answer: I do not agree with you in the matter of the relative importance of the parts of the crystal set mentioned, and want to point out that the aerial and crystal, as well as the tuning system, are certainly of vital importance in contributing to the over all efficiency of a crystal receiver. The ground lead as you mention is probably just as important as the remaining parts of the set. The success of the entire set depends not upon the relative merits of one specific component, it is rather a matter of the total efficiency of the various instruments and departments of the receiver as a whole. I want to call your attention to the article appearing in the March issue of RADIO AGE, which dealt with the construction of an antenna suitable for use with the crystal receiver of the circuit you mention, and desire to point out that the results obtained using this type of antenna was largely a matter of careful study. The crystal you are using should be of the most sensitive nature if long distance stations are desired, and the tuning component of the set should be constructed with great care if results are to be attained. You might try the use of a counterpoise, consisting of wires strung directly under the antenna, as near to the ground as possible. You might place them in the basement of the house you are living in. The counterpoise is nothing more than another aerial, carefully insulated from the ground, and having as many wires in it as space will permit. The ground post of the receiver is connected to the counterpoise instead of the conventional ground connection. The large broadcasting stations located on top of high

buildings, where an efficient ground is not accessible, use this method of obtaining a ground connection with very good results. The same applies to aeroplanes. About the longest ground lead ever brought to my notice was that of an amateur who lived on the twentieth story of a city hotel, who used the water-piping system of the building for both receiving and transmitting ground. He used a two-tube receiver of the honeycomb type, and a transmitter of the spark type, and queer as it may seem, he obtained very gratifying results.

I would attribute a great deal of his success to the fact that he was located in such a high position that the resistance and the unfavorable conditions due to the use of the waterpiping ground were just about a standoff. However, the success of a receiver, no matter what kind of circuit is used, is dependent entirely upon first the choice of instruments, next the construction and design, and last the character of antenna and ground or other collector system used. Probably one of the most overlooked factors of prime importance is intelligent and painstaking operation.

G. R. Lyons, Iowa.

Question: I notice in your October RADIO AGE, a circuit which was devised by one of your readers, O. Tuck, of Grimsby, Ontario, Canada, and want to say that this is just the type of circuit I am looking for. I would like to know if Mr. Tuck has any trouble in receiving the new wave allocations, and what size of wire is used in the construction of the Reinartz coil. I am using a hookup of the Ultra-Audion type as described in RADIO AGE, and am having very fine results with it. I am using the W D 12 tube. How would two stages of audio frequency amplification be added to this set?

Answer: The September issue contained information relative to the loading of the Reinartz receiver, enabling the operator to easily tune in the higher wave lengths now in use. In winding the coil, use number twenty-six cotton enamel covered wire. I am printing in Figure 4 the connections for a two-stage amplifier with the Ultra-Audion circuit.

Little Things That Help

Tube Socket Unnecessary

Many experimenters have found themselves in a position where everything to make up a set was on hand excepting one of the most necessary (supposedly) accessories. Often this happens to be a tube socket.

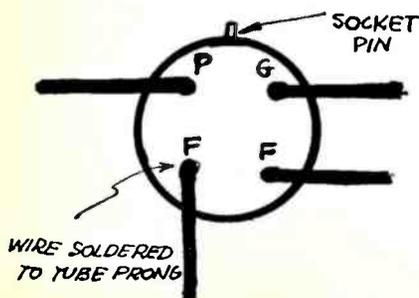
Here is a little scheme which will enable you to forget the added expense of the socket, together with the losses, and at the same time forget about this adapter business.

There are four prongs on the base of all the standard tubes of today. Two of these prongs make contact with the filament of the bulb, and two others go to the grid and plate elements of the tube. With a small flashlight battery, test out the various posts until the bulb lights. You are then making contact with the two filament prongs. Mark them F for further reference. Now on the WD 11 tube, the plate prong is the largest, and therefore the remaining one must be the grid post.

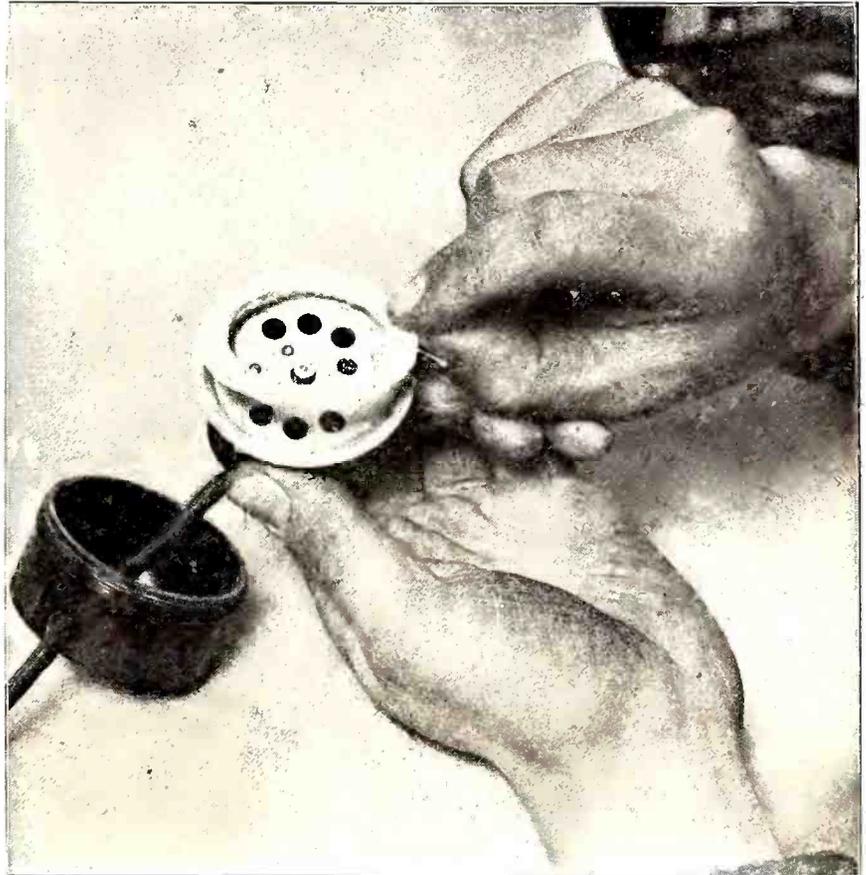
On the other valves which use the standard tube socket, the arrangement is different; so to reduce any doubt as to connections of these prongs, we are printing in Figure 1 the polarities or rather respective values of the prongs of the standard bulb.

Mark all the prongs as shown, and then proceed to hook up the circuit you are working on. Here is where you save.

Instead of making the connections of the bulb to a socket solder them directly on to the prongs of the tube. The contact is positive,



the capacity losses of a socket are eliminated, and there is no chance of anyone "swiping" your bulbs.



If there is a rattle in the phone when it is used as a loud speaker, the trouble may be eliminated by placing a cardboard disc over the diaphragm as shown in the photograph. The cap of the receiver should then be screwed on until the quality of the tone is best. (Kadel & Herbert.)

Even little Johnny, the smallest member of the family would hardly work them loose and throw them on the floor to hear them go BOP!

Of course it is necessary to use a heavy wire to keep the tube from slopping all over the set as soon as it starts to oscillate, and number 12 or 14 hard drawn copper or number 14 copper bus bar is recommended.

The tube should not rest on the glass tip, but should be in the inverted position, being held rigid by the stiff wires soldered on to its prongs.

Here is an ideal method of shortening up those connections on that new radio frequency receiver you intend to build. The short connections effected are quite a gain.

Why Burn Your Fingers?

Many are the times when experimenting with a new circuit that the patient, meek, and otherwise silent, radio bug bursts out with a string

of invectives, putting an injured finger into his mouth, allowing a soldering iron to roll unheeded onto the floor, all because the variocoupler or coil taps wouldn't solder on to the switchpoints, and the finger was used to put them on while the solder was still liquid.

If you want to save yourself the embarrassment of vehemently voicing your opinions of soldered switchtap contacts, try this simple but nevertheless effective remedy.

Instead of screwing the entire switchtap fast to the panel before you solder the connection, carry out the simple idea of first soldering the wire from the tap onto the small nut of the switchpoint. In doing so, hold the small nut in the jaws of a wide-jawed electrician's pliers, and avoid getting any solder into the threads of the nut. Make a good, strong connection with the solder, and then wipe the surplus flux off with alcohol.

Then take the soldered tap and nut and placing the switchpoint through the hole in the panel, start to turn the switchpoint holding the nut from turning with a pair of pliers. Tighten the switchpoint by taking the pliers (when the switchpoint is as firm as you can get it with your fingers,) and giving the round part of the point a quick twist, which tightens the whole business.

Antenna Facts

By Beverly Dudley, Member A. R. R. L.

A SHORT antenna has the advantage over a long antenna inasmuch as the shorter antenna permits sharper tuning, i. e., the short antenna permits the operator to select the desired station more readily than a long one would. For this reason, owners of short antennae often get results superior to those obtained on a long antenna. For the reception of broadcasting stations operating below 350 meters, a shorter antenna than was formerly used is necessary. It would be a very good idea to keep the total length of the antenna—this includes lead-in and ground lead—under 100 feet so that amateur signals from American Radio Relay League stations may be received as well as amateur broadcasting. For best results the antenna should not exceed 120 feet for broadcast reception, or eighty feet for amateur reception.

Effective Height

Apparently the height of the aerial makes little difference to most radio fans. A very high one will be able to pick up more radio frequency energy than a low one; however the high aerial, beside being able to pick up fainter signals, also collects more static, which may seriously interfere with reception, so that too high an antenna is to be avoided. It is the effective height of an antenna that counts; not always the height above ground, but ten feet above a grounded tin roof, would have an effective height of ten feet, not fifty feet.

Insulators

The antenna wires should be kept as far away from the aerial supports as possible. The antenna insulators should be of a good grade and should be so designed that they do not absorb water, and have low capacity between their terminals. Glazed porcelain insulators are the best with genuine electrose second. Avoid purchasing porous or unglazed porcelain, or cheap imitation composition insulators. Keep the antenna insulators clean and preferably replace them every year; they don't work so well when dirt gets an inch-thick on them. The long thin-shaped insulators are better than short, thick ones, as the capacity is much lower. See that the lead-in enters the house through a good porcelain tube, and that it does not touch the house other than at insulated points.

Amplifier Advice

USE the proper transformer on a certain tube.

Grind the cores of the transformers, even if they are shielded, separate the transformers about 3 or 4 inches and place the cores at right angles to each other.

Do not apply more than the specified voltage on the plates of the tubes.

Use a lower ratio transformer for the second stage, if the second stage amplifying tube is the same as the first.

Use a five watt tube for the second stage, increase the B battery voltage and use the proper C battery voltage for this tube.

See to it that the proper voltage is being applied to the filaments of the tube.

Make all the connections perfect joints, and well soldered.

See to it that all the connections between the tube prongs and the socket contacts are perfect.

Connect the grid and plate to the proper leads of the transformer, i. e., when the outside lead of the primary is connected to the plate the outside lead of the secondary should be connected to the grid.

Shunt the primary of the first stage with a fixed condenser of about .001 mfd.

Shunt both the A and B batteries with a large fixed capacity, say, .5 mfd.

Have you ever considered how much longer you could use the storage battery before recharging if—

You would not demonstrate the power of the battery by shortcircuiting the terminals and showing the heavy spark you can thus obtain.

You would make perfect connections between the filament leads and the battery terminals.

Corrosion

The antenna should be a wire conductor of large area and should be selected with care. Flat copper ribbon, copper stranded cable and large size copper wires are all good. Don't use iron wire that has a mere film of copper plating on it. Copper-plated iron wire is used much, but in view of the fact that copper wire is so cheap, it would be advisable to use number twelve or fourteen copper wire throughout the entire antenna system. Insulation on the antenna wires is beneficial inasmuch as it prevents corrosion to the wires, and does not detract from the general efficiency of the aerial.

Be sure to solder all joints in the antenna. A well designed antenna and ground system contributes materially to successful reception.

Never Too Old

Age is no bar to a complete enjoyment of radio program Frank R. Wiley of Malden, Mass., wrote WGY, the General Electric Company station as follows:

"Say, that was a corker last night. I have a single tube set about the size of a cigar box and get most of 'em as far as Chicago. Have had seventy birthdays, so haven't long to stay, but am going to get what I can while the getting is good."

One-Wire Antenna

Recent exhaustive tests with one wire antenna on merchant vessels have demonstrated the practicability of using a single wire for low power transmitting purposes as well as for receiving. Aboard ships this feature would eliminate cost, space and weight. It would make the necessary lowering of the aerials on cargo vessels during loading much easier, and reduce the necessary insulators, wire, spreaders, etc. Also the single wire aerials could be hoisted higher than a three or four wire antenna.

Amateurs who have no facilities or cannot afford to erect masts high and strong enough to carry a heavy four-wire aerial, should find the single wire of considerable benefit when using one kilowatt or less power; for two kilowatt transmission, it is said the single wire antenna is not to be compared with larger antenna.

Most every one knows that the single wire aerial picks up less interference. Its efficiency in transmitting is not quite as great as a four wire aerial, but experts believe the decrease in cost, weight and ease of handling would compensate for loss in efficiency.

The recent tests included the use of both inverted L and T type aerials, and several forms of wire. A four-strand wire cable twisted over a manila rope core was found most satisfactory.

MacMillan's Message

After completing a wide curve across Canada and back over the United States, a recent radio message from Captain MacMillan, in winter quarters in North Greenland, was delivered forty-eight hours later to his secretary in Boston, through the traffic system of the American Radio Relay League.

The message was received in Hartford, Conn., in the early morning by Boyd Phelps of the technical staff of the C. D. Tuska Company. Unable to work amateurs in Boston on account of approaching daylight, he gave the communication to Edwin Adams, advertising manager of QST, who was leaving for that city in a few hours. Upon his arrival, the latter delivered the North Pole message in person.

Due to peculiar atmospheric conditions affecting reception the routing of the message was through Jack Barnsley's amateur station at Prince Rupert, B. C., and thence to the station operated by Glenn West, 7ZU, at Polytechnic, Montana. He tried to give it to amateur station 9BAB without success, but luckily it was picked up by Phelps the first time it was sent.

Silent Night

Chicago woman, on a Monday night, exhibited new radio set to woman guest.

Guest asked: "What is coming in, now?"

Hostess said, "It is silent night."

"Oh, goody!" exclaimed the guest, "I have loved that ever since I heard Schumann-Heink sing it."

With the Radio Manufacturer

New Type Head-phones

Contending that the true index of power of an electro magnetic device depends upon the number of ampere turns embodied in the windings, the Penberthy Injector Company of Detroit, Mich., has departed from the conventional system of using only one or two magnets in their new headset. The new type of phone uses four electromagnets, with each coil wound to 1,000 ohms resistance. The permanent magnets are built up of two laminations. Total resistance of the phones is 4,000 ohms, and each set is matched at a frequency of 800 cycles.

Especial care has been taken in making the phone cords of positive contact and nonbreakable character. The head-band is finished in soft leather of dull black finish, and the entire headset is lightweight.

The Penberthy four pole, 4,000 ohm headset has been tested and approved by RADIO AGE experts.

Warren Radio Loop

Extensive tests carried on by the RADIO AGE institute find the Warren Radio Loop to be of merit in the matter of receiving local stations. The loop when tested out at the RADIO AGE Laboratories picked up in less than an hour stations from distances as far as fifty miles with practically the same audibility as that of a regular antenna. The set used in conjunction with the loop was a detector and two-stage outfit, similar to the one shown in the April issue of RADIO AGE.

Tuning with the loop was very critical, the stations being received on just a minute change in the secondary condenser. The loop is a very compact instrument, measuring not over 8x8 inches,

and provides connections for wave lengths from 200 to 1,000 meters, by a series of binding posts and jumpers which can be opened and closed to suit the operator.

The instrument should prove a popular piece of apparatus with the amateur who has trouble in getting an aerial erected, or who builds a superheterodyne or other receiver of high-power type where a loop is used.

It was received by RADIO AGE in good condition, and contained explicit printed instructions as to operation and proper use.

Practical Radio Lessons

An entirely new and exclusive method of instruction in radio has been formulated by the American Radio Association, 4513 Ravenswood Avenue, Chicago, of which G. A. Mohaupt is engineer. The biggest difficulty in teaching radio by mail was the inability of the student to grasp the practical as well as the theoretical side of the subject through the means of charts and pictures alone. The American Radio Association gives with its course, a radio outfit ready for,

wiring. The student is taken step by step through all the phases of radio. He works on an actual radio set and his education, therefore, is of practical value. He is not given mere book learning but he learns by actually doing. Many graduates of the American Radio Association earn considerable money during their spare time by constructing and installing radio sets for their friends and neighbors.

Applause Card

One of the hits of the Radio Show held in New York during the week of October 6 to 13, was the distribution from the booth of the Dictograph Products Corporation of envelopes containing five applause cards.

These cards have been received with the greatest enthusiasm by the radio public, as it gives them for the first time, in a simple form, a means of showing their approval or disapproval, as the case may be, of the programs being rendered by broadcasting stations.

The applause card was originated by the Dictograph Products Corporation.



Dr. Lee DeForest examining radio equipment on the S. S. "Paris," on which ship he returned recently from Europe. (Kadel & Herbert.)

Hints on the Adjustment of Radio Receivers

By L. W. CHUBB

Manager of Radio Engineering Department, Westinghouse Electric & Manufacturing Company

RADIO broadcasting should be governed by rules and etiquette which will enable everyone to get the most enjoyment from it. We hear many people speak of the invisible audience, but how many visualize this audience and appreciate that others in the audience have any effect on their own results or that they, in any way, affect the reception of others.

The fisherman or the golfer obtains equipment best suited to his individual needs, and learns to use it effectively by instruction or experience. He may or may not interfere with the pleasure of other sportsmen. He is expected to follow a code of etiquette. In the theater large hats are removed in consideration of those behind; at the ball game a "down in front" is forthcoming if one interferes with the vision; and in the town meeting we do not put up with the noisy individual in the audience who interferes with his neighbors by radiating his opinions.

After a slight consideration of each one's part as a member of the radio audience, it will be appreciated that corresponding conditions exist and that radio receiving must be played as a gentleman's game.

The Wireless Shadow

A radio receiving station consists of some form of antenna connected to a radio receiver of one of several types. The antenna intercepts the wireless waves and absorbs an amount of energy dependent upon the size of the tuned antenna and the conditions of operation of the radio receiver. The waves induce currents in the antenna circuit which reradiate energy from the antenna. Each station then takes from the passing waves an amount of energy equal to the difference between the energy intercepted and that reradiated. It is evident, therefore, that each station may cast a sort of wireless shadow and thus reduce the strength of signal left for those in the back seats of the vast audience.

Our great auditorium, unfortunately, has the cheap seats in front. Around each broadcasting station are thousands of listeners using crystal receivers which require the most energy, re-radiate the least, require the largest antenna, and therefore cast the greatest shadows beyond.

An important hint therefore in the operation of a crystal receiver is to de-tune the instrument when it is not in use. This does not mean that the adjustment of the crystal need be disturbed—merely move the tuning adjustment to one extreme or the other. An antenna out of tune casts no shadow.

In addition to the crystal receivers in our radio audience, there are thousands of vacuum tube receivers used at various distances from the transmitting station. These fall into three general classes: The simple tube set without regeneration; the regenerative receivers;



Chewing gum while listening-in with the phones clamped tightly to the ears, results in the ears assuming a shape much related to a cauliflower and imparts to the jaw a delicate tinge of black and blue.

and the receiver with radio frequency amplification, usually working with a loop antenna.

The first, or simple tube set, owing to its lack of sensitivity, can be used effectively only within a short distance of the broadcasting station. This type of set is usually simple to operate, requiring only the adjustment of tuning after the filaments of the tubes have been lighted.

The regenerative receiver is the most common set in use and, on account of its high sensitivity and selectivity, when properly used will be found to be the best all around radio receiver. It is this type of receiver that I particularly wish to refer to. Many operators attempt to use such an instrument with the same large antenna that was used with a crystal set, and thereby lose the advantages of the receiver.

They wonder why the receiver picks up several signals and apparently will not select one alone. The trouble is with the antenna. The sharp selective tuning of a regenerative receiver can

be taken advantage of only with a small antenna. It is not necessary to use a double circuit receiver to obtain satisfactory results and prevent interference.

Nearby Broadcasts

Theoretically, with a small antenna the same strength of signal can be obtained at the best point of adjustment of tuning and regeneration. Practically, the adjustments can be made so close that no appreciable signal is lost and the sharpest of tuning is obtained. If one is troubled by the reception of two or more nearby stations at the same time, a small indoor antenna should be used across the top of the room or of the room above.

This will allow the separate selection of signals, unless they are on almost the same wave length, and, with little practice in adjusting the instrument, distant signals can be picked up readily and satisfactorily. To obtain the best results with the regenerative receiver the operator should use only the pre-

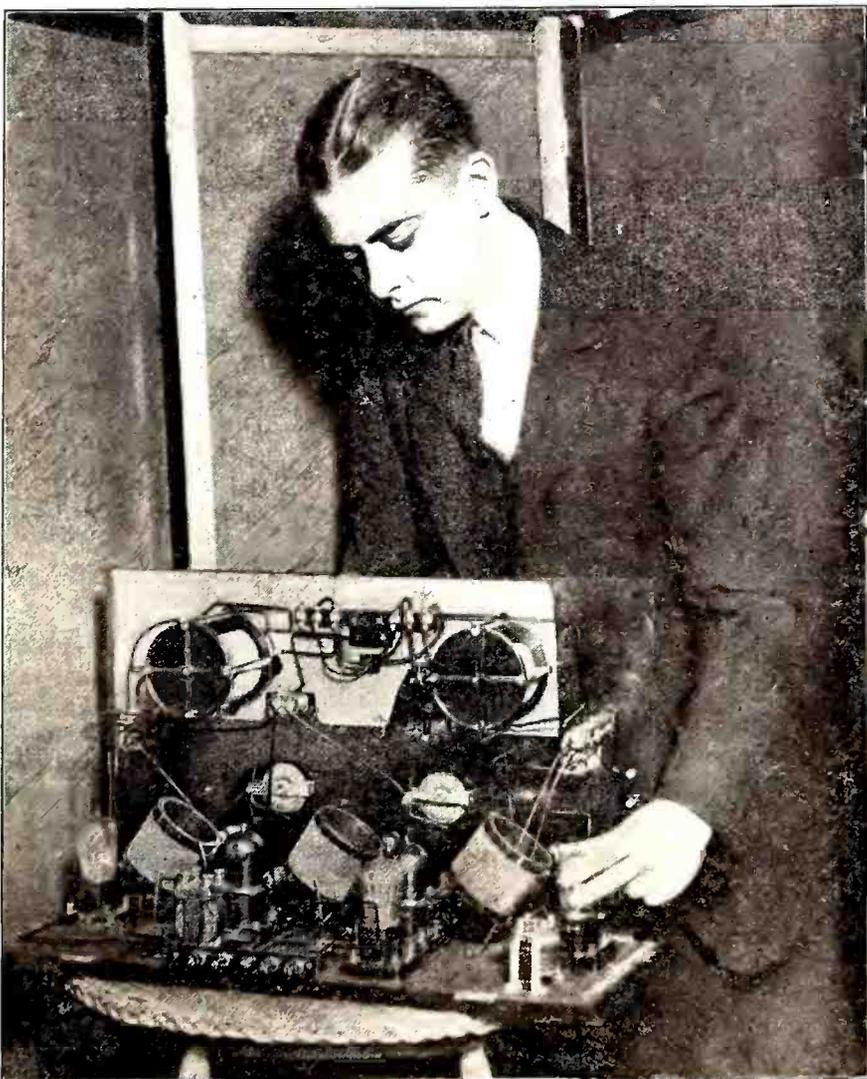
ferred methods of adjustment, and I wish to call attention to some of the important things to be considered in the operation of this type of receiver.

Most of the users of the regenerative receiver know that it has an Armstrong circuit, and that by the adjustment of a "tickler," "intensity regulator," "plate variometer," or "regenerator," whichever it may be called, the signal can be increased greatly. They know also that at a certain point the detector will commence to oscillate and the receiver will omit whistling noises or beat notes, as they are called, when the tuning is run through an incoming wave. Few of those using this type of receiver, however, know that these whistling noises can be heard in a neighbor's receiver and that similar noises which are heard when a set is not being adjusted are caused by a nearby receiver improperly adjusted.

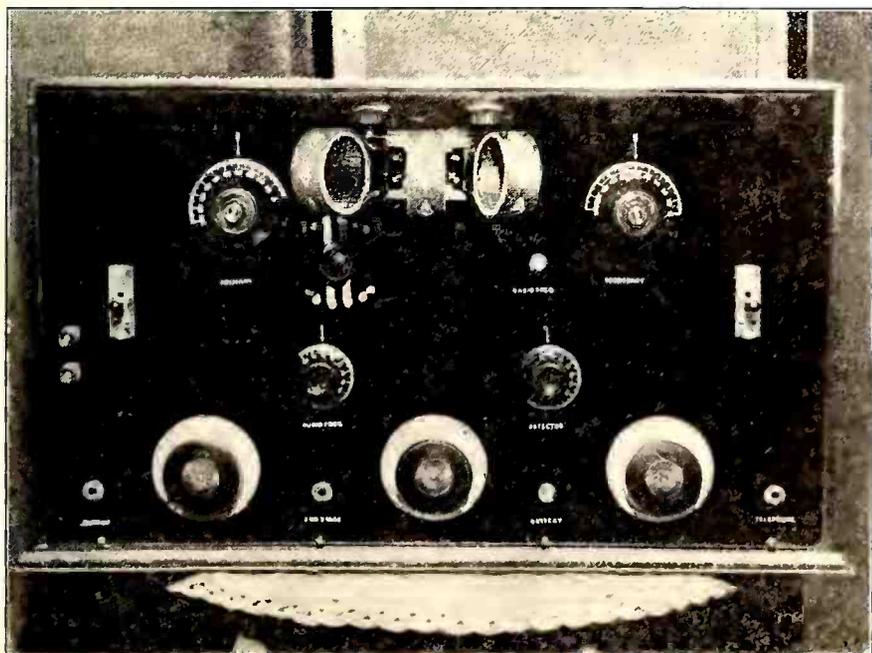
As regeneration is increased the amount of reradiation from an antenna increases until, at the point just below oscillation, the reradiation is equal to the absorption, the loudest clear signal is received, and the receiver neither disturbs a neighbor nor absorbs any appreciable energy, which can pass on to the more distant listeners.

Booster Stations

The most common infractions of radio etiquette are the use of regenerative receivers while oscillating and the hunting of signals by picking up the carrier wave with the detector tube oscillating. Most radio operators have found that by careful adjustment the "beat note" can be lowered in pitch to a central point where the noises stop and a signal can be heard with the tube oscillating. This adjustment is known as the method of "zero beat reception." Under this condition, a receiver radiates more energy than it absorbs so that the station can be considered as a booster station which will reinforce a passing



Rutledge R. Mayo and his combination honeycomb coil and neutrodyne radio set. It consists of a three-circuit honeycomb set for long wave reception and a neutrodyne set for short wave reception, all mounted on the same panel. The same tubes are used for either receiver. (Kadel & Herbert.)



A closeup of the combination three-circuit honeycomb and neutrodyne set. (Kadel & Herbert.)

radio signal. If such booster stations were properly located and the adjustments could be made so as not to produce any distortion, this method of receiving might help reception conditions. This, however, is not the case and zero beat reception should be avoided.

It will be found that the quality of signal is greatly impaired under this condition of adjustment. It is evident also that getting in and out of the "zero beat" adjustment will cause disagreeable noises in the neighborhood and even when the adjustment has been obtained many snorts and grunts are produced by the slightest change in the wave length of either the transmitting station or the receiver.

In hunting signals it is a common practice to have the detector tube oscillating and then, after finding a carrier wave, to lower the regeneration to a point below oscillation to clear up the signals. This practice disturbs others who may be tuned to the same wave and is an unsportsmanlike procedure that ruins their enjoyment of radio broadcasting.

The Proper Method

I should like to suggest the following method of receiving broadcasting programs with regenerative receivers. After adjusting the filament currents of the vacuum tubes to a point which has been found to be satisfactory increase the regeneration to a point just below oscillation. Now tune the set slowly up or down the scale, keeping the regeneration adjusted just below oscillation until the desired signal is heard or a breathing sound is noticed, indicating the presence of a carrier wave from a station which may not be operating at the instant.

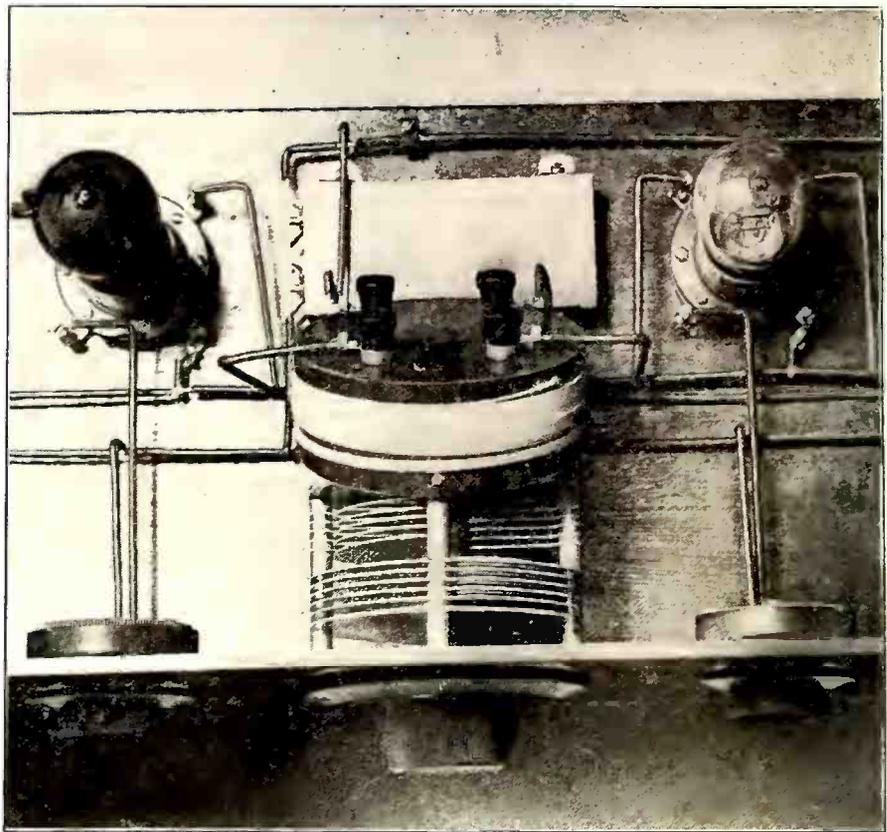
If the receiver is well designed the adjustment for regeneration will be practically the same throughout the range of broadcasting wave lengths and any worth while signal can easily be tuned in, after which the volume can be increased by a final adjustment of the regeneration.

You will soon be able to pick up signals just as easily by this method as you can by the beat note method. If everyone will hunt signals and listen to the music with the detector tube adjusted in this way, the quality of broadcast programs will be very much improved. The gurgling, rough, and distorted music which is now heard, in a large part is due to the reradiation from many oscillating receivers, will disappear. The whistling noises which go up and down the scale, due to a neighbor's hunting signals with an oscillating receiver, will be eliminated. The steady screaming notes which are heard at or around the signal from a broadcasting station are due to interference between two or more broadcasting stations and cannot be eliminated until a great number of these stations are closed up or are given individual and separated wavelengths.

Chile Is in Line

Another step was taken in the development of radio-telephony in Chile recently when for the first time a conversation was held between a private broadcasting station, belonging to a Chilean amateur in Vina del Mar, on the Pacific Coast, and Tucuman, Argentina. The Vina del Mar station was distinctly heard in a radio club in the latter city at midnight, whereupon conversation was kept up for over an hour. A few days later, conversation was established between the Chilean coast and Buenos Aires. Musical programs from the Vina del Mar station were also clearly heard on board vessels traveling along the Chilean coast.

The number of Chilean amateurs has been growing for some time and not a few have installed apparatus in their homes. Attempts to commercialize radio interests have been rare and half-hearted heretofore, but a strong business organization has been formed in Santiago under the firm name of "Compania Radio-Chilena," for the purpose of installing an up-to-date and adequate broadcasting station on the roof of Santiago's single skyscraper, the "Edificio Ariztia."



Another tuned radio frequency picture. The radio frequency transformer's location with reference to the condenser is plainly shown. Walter S. Lemon, the designer of this outfit, gets distance with a loop aerial. (Kadel & Herbert.)

Jack Barnsley

Prince Rupert, B. C.—Starting off with a queerly constructed homemade radio receiver that would be the laughing stock of the most uninitiated present day radio fan, Jack Barnsley of this place now has a high power amateur station that has made him the only connecting link between the Arctic explorer, Captain Donald D. MacMillan, and the whole civilized world.

Beside being peculiarly well situated to receive messages from the little schooner, "Bowdoin," in winter quarters at Refuge Harbor, he has a radio receiving set and antenna installation that compares favorably with some of the best stations in the United States.

It was sometime in 1910 that Barnsley thanked his lucky stars for the good fortune that had brought him a Bell telephone receiver, a dry battery, a couple of carbons and a hatpin with which to build his first radio apparatus. He made his coil from some stray wire, headphones from the single receiver, a detector from the carbons and the steel needle, sharpened to a fine point, for the movable part.

A few years later and Barnsley was working for the Marconi Company as a wireless operator on coastwise steamers, finally on board the "Empress of Russia" when he visited Japan, China and Manila. A recruiting sign for the Royal Air Force attracted his attention in 1917 and there followed a "hitch" as instructor in the army.

Since he established communication recently with the Arctic vessel after weeks

of complete silence, he has received scores of messages from members of MacMillan's crew and sent them on to relatives and friends in the states by means of the traffic system of the American Radio Relay League, of which he is a member. He uses an improved type of regenerative receiver with two-step audio amplifier.

Radio Jumps Mountain

Radio is being used successfully in India to send messages over a mountain 15,000 feet in height. Previously, considerable difficulty was found in wire communication due to heavy snowdrifts and storms which severed the lines. This achievement has been effected between the cities of Srinagar and Jammu, in Kashmir. Other installations have been effected or are planned in Bhopal, Gwalior, Hyderabad and Rejkot, by Marconi engineers, Trade Commissioner Spofford reports to the United States government from Calcutta.

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How to Copy Wireless Code Signals

By FELIX ANDERSON

Technical Assistant Radio Age, and Kendall North, Radio 9BDL

Installment Two

ASSUMING that you are now so familiar with the sounds of the various code characters of the radio telegraph alphabet, that when the sounds DAH DAH DAH DAH di DAH are issued you will recognize them as O. K. within a reasonable time limit, we will proceed with the next steps toward making you a proficient operator as far as code copying is concerned. If you find that you are having trouble in recognizing the various letters, we would advise your spending a little more time and effort on them, as in this case, a little too much is a great deal more beneficial than not enough.

Now that you have the accents, sounds and construction of the code character firmly placed in mind as a musical sound, the next step will be to familiarize yourself and train your arm to repeat these combinations with a key.

You will now need a few pieces of apparatus; namely, a key, buzzer and source of power. The key should be chosen with care, and we would advise that you do not purchase a makeshift affair, inasmuch as from our experience we know that you will undoubtedly "fall" for the transmitting game sooner or later, once you have learned the code, and then you will agree with us that it is certainly *dididAHdit DAHdididit*, (FB or fine business) to have a creditable key handy. The buzzer can be purchased from your local hardware store, or can be of the high-pitch type, which is procurable at any radio store. If a high-pitched buzzer, sometimes called high frequency buzzer, is used, it will be necessary to use direct current from a local storage battery, but if an ordinary buzzer is used, the 110 volt house lighting current, stepped down by a small toy transformer may furnish the juice. A key which is very popular with the amateurs, called the Boston key, can be procured at almost any good radio store which handles transmitting apparatus.

Selecting the Tone

Connect up the apparatus as shown in Figure 1, and then proceed to adjust the buzzer for the best tone. A smooth, soft, easy to read, tone is the best, and the ear of the person using the apparatus can best judge this. The high frequency buzzers usually have an adjusting screw provided for changing the note of the buzzer, but the plain house buzzer, of the type procurable at the hardware store, will take a little closer adjustment for a nice note. This may be accomplished by placing a few pieces of fine paper between the armature or vibrator

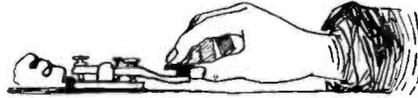


Figure 2. This illustrates the correct position of the hand when sending. The wrist should not touch the table, and the heavier muscles of the forearm should do the work, the finer touches being made by the more delicate muscles of the wrist and fingers.

pieces, to take any harsh sound away.

After you have adjusted the buzzer to the best tone, the next matter will be to set the various screws provided on the key to suit your individual fist. The key should just have enough tension or spring to bring it up with easy break, but should have sufficient spring to make smooth sending possible. The best key adjustment will be found after a few hours' practice. The spacing should be just a little less than 1-32 of an inch, or sufficiently wide to prevent arcing of the contacts.

Get yourself seated in a comfortable chair, at a table or other firm support, that is plenty wide to allow you to place your entire arm from the elbow down on the table. With the index finger and middle finger placed loosely but firmly on the key, with a slight curve press the key down firmly, and then release it. The key when released should follow your fingers back to the original off position.

If it does not, the key is needing a little more spring, and should be adjusted to assure smooth working. When adjusting the key, the signal *dididAHdit*

or the word "test" is usually sent, and if difficulty is experienced in snapping off the dits smoothly, the key should be so arranged that it becomes possible to do so. The entire forearm should be relaxed, and the fingers, while firm, should touch the knob lightly. The habit of sending with the forearm relaxed should be cultivated, inasmuch as sending with the arm "cramped," or rigid, will result in what the amateurs dub "glass arm" or "pumphandle fist."

Starting to Send

Take a piece of newspaper, choosing some item of interest, which contains some numbers and all the letters of the alphabet, and putting yourself in the frame of mind of an operator of a high-power long-distance station, with thousands of receivers tuned in on your wave, start to send PX (press), consisting of the newspaper item you are sending from. If you come to a dollar sign, spell out the word dollars preceding the number. If you come to a comma, omit it, and when you encounter the end of a sentence, merely make the space between the last word of the preceding sentence and the first of the next sufficiently long to show appreciable difference from the spacing of the words.

When you are sending, see to it that at no time your fingers touch the metal of the key. There will come a time later when you will have about 100,000,000,000,000 volts or more passing through the key circuit, and the sensation is not one of pleasure, when direct contact is made. Don't forget to use the wrist movement.

Send slowly—If you speed up your

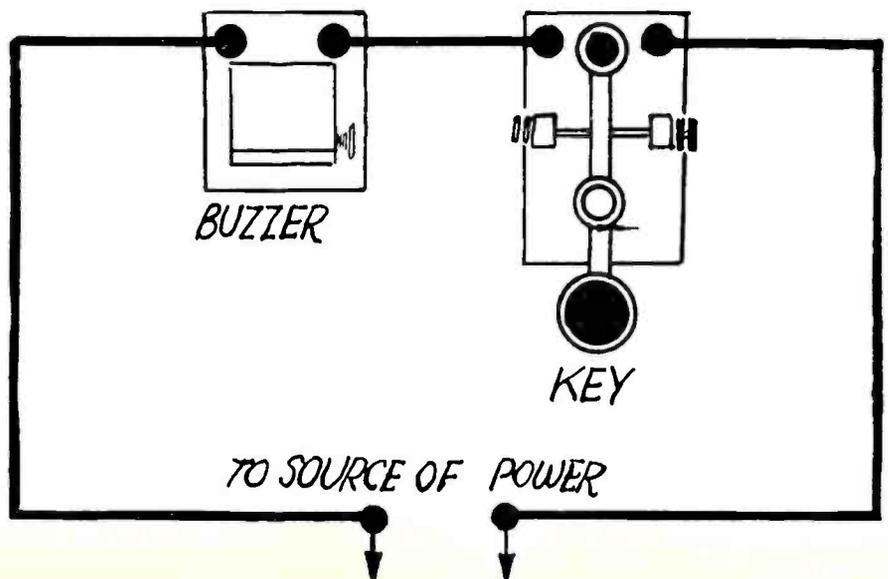


Figure 1. The circuit for the key and buzzer.

transmitting before you really know how to handle the key, you will only acquire jerky, ill-spaced sending, and nothing will be accomplished. Make your dashes three times as long as your dots, and longer if you find trouble in making the sending smooth. The dits or dots should be snapped off with a quick movement of wrist and fingers combined.

A word as to the proper accent of the individual characters as they appear in a word or sentence is probably the next thing to be considered. Between some characters such as S and H and T and M or O, the space will have to be somewhat emphasized to prevent the combination from being confused. The spaces between the letters of a word, should be about one-third of that of the spaces between words, and the spaces between the words of a sentence should be about a third of the space between the spaces separating the sentence. We will once more call your attention to the proper accent of the DAH components of a character, namely in the case of the letters C and N. The letter C should be sent *DAHdiDAHdit*, making the characters sound as a part of one letter, while the combination N N should be sent *DAHdit*—DAHdit with an emphasized space between the two letters. One can readily see how this precaution will prevent the sound from being confused. In any case where this double combination appears, this rule applies, and it also holds for characters where a series of dots or dashes composing the characters of a letter appear in close sequence. By all means, send slowly, as slow sending always results in the proper formation of the characters, and later develops into a smooth, easily read "fist."

Correcting an Error

If you make an error in transmission, the proper way to correct it is to send *didi DAHDAH didi*, the sound for the interrogation point, and then to repeat the entire word in which the error was made. The old way is to send a series of fast dots in quick succession, but among amateurs the interrogation method has almost entirely superseded this method.

One of the reasons we emphasize the fact that one should not send faster than he can receive, is explained by the tradition among amateurs that the person with whom communication is being carried, will, if he is a good operator, not send any faster than the one with whom he is talking.

Give yourself plenty of practice with the key, as it will assist you immensely in copying signals later on. About a week of practice for a starter before attempting to copy regular transmission over the air is a good plan, as you will then be more likely to recognize any errors in your sending. After you have worked out this phase of code learning to your own satisfaction, the next step will be to proceed with the interesting business of

Actual Code Copying

It will probably appear to the reader who has started the business of learning

him through a great many unnecessary preliminaries, but we want to assure you that every one of them is vitally necessary in the course of the making of a good operator. This next step is the real test of how much you have applied yourself to the foregoing procedure, and is also a test of your patience, perseverance and application.

Scare up that piece of paper you used in the first steps of learning the code, and get yourself a pencil to copy with. We will assume that you have a receiver capable of tuning down to 200 meters, and that you know almost exactly where the amateur "offenders(?)" come in.

Before we go further, we want to tell you right now, that you shouldn't be disappointed if you can't copy everything that comes through the receivers—there are times when the most expert of us can't do it. Some of the traffic going through is snapped off at a mighty lively rate—about twenty-five or thirty words a minute—and you have to step kinda lively to cross your T's and dot your I's when copying. But on the other hand, you can always single out some fellow who is going along at a rate more your size, and that is the one you should start on. At any rate, don't let yourself become disappointed—here is where the real trial comes in.

Choose one of the signals of code that is going at a speed that enables you to recognize some of the letters as the sending goes along. Tune the signal in to the loudest point, and then start to put down just what you hear. Copy the letters as they come in, reading about two or three letters behind the sending, i. e., you should acquire the habit of reading slightly behind the key.

By this we mean that you should be putting down the letter you heard two or three letters back while you are reading the ones that are being sent. If you find that this is too far advanced for you then merely listen hard, putting down the ones that you recognize.

Copying Calls

The best practice for this is to listen to some station calling, inasmuch as when a station is calling another, the transmission rules require that the one calling shall send the call of the one being called three times followed by the sign DE and then sign his own call three times. This it can be readily seen offers much chance for the beginner to correct mistakes in copy, and get the entire transmission correct. Calls will probably be the first code signals you will be able to recognize, and therefore you will probably start to find it interesting. If when you are listening to this process of calling, you miss a letter, copy the next one—don't stop, as when the call is repeated you will be able to put in the missing letter.

As you progress with your receiving speed you will find yourself copying signals that are meaningless as far as making sense out of your copy is concerned. You find that you have the entire transmission correct as you know that you have written down just what you have heard, but when it comes to

make any sense. So before we lure you any further into this mysterious business, we want to let you in on some of the traditions, abbreviations, conventions and procedures used among the code listeners and senders.

What is Said in Code

First of all we want to tell you that the United States is divided up into nine radio districts. Briefly, we will tell you how these subdivisions come:

FIRST DISTRICT:

Has its headquarters at First District Customs House, Boston, Mass. It includes the states of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island and Connecticut.

SECOND DISTRICT:

Headquarters at the Custom House, New York, N. Y., and comprises the counties of New York, Staten Island, Long Island and those on the Hudson River, including Schenectady, Albany, and Rensselaer of the State of New York; also the counties of Bergen Passaic, Essex, Union, Middlesex, Monmouth, Hudson, and Ocean of the State of New Jersey.

THIRD DISTRICT:

Headquarters, Custom House, Baltimore, Md. It comprises all of the counties in New Jersey not included in the above list; all counties south of the Blue Mountains in Pennsylvania, the states of Delaware, Maryland, Virginia and the District of Columbia.

FOURTH DISTRICT:

Headquarters at the Federal Building, Baltimore, Md. The fourth district includes the states of North Carolina, South Carolina, Georgia, Florida and the territory of Porto Rico.

FIFTH DISTRICT:

Headquarters at the Custom House, New Orleans, La., and is composed of the states of Alabama, Mississippi, Louisiana, Texas, Tennessee, Arkansas, Oklahoma and New Mexico.

SIXTH DISTRICT:

Headquarters, Custom House, San Francisco, California. The states of California, Nevada, Utah, Arizona and the territory of Hawaii compose this district.

SEVENTH DISTRICT:

Headquarters at the Federal Building, Seattle, Wash. The seventh district comprises the states of Oregon, Washington, Idaho, Montana, Wyoming and the territory of Alaska.

EIGHTH DISTRICT:

Headquarters at the Federal Building, Detroit, Mich. The Eighth District comprises all the counties of New York not included in the second district; all the counties of Pennsylvania not included in the third district, the states of West Virginia and Ohio and the lower peninsula of the State of Michigan.

NINTH DISTRICT:

Headquarters at the Federal Building, Chicago, Ill. The ninth district comprises the following states: Illinois, In-

diana, Wisconsin, Minnesota, Kentucky, Kansas, Missouri, Iowa, Colorado, South Dakota, North Dakota, and the upper peninsula of Michigan.

By referring to the above list you can tell what radio district you are in.

The calls of amateur stations are arranged in alphabetical order, classified under the various districts. Thus, if you hear 1CNI you can tell that you are listening to an amateur in Massachusetts, or in the first district. The government when issuing licenses allots a call to each station. These calls are classified in the order of from what district they come from, and are listed in call books similar to a telephone book. Thus if you hear the call, you can readily look up the fellow and find his address.

Ship, naval, commercial and other stations are listed in another call book. Copies of either book may be had by writing the Superintendent of Documents, Bureau of Printing, at Washington, D. C.

Q Signals

International agreement provides for what the amateurs call "Q" signals. A copy of this set of international signals is printed hereafter in this article. The use of these signals is to cut down the verbosity of asking commonplace questions as to operating conditions, traffic, etc., and make the transmission more speedy. When the signal QTC is heard it means "I have a message for you," and reversed or rather interrogated thusly: QTC? it conveys the sentence: "Have you a message for me?" When the signal QRZ is sent, it means "your signals are weak here," and when interrogated QRZ? it reverses the idea and asks "Are my signals weak?" One can readily see how this speeds up the interchange of thoughts concerning the existing operating conditions. We would recommend that every code learner memorize the following Q signals, as they are nearly always used: QTZ? QSR? QSA QRK QRS QSL and any others as the need comes, but the ones above mentioned are sent through the air many times in a day, and therefore to understand what is going on, you should know them.

"Ham" is the term applied to the amateur who is interested in the business of sending code signals. In his everyday life in radio, he makes use of a lot of snappy signals to convey his thoughts over the air, which to the average reader would not mean much. Allow us to explain.

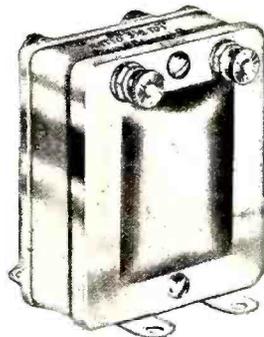
Taking an extract from some of our own pieces of copying, it runs something like this:

tk s fr QSR om ur FB hr vy QSA and stedy nm hr nw so best 73s c u agn sk.
 Could you understand that? No? Neither could we when we started, and every time we heard some new abbreviation we had to run around and get some OM to help us out in the matter of decoding it. Taking the first part of the above extract: tks means thanks, fr means for, QSR relaying, and om means "Old Man." Old Man is a term used among

amateurs in transmission, and is significant of the spirit of good will and friendship existing between amateurs. So you see, the whole thing put together into real language would mean: "thank

you for relaying that message for me, old man"; and the remaining transmission when decoded would read:

"Your signals are fine business here. They are very loud and steady. Nothing



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 "Radio" Want-ads

more here now so best regards, will see you over the air again," (sk) end of transmission.

That's the way the amateur talks over the air. It's almost a language of its own, and to let you on the fun of the game we are printing some of the commonest abbreviations used among code operators:

The signal di di DAH di DAH for O. K.

- 73 for Best Regards.
- wlom for Well Old Man.
- k for Go Ahead.
- Sk for finish of transmission.
- hr or er—here or hear.
- ka—attention.
- no soap—for nothing doing.
- tnx, tks, tku—thanks, thank you.
- es—and.
- msg—message.
- tfc—traffic.
- cul—see you later.
- c—see.
- gg—going.
- u—you.
- r—are.
- ur—you are, your.
- oic—Oh I see.
- rcd, r—received.
- abt—about.
- min—minute.
- fixt—fixed.
- wl—well.
- om—old man.
- dg, yl, ow—refers to a young lady operator, namely dear girl, young lady, or old woman as the case may be. The term ow is only used when the two persons talking are very well acquainted.
- lstn—listen.
- QST—stand by and listen. Copy what I have to say.
- fm—from.
- eo—to.
- spk—spark.
- cw—continuous wave.
- becuz—because.

arrl—American Radio Relay League.
tt—that.

The signal diDAHdi di dit means wait. The signal DAH di di di DAH is the signal sent while thinking, illustrated thusly:

er nr 12 fm chgo eo (address)
(and then the signal ---)
crd. recd. taks. wl qsl.

sg
9DQS

sg—signed.
QSI.—acknowledged.
chgo—Chicago.
NY—New York.
crd—card.

There are many other abbreviations and forms of spelling words for which no rules can be formed. In code, the quickest, simplest and most effective way possible is u s c d in conveying thoughts. No rules for spelling, tense, or other grammar exists excepting in the transmission of reports, commercial messages and other formal business.

The amateur laughs over the air when something funny is said or done by sending Hi hi hi or mim mim or else ha ha. More than once we've experienced the razz when calling a sixth district station with a quarter KW spark set, and when we reset the antenna switch for receiving were suddenly overwhelmed by a host of hi's, ha's and mim's coming from about fifty local stations due to the futility of trying to work about 2,000 miles with 250 watts spark. As the amateurs say over the air at times "tonk" or "Awf." We think that this is a pretty good starter on abbreviations for you to acquire, and want to say that you have at your command more pleasure in using them than any amount of jokes you can spill verbally on your friend Bill.

We want to show you what just a bit of amateur "chewing the fat" going through the air is like and print the

following taken from the logs of the stations of the writers. (By the way a log is a record of the business of the station, the calls heard and any other interesting items.)

We will take our own specific call letters and enact a little chat over the air: CQ CQ CQ de 9BDL QTC CQ CQ CQ de 9BDL k (That's 9BDL saying that he wants somebody to relay a message for him.) CQ is the general call. Here's someone calling him.

9BDL 9BDL 9BDL DE 9DQS 9DQS 9DQS GE QSR QRV 9BDL 9BDL 9BDL De 9DQS 9DQS 9DQS k.

(That was station 9DQS calling 9BDL saying good evening, I am ready to relay the message for you.)

R 9DQS de 9BDL r ok er nr 1 fm hr eo john smith 1234 western st., los angeles cal bk crd red ltr follows with dope on cw set. pse qsl. sg kn 9BDL hw 1? 9DQS de 9BDL k (9BDL giving the message to 9DQS and asking how he got it.)

R 9BDL de 9DQS ok 1 qrv 2 9BDL de 9DQS k.

(9DQS saying number one is O. K. and for him to go ahead with number 2.)

r 9DQS de 9BDL tks sa om if u c dorothy tell her no soap abt tt dance nxt satrday. gess nill nw QTC? 9DQS de 9BDL k.

(9BDL acknowledging receipt of message by 9DQS and asking him to do a personal favor for him. He then says he has no more traffic to handle and asks 9DQS if he has any further messages to handle.)

r 9BDL de 9DQS OK art om nm hr nw so c u 1 73 sk 9BDL de 9DQS k.

(9DQS saying all right old man, nothing more here now so will see you later, best regards, and signalling end of transmission.

73 sk 9BDL.

(9BDL announcing his willingness to sign off) usually followed by the signal di dit from the station last talking telling other stations who may be waiting to go ahead.

This, however, is just one of the most common examples of the type of transmission going on right over your head, and does not show you the pleasure derived from listening to stations from all over the world, listening to reports of wrecks, disasters, steamship distress signals, etc., but even then, it is fun to know what the other fellow is doing so that you cannot understand it.

We sincerely hope that the foregoing pointers will help many fellows who desire to become real honest-to-goodness radio bugs on their way to understanding more of the mysteries of the radio game and we hope that at some time we may have the pleasure of conversing with some of our readers over the air through the medium of code, as taught through the columns of RADIO AGE. We want to tell you that if there are any further details that puzzle you with regard to copying the code, we shall be pleased to answer them for you through the regular service in RADIO AGE'S Troubleshooter department.

Gess nm hr nw so hope to wrk u over the airsumtime best 73's.

SK de 9DQS es 9BDL.

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Enthroned by Radio

THE engagement of Señorita Carmen Fernandez Ramos, Cuba's beauty queen, has just been announced, thus providing a climax to a series of unusual triumphs, and proving the potential value of feminine charms backed by loyal friends.

Four months ago this orphan girl was poor and obscure, her perfect Cuban type of beauty known only to her fellow-operators at the long distance switch-board of the Cuban Telephone Company in Havana. Today, because of that beauty and because of those fellow-operators, she is one of the most stylishly-gowned women in the Cuban capital; she has \$8,000 in cash; is soon to marry Havana's exclusive photographer of the wealthy and the socially prominent, and her name and features are known in North America from Atlantic to Pacific.

When El Mundo, one of Havana's leading newspapers, offered a \$5,000 prize for the prettiest girl in the Republic, the telephone operators decided to back their charming comrade against the formidable field. And it was formidable, for Cuba producers at least as many pretty girls to the acre as any country on earth.

The Cuban Telephone Company operates Broadcasting Station PWX, the chief source of entertainment of the thousands of radio fans in the Island, and with a voice which, incidentally, is heard in every state of the Union and throughout Canada. The operators decided to conduct their campaign by radio.

Other candidates used old-fashioned methods. But they could not compete with the Radio Girl. Carmen was elected Beauty Queen of Havana by a majority of 100,000 votes. Meanwhile, the curiosity of radio fans in the States and Canada had been aroused, and there came numerous requests for her pictures from publications and from individuals.

As the selection of the prettiest girl of each province was to be made from photographs by a jury of Cuba's best known artists, Señorita Carmen's operator friends determined to take her to pose before the camera of the socially-favored specialist in feminine portraits, Joaquin Blez, than whom there was none more excellent.

Attired in a Parisian gown by Mme. Cumont, the handiwork of the gay Cuban capital's foremost French modiste, and the first fruit of her victory in the Havana contest, Señorita Fernandez Ramos climbed the stairs to the Blez Studio. She presented a decided contrast to the Cuban telephone operators, in their uniform attire of white shirt waist and blue cotton skirt.

In his career, Señor Blez had surveyed the feminine charms of Cuba's socially select with an impartial, professional eye, until he might have been adjudged immune to any irregular heart action due to the visions of loveliness that frequently glided across the huge polar bear rug in his reception room. Just at the moment, he was photographing a member of the chorus of the New York Winter Garden.

But when Señor Blez stepped to the door of his reception room, and his eye rested upon the exquisite features and form of the telephone girl, enhanced by the Parisian gown, the disinterested professional glint faded forever from his eye, as far as that particular señorita was concerned.

There was something more than pride of his art that Señor Blez put into that job. His friends admitted that he had outdone himself. The jury of artists returned a quick and unanimous verdict. Señorita Fernandez Ramos was named the fairest exponent of feminine pulchritude in the province; subsequently she won the title of Beauty Queen of Cuba, and with it the \$5,000 prize.

Then the Havana City Council, out of tribute to the capital's fair daughter, voted \$3,000 to enable her to buy a home.

Havana's leading department store, inspired with the beauty contest spirit which by this time had the Paris of America in its clutches, put up a selection of its best gowns as a prize, and announced a new contest. There was a gigantic window display of the photographs of contestants—and there was also a delicately hand-colored pastel of Señorita Fernandez Ramos, by Blez.

The customers of the store took one look at the portrait in which the heart of the artist had directed his skilled hand, and cast their votes for Carmen. She won the gowns.

Last of a series of brilliant social affairs came a charity ball at the Teatro Nacional. All Havana was there. It was a brilliant display of gowns and jewels, not to mention the array of beautiful women.

Señorita Fernandez Ramos led the grand march, on the arm of Señor Fontanills, Havana's social dictator. As she walked into the spotlight glare behind a battery of movie cameras, she came face-to-face with a full length and almost life-sized pastel portrait of herself. The name of the artist in the corner was Blez.

The Beauty Queen has posed for other Cuban artists. Of course, she has been approached by the movies. She has been put forward as a candidate in the international beauty contest at Nice. Various other offers have been made to her. But she continues working for the Cuban Telephone Company, among the loyal girl friends who fought her victorious campaign.

If your newsdealer has sold out his supply of RADIO AGE you are likely to miss just the hook-up that you have been looking for. To avoid any such chance fill out the coupon in this issue and send in your subscription. Then you will be safe. And don't forget that with each subscription at the special price of \$2.00 a year, or \$1.00 for six months, we send you free the popular Reinartz Radio booklet FREE. Address Radio Age, 500 N. Dearborn Street, Chicago, Ill.



Charges Radio and Auto Batteries at Home Over Night for a Nickel

For a friend who owns a radio set or auto, what would be more appropriate than a gift which would eliminate the inconvenience and expense of taking his battery to a service station every time it requires recharging? The

**GOLD SEAL
HOMCHARGER**

is such a gift, appropriately dressed up in a beautiful package. It charges any Auto, Radio or "B" storage battery in the quickest, simplest and most efficient manner possible. Connects to any lamp socket—operates silently—requires no watching. Fully automatic in operation—absolutely safe. Beautifully finished in mahogany and gold. Unqualifiedly guaranteed. Over 125,000 already in use.

At all good dealers, \$18.50 complete (\$25.00 in Canada)—no extras to buy.

FREE: Ask your dealer or write direct for free copy of Homcharger list of broadcasting stations and GOLD SEAL bulletin.



Insist on the GOLD SEAL. It's your guarantee against substitution and appears on name-plate and package. No other charger is just as good.

Automatic Electrical Devices Co., 146 West Third St., Cincinnati, O.
Largest Manufacturers of Vibrating Rectifiers in the World

STA-RITE AUTO-RADIO BATTERIES SAVE YOU 60%

This large saving is made possible by coming direct to you, instead of going thru Jobbers, Distributors, Branch Houses, Dealers, Salesmen etc. Sta-Rite Batteries are guaranteed for 2 yrs. in writing and are made by one of the Largest battery factories in the Country, and who have been building batteries for over 8 years.

TRY TO BEAT THESE PRICES
AUTOMOBILE BATTERIES
6 Volt, 11 Plate, Ford, Cher. Hup. Buick Cleveland, Durant \$11.50
6 Volt, 13 Plate, Overland, Nash, Buick, Reo, Page Hudson, Studebaker, Essex, Willys etc. \$13.25
12 Volt, 7 Plate, Maxwell, Dodge, Franklin, \$16.00
OTHER SIZES ON REQUEST

RADIO BATTERIES
2 volt for W.D. 11 & W.D. 12 6 volt 60 amp. hr. \$7.90
tubes run 300 hours on 1 6 " 80 " " 8.85
charge..... \$4.00 6 " 100 " " 10.50
4 volt for U. V. 199 \$7.55 6 " 120 " " 12.10
6 " 150 " " 14.50



All batteries are fully guaranteed in writing and shipped subject to examination. Send 10 per cent. with order, balance on arrival. Deduct 5 per cent. if full cash accompanies order. Shipped same day order received. Act now.

STA-RITE BATTERY CO., Louisville, Ky.

OPERATE A LOUD SPEAKER ON ONE TUBE

We have a new wonder circuit that will efficiently work your loud speaker on a single tube on local stations. Over 2,000 miles have been covered loud and clear with phones. Parts are few and inexpensive. Easy to build. Send 25c for hook-up and complete instructions.

Leumas Radio Laboratories, 311 Fifth Ave., N. Y.



AT LAST!
GREENBACK
FIXED
DETECTOR
No more indistinct sounds. No time wasted finding sensitive part of crystal. Greatest improvement on market. **POOL-PROOF, DUST-PROOF, TROUBLE-PROOF.** Used wherever a crystal detector is part of circuit. Get one today! Five dollar bill to this ad with name and address and get it quick **98c** postpaid. **FULLY GUARANTEED** **LORAIN MFG. CO.** Dept. A-12, 128 N. Wells St., Chicago, Illinois

LEARN RADIO

Here's your opportunity. Radio needs you. Win success in this fascinating field. Trained men in demand at highest salaries. Learn at home, in your spare time.

Be a Radio Expert

I will train you, quickly and easily, to design, construct, install, operate, repair, maintain, and sell all forms of Radio apparatus. My new methods are the most successful in existence. Learn to earn **\$1,800 to \$10,000 a Year**

FREE Wonderful, home-construction, tube receiving set, of latest design. Write for "Radio Facts" free. Engineer Mohaupt. **American Electrical Association** Dept. 412 4513 Ravenswood Ave., Chicago

CLASSIFIED ADVERTISEMENTS

Six cents per word per insertion, in advance. Name and address must be counted. Each initial counts as one word. Copy must be received by the 15th of month for succeeding month's issue.

HELP WANTED

750 men—boys 18 up wanted immediately to prepare for U. S. Government Positions. Railway Mail Clerks, City Mail Carriers, Post Office Clerks, Income Tax Examiners; \$117 to \$250 month. Steady work. Short hours. Paid vacation. Influence unnecessary. Write immediately—today—for schedule of examinations. Franklin Institute, Dept. E114, Rochester, N. Y.

FOR SALE

For Sale: DeForest OT-20 transmitter, complete, good repair; also 100 watt Radio Corporation set with kenotrons. Address, Radio Station WCAJ, University Place, Nebraska.

FREE HOOKUP

Sixty-thousand miles on Home-made Receiver. Twenty-six hundred mile range. Hundred-station log and Hookup free. Spencer Roach, 2905 Columbia Avenue, Philadelphia, Pa.

BOOKS

If you have not bought your Reinartz Book, fully illustrated with hook-ups and clear description of how to make this popular circuit, send \$2.00 in money order or currency and we will send you the booklet "Reinartz Radio" and place you on the subscription list of Radio Age for one year. Address Radio Age, 500 N Dearborn Street, Chicago, Ill.

PANEL SHIELDING

Don't let Body Capacity interfere. Use our pane shielding which is applied to any set in five minutes without removing instruments. Price 35c. H. & M. Specialty Co., Box 66, Brighton, Mass.

If your newsdealer has sold out his supply of Radio Age you are likely to miss just the hook-up that you have been looking for. To avoid any such chance fill out the coupon in this issue and send in your subscription. Then you will be safe. And don't forget that with each subscription at the special price of \$2.00 a year, or \$1.00 for six months, we send you free the popular Reinartz Radio booklet FREE. Address Radio Age, 500 N. Dearborn Street, Chicago, Ill.

For the BCL who wants volume (some of them do not seem to be able to get a loud enough signal) this is the set. With the head set, the range is from coast to coast. I am partial to my Reinartz with two stages of audio, which by the way has been heard over two blocks on the speaker above mentioned, my Cockaday for selectivity — but when I want volume, especially in hot weather, I resort to my little Erla reflex.

The BCL's who are not subscribers to RADIO AGE should certainly be, for the hookups and data given in your wonderful little magazine are plainer and more easy to understand than those of any other magazine.

Very truly yours,
J. H. JONES.

Crestwood, Ky.

Reflex circuits are sometimes hard to get adjusted correctly, and there are very few of them that can be worked out very well by the average enthusiast, but we knew that the Erla was a good one, and therefore we printed the data concerning its construction and operation. That the set can do its stuff is certainly made plain in Mr. Jones' letter. We want to extend our thanks to him, and are glad to learn that the Reinartz and Cockaday circuits also are giving the proper results.

Here's a chance to settle that ever prevailing question of "how much should I pay for a good radio set?"

RADIO AGE,
Gentlemen:

I am sending you a hookup of a small set with which we are having fine success, and which may be of interest to some of your readers.

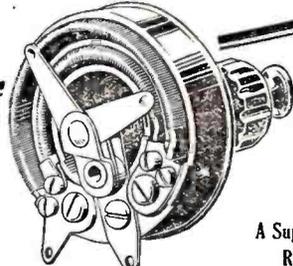
In this set, instead of using a tuning coil, we use a spiderweb coil of seventy turns of No. 18 S C C, with taps at every tenth turn. With it we can get all stations on the new wave lengths, clearly and with surprising volume.

Some of the stations we have logged are: KSD, WLW, WSAI, WHAS, WJAX, WWJ, KDKA, WCAE, WEAF, WGY, WGR, WLAG, WMC, WSB, WHB, WFAA, WBAP, WOAW, WOC, WRM, WJAZ, WPAD, WDAP, WMAQ, KYW, WIAD and others.

This set, using all reliable material, can be built and installed at an expenditure of not over \$25. I might add that this set was constructed by my son, who is fourteen years old.

Very respectfully yours,
HENRY W. LEMBERGER.
2037 Osborn St., Burlington, Iowa.

This letter ought to settle the question as to what kind of set to build for some of our beginners. If a set can be built at so small an expense, and get stations as well as this one does and at the same time be so simple that a mere boy can build it then it must be a pretty good one. Mr. Lemberger has all the reason



\$3.00
AND
WORTH
IT
A Super Vernier
Rheostat

100% EFFICIENCY

FROM YOUR TUBES

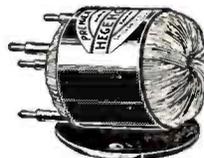
Premier

"MICROSTAT"

Trade Mark

There is no substitute for the Premier "Microstat"—no other instrument that gives such perfect control of the current delivered to the filament of radio tubes. New principle—two windings in parallel—one 6 ohm—other 40 ohm. Absolutely noiseless. Infinite control—handles any tube—Cap. 3 amp. Bakelite moulded—silver etched dial. Do not install a rheostat until you know all about the "MICROSTAT." Our Bulletin No. 92 explains it in detail. Send for it. It's FREE.

\$3.50



Cut one-half actual size

Pat. Pend.

HEAR THEM ALL CLEARLY

with a Premier

"HEGEHOG"

(Trade Mark)

Audio Transformer

Little but mighty—a wizard for volume and tone quality. Look at the cut. It shows the "HEGEHOG" one half actual size. "Small," you say. Yes, but inside this "Little Wonder" you will find more efficiency, more reproduction volume, and less distortion than found in any other Transformer, regardless of size, price or design. The secret is in its patented construction. It is shielded 100% against foreign noises. Full guaranteed. Ratios 1 to 3, 1 to 4, 1 to 5, \$3.50; 1 to 10, \$4.50. You'll want them in your next "hook-up," so get all the facts NOW. Our Free Bulletin No. 92 gives them fully. Send for it.

Ask for and insist on "HEGEHOG" and "MICROSTAT" at your dealer's.

Premier Electric Company

3803 Ravenswood Ave., Chicago

in the world to be proud of that embryo radio engineer of his.

Mr. Lemberger enclosed the circuit shown in Figure 1. This circuit is of the Ultra-Audion type very similar in construction to that described in the October number of RADIO AGE on page eight.

B. F. Odell, of 270 Ogden Street, Orange, N. J., writes:
RADIO AGE,
Gentlemen:

My RADIO AGE for October has not come to hand as yet. Please don't let me miss it. You gave us a layout for a Reinartz hookup in the May issue of the AGE. I finished it some time ago, and want to tell you that it is a peach! I am getting stations from coast to coast. Have lots of visitors to see it and HEAR it. It certainly is the best ever.

That's where the Reinartz boosters put another notch in their cabinets. We are glad you informed us that your copy of RADIO AGE did not come, and we want to tell our readers to notify us of changes of address, and also if RADIO AGE is not received regularly, so as to keep our card files up to the minute.

E. L. Landell, of Shelbyville, Ill., writes enclosing the following list of stations heard on a circuit of his own design:

On October 1, 1923, 7:30 to 10:30 p. m.: KSD, WBAP, WMC, WSB, WGY, WOS, WCAE, WHAZ, WOAW.

On October 2, 1923, 6:30 to 7:45 p. m.: WDAP, WGY, WBAP.

October 4, 1923, same time: WHB, WSB, WFAA, WOAW, KDKA, WJAZ.

October 5, 1923, 7:15 to 9:30 p. m.: WMAQ, WHB, WBAP, WCK, WOS, WDAF, KYW, WFAA, WMC, WGY, KSD, WPAD, WDAP.

Mr. Landell further writes:

"Anyone wishing a copy of the circuit may write me at Shelbyville, Ill. The circuit is of my own design, using the regenerative principle."

Mr. Landell is one of those fellows who ought to learn the code. We'll

bet you can't tell us what the programs from any of those stations were. But who does when they are radio golfing? Your eardrums swell out like a football from the intense listening for the call, and as soon as the call is down on paper, the set is detuned and you are looking for more DX. At any rate, Mr. Landell did some fast tuning work. He must have a calibrated set.

Homer L. Jones, of 216 Euclid Avenue, Sioux Falls, S. D., writes:

"I am using a Reinartz with splendid results. I pick up fifteen to twenty stations most any good night. Get them from coast to coast and from San Antonio to the Canadian stations."

That's the Reinartz again. We've said enough about that circuit for this issue. We wouldn't be surprised if some fellow wrote us and told us about hearing a fly crawl on the wall down at the Havana, Cuba, broadcasting station, and add—I did it with my little Reinartz!

If your landlord is one of those fellows who threatens to raise your rent ten dollars for the privilege of putting up a radio antenna, or is one of those pessimists who contend that a wireless system "draws" lightning, you can fool him after you have taken the following hint:

RADIO AGE,
Gentlemen:

I don't know if my dope is of any use or not, but if you want to publish it in RADIO AGE, I am very glad to let you use it. It will, I know, help a great number of radio fans who live in buildings where they are not allowed to put up an outside antenna.

I have a Reinartz circuit, which I built from drawings in RADIO AGE for September, 1922, which consists of a detector and two stages of audio frequency amplification. With an outside antenna, I received a great number of out-of-town stations. When the warm weather came, I took my aerial down thinking to make some changes in it, but instead of putting up another outside aerial

I did some experimenting with an indoor antenna.

The room my set is located in is about ten by fifteen feet. I took a single strand of bell wire and ran it around the picture moulding, connecting one end to the antenna binding post of my set, and letting the other hang loose. With this arrangement I could hear all the local stations very well. Experimenting further, I took an oatmeal box, and wrapped twenty-four turns of No. 18 DCC around it in one direction, and then reversing the direction wound twenty-four more. I connected this arrangement in series with the picture moulding antenna and aerial post in the receiver, using the regular ground.

With this arrangement I have been able to hear all local stations with great audibility, and have so far increased my range to WOC at Davenport, Iowa. All the local DX (within 100 miles) stations come very well. I am enclosing a sketch of the arrangement.

Very truly yours,

J. A. LELAND.

6408 Drexel Ave., Chicago, Ill.

Every little thing helps, Mr. Leland, so we thank you for the suggestion. Your suggestion is probably just what the fellows you mention are looking for. We might add, however, that the addition of one or two stages of radio frequency would probably increase the range to a remarkable degree. We are printing in Figures 2 and 3 a suitable arrangement, with Mr. Leland's picture-moulding-oatmeal-box antenna. Please notice Mr. Leland uses a Reinartz!

Well, fellows, this will be about all until next year, but before we quit we want to tell you to be sure and get your sets all set to tune in good and strong on station XMAS. S'long! C U in 1924.

Here's another record to shoot at, men! Fred Marco, secretary of the
(Continued on page 38.)

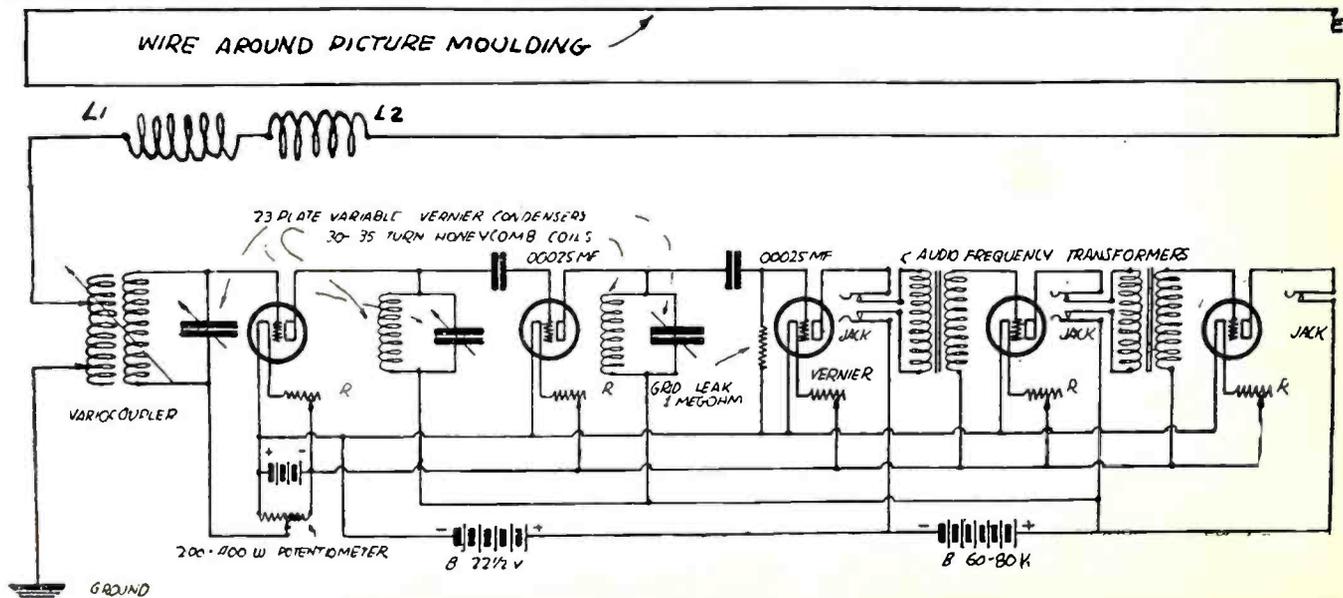


Figure 2. This composite sketch shows Mr. Leland's arrangement of using the picture moulding oatmeal box antenna. L1 is a coil wound on an oatmeal box, having 25 turns and L2 is a coil of the same number of turns, wound on the same box in the opposite direction from L1. The circuit shown, while not of the type used by Mr. Leland, is a type of circuit particularly adaptable to the experiment

Complete Corrected List of U. S. and Canadian Broadcasting Stations

Complete Each Issue

THE list of broadcasting stations on these pages is brought up to date each month by additions of new stations and deletion of those which have suspended operation. The list is the product of a vast volume of correspondence and its completeness is due in large measure to the assistance of our special news service in Washington, D. C. Suggestions, corrections and additional data will be welcomed from readers. Broadcasters: Send in your program schedules.

Call Letters	Station Name	City	State	Wave Length
KDKA	Westinghouse Electric & Mfg. Co.	East Pittsburgh	Penn.	326
KOPM	Westinghouse Electric & Mfg. Co.	Cleveland	Ohio	270
KUPT	Southern Electrical Co.	San Diego	Calif.	244
KOYL	Telegraph Publishing Co.	Salt Lake City	Utah	360
KOYM	Savoy Theatre.	San Diego	Calif.	252
KDYQ	Oregon Institute of Technology.	Portland	Oreg.	360
KOYS	The Tribune.	Great Falls	Mont.	360
KDYW	Smith Hughes & Co.	Phoenix	Ariz.	360
KOYX	Star Bulletin.	Honolulu	Hawaii	360
KOZB	Frank E. Siefert.	Lakersfield	Calif.	240
KOZE	The Rhoads Co.	Seattle	Wash.	455
KOZF	Automobile Club of Southern California.	Los Angeles	Calif.	278
KOZI	Electric Supply Co.	Wenatchee	Wash.	360
KOZK	Nevada Machinery & Electric Co.	Reno	Nev.	360
KOZQ	Nichols Academy of Dancing.	Denver	Colo.	360
KOZR	Bellingham Publishing Co.	Bellingham	Wash.	261
KOZT	Seattle Radio Assn.	Seattle	Wash.	360
KFAD	McArthur Bros. Mercantile Co.	Phoenix	Ariz.	360
KFAE	State College of Washington.	Pullman	Wash.	360
KFAF	Western Radio Corp.	Denver	Colo.	360
KFAJ	University of Colorado.	Boulder	Colo.	360
KFAM	The Electric Shop.	Moscow	Idaho	360
KFAP	Standard Publishing Co.	Butte	Mont.	360
KFAR	Studio Lighting Service Co. (O. K. Olsen).	Hollywood	Calif.	280
KFAU	Independent School District of Boise City, Boise High School.	Boise	Idaho	274
KFAV	Abbot Kinney Co.	Venice	Calif.	224
KFAW	The Radio Den (W. B. Ashford).	Santa Ana	Calif.	280
KFAZ	W. J. Virglin.	Medford	Oreg.	283
KFBG	F. A. Buttrey & Co.	San Diego	Calif.	278
KFBH	W. E. Azbill.	San Diego	Calif.	360
KFBE	Reuben H. Horn.	San Luis Obispo	Calif.	360
KFBG	First Presbyterian Church.	Tacoma	Wash.	360
KFBK	Kimball-Upson Co.	Sacramento	Calif.	283
KFBL	Leese Bros.	Everett	Wash.	224
KFBS	Trinidad Gas & Electric Supply Co. and the Chronicle News.	Trinidad	Colo.	360
KFBW	The Cathedral (Bishop N. S. Thomas).	Laramie	Wyo.	283
KFCB	Nielsen Radio Supply Co.	Phoenix	Ariz.	238
KFCD	Salem Electric Co. (F. S. Barton).	Salem	Oreg.	360
KFCF	Frank A. Moore.	Walla Walla	Wash.	360
KFCG	Electric Service Station (Inc.).	Billings	Mont.	360
KFCI	Colorado Springs Radio Co.	Colorado Springs	Colo.	360
KFCJ	Los Angeles Union Stock Yards.	San Francisco	Calif.	360
KFCM	Richmond Radio Shop (Frank T. Doering).	Richmond	Calif.	360
KFCN	Ralph W. Flygare.	Ogden	Utah	360
KFCV	Fred Mahaffey, Jr.	Houston	Tex.	360
KFCW	Western Union College.	LeMars	Iowa	252
KFCA	Omaha Central High School.	Omaha	Nebr.	258
KFDB	Adler's Music Store.	Baker	Oreg.	360
KFDD	St. Michael's Cathedral.	Idaho	Idaho	252
KFDE	University of Arizona.	Tucson	Ariz.	360
KFDF	Oregon Agricultural College.	Corvallis	Oreg.	360
KFDL	Knight-Campbell Music Co.	Denver	Colo.	360
KFDM	H. Everett Cutting.	Bozeman	Mont.	248
KFDN	Bullock's Hardware & Sporting Goods (Robert G. Bullock).	York	Nebr.	360
KFDO	Nebraska Radio Electric Co.	Lincoln	Nebr.	240
KFDV	Gilbrech & Stinson.	Payetteville	Ark.	360
KFDW	First Baptist Church.	Shreveport	La.	360
KFDY	South Dakota State College of Agriculture and Mechanic Arts.	Brookings	S. Dak.	360
KFDZ	Harry O. Iverson.	Minneapolis	Minn.	360
KFEC	Meier & Frank Co.	Portland	Oreg.	360
KFEJ	Guy Greason	Tacoma	Wash.	360
KFEL	Winner Radio Corp.	Denver	Colo.	360
KFEP	Radio Equipment Co. (Joseph L. Turre).	Denver	Colo.	360
KFEQ	J. L. Scroggin	Osaka	Nebr.	360
KFER	Auto Electric Service Co.	Port Dodge	Iowa	263
KFEV	Radio Electric Shop.	Douglas	Wyo.	231
KFEW	Augsburg Seminary.	Minneapolis	Minn.	261
KFEY	Bunker Hill & Sullivan Mining & Concentrating Co.	Kellogg	Idaho	360
KFEZ	American Society of Mechanical Engineers (F. H. Schubert).	St. Louis	Mo.	360
KFFA	Dr. R. O. Shelton.	San Diego	Calif.	212
KFFB	Jenkins Furniture Co.	Boise	Idaho	240
KFFE	Eastern Oregon Radio Co.	Penitentiary	Oreg.	360
KFFO	Dr. E. H. Smith.	Hillsboro	Oreg.	229
KFFQ	Markshoffel Motor Co.	Colorado Springs	Colo.	360
KFFR	Nevada State Journal (Jim Kirk).	Sparks	Nev.	278
KFFV	Graceland College.	Lamoni	Iowa	282
KFFX	McGraw Co. (Luby).	Alexandria	La.	275
KFFY	Al. G. Barnes Amusement Co.	Dallas	Tex. (portable)	226
KFGC	Louisiana State University.	Baton Rouge	La.	254
KFGD	Chickasha Radio & Electric Co.	Chickasha	Okl.	248
KFGH	Leland Stanford University.	Stanford University	Calif.	360
KFGJ	Missouri National Guard, 138th Infantry.	St. Louis	Mo.	266
KFGL	Arlington Garage.	Arlington	Ore.	234
KFGM	Carroll Hardware Co.	Boone	Iowa	226
KFGV	Heidbreder Radio Supply Co.	Utica	Nebr.	224
KFGX	First Presbyterian Church.	Orango	Tex.	250
KFGZ	Emmanuel Missionary College.	Berrien Springs	Mich.	268
KFHA	Western State College of Colorado.	Gunnison	Colo.	252
KFHB	Rialto Theater (P. L. Beardwell).	Hood River	Ore.	280
KFHD	Utz Electric Shop Co.	Shreveport	La.	266
KFHE	Central Christian Church.	Neah Bay	Wash.	283
KFHF	Ambrose A. McCue.	Neah Bay	Wash.	283
KFHJ	Fallon & Co.	Santa Barbara	Calif.	360
KFHQ	Curtis Brothers Hardware Store (Alfred E. Fowler).	Los Gatos	Calif.	242
KFHR	Star Electric & Radio Co.	Seattle	Wash.	270
KFHS	Clifford J. Dow.	Lihue	Hawaii	275
KFHU	M. G. Sateren.	Mayville	N. Dak.	275
KFHX	Robert W. Nelson.	Hutchinson	Kans.	229
KFHY	Earle C. Anthony (Inc.).	Los Angeles	Calif.	460
KFIB	Franklin W. Jenkins.	St. Louis	Mo.	244
KFID	Ross Arbuckle's Garage.	Iola	Kans.	246
KFIE	Benson Polytechnic Institute.	Portland	Oreg.	360
KFIK	Gladbrook Electrical Co.	Gladbrook	Iowa	224
KFIL	Windisch Electric Farm Equipment Co.	Louisburg	Kans.	334
KFIN	North Central High School.	Spokane	Wash.	252
KFIO	Yakima Valley Radio Broadcasting Association.	Yakima	Wash.	224
KFIU	Alaska Electric Light & Power Co.	Juneau	Alaska	226
KFIV	V. H. Broyles.	Pittsburg	Kans.	240
KFIX	Reorganized Church of Jesus Christ of Latter Day Saints	Independence	Mo.	240
KFYI	Brott Laboratories.	Seattle	Wash.	236
KFIZ	Daily Commonwealth and Oscar A. Huelsman.	Fond du Lac	Wis.	273
KFJA	Central Power Co.	Grand Island	Nebr.	244
KFJB	Marshall Electrical Co.	Marshalltown	Iowa	248
KFJC	Seattle Post-Intelligencer.	Seattle	Wash.	233
KFJD	Weld County Printing & Publishing Co.	Greeley	Colo.	236
KFJE	National Radio Manufacturing Co.	Oklahoma City	Okl.	252
KFJH	"The Sugar Bowl" (H. R. Shaw).	Selma	Calif.	273
KFJI	Liberty Theatre (E. E. Marsh).	Astoria	Oreg.	252
KFJJ	Carrollton Radio Shop.	Carrollton	Mo.	236
KFJK	Elvano Radio and Electric Co.	Bristow	Okl.	233
KFJL	Hardison Amusement Co.	Clinton	Iowa	242
KFJM	University of North Dakota.	Grand Forks	N. Dak.	229
KFJR	Ashley C. Dixon & Son.	Stevensville	Mont. (near)	258
KFJU	Central Power Co.	Kearney	Nebr.	234
KFJV	Thomas H. Warren	Dexter	Iowa	224
KFJW	Le Grand Radio Co.	Towanda	Kans.	226
KFJX	Iowa State Teachers' College.	Cedar Falls	Iowa	246
KFJY	Tuswall Radio Co.	Fort Dodge	Iowa	246
KFKZ	Texas National Guard, One hundred and twelfth Cavalry.	Fort Worth	Tex.	254
KFKA	Colorado State Teachers College.	Greeley	Colo.	248
KFKB	Brimley-Jones Hospital Association.	Milford	Kans.	286
KFKH	Denver Park & Amusement Co.	Lakeside	Colo.	226
KFKK	Conway Radio Laboratories (Ben H. Woodruff).	Conway	Ark.	224
KFKV	F. F. Gray	Butte	Mont.	283
KFKW	Westinghouse Electric & Manufacturing Co.	Port Dodge	Iowa	286
KFKX	Nassour Bros. Radio Co.	Colorado Springs	Colo.	234
KFLA	Abner R. Willson.	Butte	Mont.	283
KFLB	Signal Electric Manufacturing Co.	Menominee	Mich.	248
KFLD	Paul E. Greenlaw	Franklinton	La.	234
KFLE	National Educational Service.	Denver	Colo.	268
KFLH	Erickson Radio Co.	Salt Lake City	Utah	238
KFLI	Everette M. Foster.	Cedar Rapids	Iowa	240
KFLQ	Bizzell Radio Shop.	Lieke Radio	Ark.	261
KFLR	University of New Mexico.	Albuquerque	N. Mex.	254
KFLU	Rio Grande Radio Supply House.	San Benito	Texas	236
KFLV	Rev. A. T. Frykman.	Rockford	Ill.	229
KFLW	Missoula Electric Supply Co.	Missoula	Mont.	234
KGB	Tacoma Daily Ledger.	Tacoma	Wash.	252
KGG	Hallock & Watson Radio Service.	Portland	Oreg.	360
KGM	Northwest Radio Mfg. Co.	Portland	Oreg.	360
KGU	Marion A. Mulrony.	Honolulu	Hawaii	Waikiki Beach
KGW	Portland Morning Oregonian.	Portland	Oreg.	492
KGY	St. Martins College (Rev. Sebastian Ruth).	Lacy	Wash.	258
KHJ	Times-Mirror Co.	Los Angeles	Calif.	395
KHQ	Louis Wasmer.	Seattle	Wash.	360
KHJ	G. Gould.	Stockton	Calif.	360
KJL	Northwest Radio Service Co.	Seattle	Wash.	270
KJS	Bible Institute of Los Angeles.	Los Angeles	Calif.	360
KLN	Monterey Electric Shop.	Monterey	Calif.	261
KLS	Warner Brothers Radio Supplies Co.	Oakland	Calif.	360
KLX	Tribune Publishing Co.	Oakland	Calif.	360
KLZ	Reynolds Radio Co.	Denver	Colo.	360
KM	San Joaquin Light & Power Corp.	Tacoma	Wash.	360
KMO	Lowmo	Tacoma	Wash.	360
KNJ	Roswell Public Service Co.	Roswell	N. Mex.	250
KNT	Grays Harbor Radio Co. (Walter Hemrich).	Aberdeen	Wash.	263
KNV	Radio Supply Co.	Los Angeles	Calif.	256
KNX	Electric Lighting Supply Co.	Los Angeles	Calif.	360
KOB	New Mexico College of Agriculture & Mechanic Arts	State College	N. Mex.	360
KOP	Detroit Police Department.	Detroit	Mich.	286
KPO	Yale Bros.	San Francisco	Calif.	423
KPP	University of California.	Berkeley	Calif.	360
KQP	Apple City Radio Club.	Hood River	Oreg.	360
KQV	Douglas-Hill Electric Co.	Pittsburgh	Pa.	360
KQW	Charles D. Herrold.	San Jose	Calif.	360
KRE	Berkeley Daily Gazette.	Berkeley	Calif.	278
KSD	Post Dispatch (Pulitzer Pub. Co.).	St. Louis	Mo.	546
KSS	Prentiss & Dean Radio Co. and Radio Research Society of Long Beach.	Long Beach	Calif.	360
KTW	First Presbyterian Church.	Seattle	Wash.	360
KUO	Examiner Printing Co.	San Francisco	Calif.	360
KUS	City Dye Works & Laundry Co.	Los Angeles	Calif.	360
KUY	Coast Radio Co.	El Monte	Calif.	256
KWG	Portable Wireless Telephone Co.	Stockton	Calif.	360
KWH	Los Angeles Examiner.	Los Angeles	Calif.	360
KXQ	Modesto Herald Publishing Co.	Modesto	Calif.	360
KXJ	Electric Shop.	Honolulu	Hawaii	360
KYW	Westinghouse Electric & Mfg. Co.	Chicago	Ill.	536
KZM	Preston D. Allen	Oakland	Calif.	360
KZN	The Deseret News	Salt Lake City	Utah	360
KZV	Wenatchee Battery & Motor Co.	Wenatchee	Wash.	360
WAAB	Valdemar Jensen.	New Orleans	La.	268
WAAC	Tulane University.	New Orleans	La.	360
WAAD	Ohio Mechanics Institute.	Cincinnati	Ohio	360
WAAP	Chicago Daily Drivers Journal.	Chicago	Ill.	286
WAAK	Gimbel Brothers.	Milwaukee	Wis.	280
WAAM	J. R. Nelson Co.	Newark	N. J.	263
WAAN	University of Missouri.	Columbia	Mo.	254
WAAP	Omaha Grain Exchange.	Omaha	Nebr.	360
WAAZ	Inflister-Miller Motor Co.	Emporia	Kans.	360
WABP	Lake Forest College.	Lake Forest	Ill.	266
WABQ	Dr. John B. Lawrence.	Harrisburg	Pa.	266
WABC	Pulwider-Grimes Battery Co.	Anderson	Ind.	229
WABD	Parker High School.	Dayton	Ohio	283
WABE	Young Men's Christian Association.	Washington	D. C.	283
WABF	Mount Vernon Register-News Co.	Mount Vernon	Ill.	234
WABG	Arnold Edwards Piano Co.	Jacksonville	Fla.	248
WABH	Lange Shore Tire.	Sandusky	Ohio	240
WABJ	Electric Light & Electric Co.	Banor	Me.	240
WABK	The Radio Laboratories.	South Bend	Ind.	240
WABL	First Baptist Church.	Worcester	Mass.	252
WABM	Connecticut Agricultural College.	Storrs	Conn.	283
WABN	F. E. Doherty Automotive and Radio Equipment Co.	Saginaw	Mich.	254
WABO	Waldo C. Grover.	La Crosse	Wis.	244
WABP	Lake Avenue Baptist Church.	Rochester	N. Y.	252
WABA	Robert T. Weir.	West Lafayette	Ind.	266
WABQ	Purdue University.	West Lafayette	Ind.	360
WABR	Sterling Electric Co.	Minneapolis	Minn.	360
WABH	The Dayton Co.	Minneapolis	Minn.	417
WABJ	Wireless Phone Corp.	Paterson	N. J.	244
WABK	James Millikin University.	Deatur	Ill.	360
WABL	Warham-Carter Publishing Co. (Star Telegram).	Fort Worth	Tex.	476
WBAV	Erner & Hopkins Co.	Columbus	Ohio	390

Complete Corrected List of U. S. and Canadian Broadcasting Stations

WBAA	Marletta College	Marletta, Ohio	246	WIAR	Paducah Evening Sun	Paducah, Ky.	360
WBAX	John H. Stenger, Jr.	Wilkes-Barre, Pa.	360	WIAS	Home Electric Co.	Burlington, Iowa	360
WBAY	Western Electric Co.	New York, N. Y.	492	WIAT	Leon T. Noel	Tarkio, Mo.	360
WBBA	Newark Radio Laboratories	Newark, Ohio	240	WIAU	American Trust & Savings Bank	Le Mars, Iowa	360
WBBD	Barbey Battery Service	Reading, Pa.	234	WIK	K. & L. Electric Co. (Herbert F. Kelso and Hunter J. Lohman)	McKeport, Pa.	234
WBL	T & H Radio Co.	Anthony, Kans.	261	WIL	Continental Electric Supply Co.	Washington, D. C.	360
WBS	D. W. May, Inc.	Newark, N. J.	360	WIP	Gimbel Brothers	Philadelphia, Pa.	509
WRT	Southern Radio Corp.	Charlotte, N. C.	360	WIAB	American Electric Co.	Lincoln, Nebr.	360
WBZ	Westinghouse Elec. & Mfg. Co.	Springfield, Mass.	337	WIAD	Jackson's Radio Engineering Laboratories	Waco, Tex.	360
WCAD	St. Lawrence University	Canton, N. Y.	280	WIAF	Press Publishing Co.	Muncie, Ind.	360
WCAB	Kaufmann & Baer Co.	Pittsburgh, Pa.	462	WIAG	Norfolk Daily News (House Pub. Co.)	Norfolk, Nebr.	360
WCAG	Clyde R. Randall	New Orleans, La.	258	WIAK	Clifford L. White	Greentown, Ind.	254
WCAL	Enteklin Electric Co.	Columbus, Ohio	286	WIAM	P. M. Perham	Cedar Rapids, Iowa	268
WCAN	Nebraska Wesleyan University	University Place, Nebr.	360	WIAN	Peoria Star	Peoria, Ill.	280
WCAP	Alfred P. Daniel	Houston, Tex.	360	WIAQ	Capper Publications	Topeka, Kans.	360
WCAL	St. Olaf College	Northfield, Minn.	360	WIAR	The Outlet Co. (J. Samuels & Bro.)	Providence, R. I.	360
WCAM	Villanova College	Villanova, Pa.	360	WIAS	Pittsburgh Radio Supply House	Pittsburgh, Pa.	360
WCAD	Sanders & Stayman Co.	Baltimore, Md.	360	WIAT	Kelly-Vawter Jewelry Co.	Marshall, Mo.	360
WCAP	Chesapeake & Potomac Telephone Co.	Washington, D. C.	469	WIAJ	Union Trust Co.	Cleveland, Ohio	390
WCAR	Alamo Radio Electric Co.	San Antonio, Tex.	360	WIAX	Chicago Radio Laboratory	Chicago, Ill.	448
WCAS	William Hood Dunwoody Industrial Institute	Minneapolis, Minn.	246	WIAY	Richard H. Howe	Montgomery, Ala.	229
WCAT	South Dakota State School of Mines	Rapid City, S. Dak.	240	WIH	W. Hoyer, Dr.	Washington, D. C.	273
WCAU	Durham & Co.	Philadelphia, Pa.	286	WIX	Deforest Radio Telephone & Telegraph Co.	New York, N. Y.	360
WCAV	J. C. Dice Electric Co.	Little Rock, Ark.	360	WIY	R. C. A.	New York, N. Y.	405
WCAX	University of Vermont	Burlington, Vt.	360	WJZ	R. C. A.	New York, N. Y.	455
WCAY	Kesselhuan O'Driscoll Co.	Millwaukee, Wis.	261	WKAA	H. F. Paar	Cedar Rapids, Iowa	268
WCBA	Carthage College	Carthage, Ill.	246	WKAD	Chas. Looff (Crescent Park)	East Providence, R. I.	240
WCBB	Charles W. Helmback	Allentown, Pa.	280	WKAF	W. S. Radio Supply Co.	Wichita Falls, Tex.	360
WCBB	K. & K. Radio Supply Co. (Charles H. Katzenberger)	Allentown, Pa.	280	WKAG	United Battery Service Co.	Montgomery, Ala.	226
WCBD	Wilbur G. Voltra	Greenville, Ohio	240	WKAP	Dante W. Flint	Cranston, R. I.	360
WCE	Flindley Electric Co.	Zion, Ill.	345	WKAR	Radio Corp. of Porto Rico	San Juan, P. R.	360
WCK	Stix, Baer & Fuller Dry Goods Co.	Minneapolis, Minn.	360	WKAS	Michigan Agriculture College	East Lansing, Mich.	280
WCM	University of Texas	Austin, Tex.	360	WKAL	L. E. Lines Music Co.	Springfield, Mo.	360
WCX	Detroit Free Press	Detroit, Mich.	517	WKAW	Laconia Radio Club	Laconia, N. H.	254
WCDA	Tampa Daily Times	Tampa, Fla.	360	WKAW	Turner Cycle Co.	Beloit, Wis.	242
WCDA	Kansas City Star	Kansas City, Mo.	411	WKAY	Brenau College	Gainesville, Ga.	280
WDAG	F. Laurance Martin	Amarillo, Tex.	263	WKBC	Joseph J. Zamolski Co.	Okla. City, Okla.	360
WDAA	Trinity Methodist Church (South)	El Paso, Tex.	268	WKBY	W. K. Radio Supply Co.	Okla. City, Okla.	360
WDAI	Hughes Radio Corp.	Syracuse, N. Y.	246	WLAG	Cutting & Washington Radio Corp.	Minneapolis, Minn.	417
WDAK	The Courant	Hartford, Conn.	261	WLAH	Samuel Woodworth	Syracuse, N. Y.	234
WDAL	Florida Times-Union	Jacksonville, Fla.	360	WLAJ	Waco Electrical Supply Co.	Waco, Tex.	360
WDAP	Automotive Electric Co.	Dallas, Tex.	360	WLAK	Vermont Farm Machine Corp.	Bellows Falls, Vt.	360
WDAP	Board of Trade	Chicago, Ill.	360	WLAL	Naylor Electrical Co.	Tusla, Okla.	360
WDAP	Lita Brothers	Philadelphia, Pa.	360	WLAN	Putnam Hardware Co.	Houlton, Me.	285
WDAS	Samuel A. Waite	Worcester, Mass.	360	WLAP	W. P. Jordan	Louisville, Ky.	360
WDAU	Shoum Kilburn	New Bedford, Mass.	360	WLAQ	Arthur E. Schilling	Kalamazoo, Mich.	360
WDAX	First National Bank (Appamoose County Farm Bureau)	New Bedford, Mass.	360	WLAT	Radio and Specialty Co.	Burlington, Iowa	360
WDAY	Radio Equipment Corp.	Centerville, Iowa	360	WLAV	Electric Shop	Pensacola, Fla.	254
WDBB	Kirk, Johnson & Co.	Fargo, N. Dak.	244	WLAW	Police Dept., City of New York	New York, N. Y.	360
WDBF	Robert G. Phillips	Lancaster, Pa.	258	WLAX	Putnam Electric Co. (Greencastle Community Broadcasting Station)	New York, N. Y.	360
WDBF	Church of the Covenant	Yonkers, N. Y.	261	WLB	University of Minnesota	Greencastle, Ind.	231
WDT	Ship Owners Radio Service	Washington, D. C.	360	WLW	Creeley Manufacturing Co.	Minneapolis, Minn.	360
WDZ	James L. Bush	New York, N. Y.	405	WMAB	Radio Supply Co.	Cincinnati, Ohio	360
WEAA	P. D. Fallain	Tuscola, Ill.	278	WMAC	J. Edw. Page (Olive B. Meredith)	Okla. City, Okla.	360
WEAF	American Telephone & Telegraph Co.	Lincoln, Nebr.	280	WMAC	Round Hills Radio Corp.	Cazenovia, N. Y.	261
WEAH	Wichita Board of Trade	Wichita, Kans.	244	WMAF	General Supply Co.	Dartmouth, Mass.	360
WEAI	Cornell University	Ithaca, N. Y.	286	WMAJ	Drovers Telegram Co.	Lincoln, Nebr.	254
WEAJ	University of South Dakota	Vermilion, S. Dak.	283	WMAK	Norton Laboratories	Kansas City, Mo.	275
WEAM	Borough of North Plainfield (W. Gibson Buttfield)	Vermilion, S. Dak.	283	WMAK	Trenton Hardware Co.	Lockport, N. Y.	360
WEAN	Shepard Co.	North Plainfield, N. J.	252	WMAK	First Baptist Church	Trenton, N. J.	360
WEAD	Ohio State University	Providence, R. I.	273	WMAK	Utility Battery Service	Columbus, Ohio	286
WEAP	Mobile Radio Co.	Columbus, Ohio	360	WMAQ	Chicago Daily News	Chicago, Ill.	448
WEAR	Haltiworer American & News Publishing Co.	Mobile, Ala.	360	WMAV	Alabama Polytechnic Institute	Auburn, Ala.	250
WEAS	Hecht Co.	Baltimore, Md.	360	WMAW	Kingshighway Presbyterian Church	St. Louis, Mo.	280
WEAT	Davidson Bros. Co.	Washington, D. C.	360	WMAZ	Mercer University	Macon, Ga.	268
WEAY	Iris Theatre (Will Horowitz, Jr.)	Washington, D. C.	360	WMC	"Commercial Appeal" (Commercial Publishing Co.)	Memphis, Tenn.	500
WEB	Benwood Co.	St. Louis, Mo.	360	WMC	Irishman Equipment Co.	Memphis, Tenn.	500
WEV	Hurlburt-Still Electrical Co.	St. Louis, Mo.	360	WMC	Douglas-Hill Electric Co.	Washington, D. C.	261
WEW	St. Louis University	St. Louis, Mo.	261	WMAC	Shepard Stores	Boston, Mass.	278
WFAA	Dallas News & Dallas Journal	St. Louis, Mo.	261	WMAD	University of Oklahoma	Norman, Okla.	360
WFAB	Carl F. Woose	Dallas, Tex.	476	WMAL	R. J. Rockwell	Omaha, Nebr.	242
WFAC	H. C. Sprattley Radio Co.	Syracuse, N. Y.	234	WMAM	Ideal Apparatus Co.	Evansville, Ind.	360
WFAD	Electric Supply Co.	Poughkeepsie, N. Y.	360	WMAN	Syracuse Radio Telephone Co.	Syracuse, N. Y.	286
WFAG	Wichita Wireless Instrument Co.	Port Arthur, Tex.	360	WMAN	Wittenberg College	Springfield, Ohio	231
WFAM	Times Publishing Co.	St. Cloud, Minn.	360	WMAN	Charleston Radio Electric Co.	Charleston, S. C.	360
WFAN	Hutchinson Electric Service Co.	Hutchinson, Minn.	360	WMAN	C. G. Butler, Mo.	231	
WFAO	Missouri Wesleyan College	Cameron, Mo.	360	WMAN	Texas Radio Corp. & Austin Statesman	Austin, Tex.	360
WFAU	Daily Arcus-Leader	Sloux Falls, S. Dak.	360	WMAN	Lennik Brothers Co. (Frederick Lennik)	Philadelphia, Pa.	360
WFAV	University of Nebraska, Department of Electrical Engineering	Sloux Falls, S. Dak.	360	WMAN	Peoples Telephone & Telegraph Co.	Knoxville, Tenn.	236
WFI	Strawbridge & Clothier	Lincoln, Nebr.	275	WMAN	Peninsular Radio Club (Henry Kunzmann)	Fort Monroe, Va.	360
WGAN	Lancaster Electric Supply & Construction Co.	Philadelphia, Pa.	248	WMAZ	Dakota Radio Apparatus Co.	Yankton, S. Dak.	244
WGAL	Cedil E. Lloyd	Lancaster, Pa.	248	WMAZ	Shotton Radio Manufacturing Co.	Albany, N. Y.	360
WGAP	Glenwood Radio Corp. (W. G. Patterson)	Pensacola, Fla.	360	WMAZ	Dr. W. H. Hardy	Albany, N. Y.	360
WGAR	Southwest American	Shreveport, La.	360	WMAZ	Mrs. Radio Co.	Albany, N. Y.	360
WGAU	Radio Manufacturing & Service Co. (Marcus G. Limb)	Fort Smith, Ark.	360	WMAZ	Friday Battery & Electric Corp.	Sigourney, Iowa	360
WGAW	Ernest C. Albright	Wooster, Ohio	226	WMAZ	Midland College	Fremont, Nebr.	360
WGAZ	Northwestern Radio Co.	Altoona, Pa.	261	WMAZ	Tyler Commercial College	Tyler, Tex.	360
WGBA	South Bend Tribune	Madison, Wis.	360	WMAZ	Amolo Theater (Boliviere Amusement Co.)	Beiridre, Ill.	224
WGBB	American Radio & Research Corp.	Altoona, Pa.	261	WMAZ	Palmetto Radio Corp.	Charleston, S. C.	360
WGBL	Thomas F. J. Howlett	Madison, Wis.	360	WMAZ	Southern Equipment Co.	San Antonio, Tex.	360
WGR	Federal Telephone & Telegraph Co.	Madison, Wis.	360	WMAZ	Wash. Electrical Co.	Paris, Kans.	258
WGW	Interstate Electric Co.	Madison, Wis.	360	WMAZ	William E. Woods	Wesley Groves, Mo.	229
WGY	General Electric Co.	Madison, Wis.	360	WMAZ	Vaughn Conservatory of Music (James D. Vaughn)	Lawrenceburg, Tenn.	360
WHA	University of Wisconsin	Madison, Wis.	360	WMAZ	Lyrradon Mfg. Co.	Mishawaka, Ind.	360
WHA4	State University of Iowa	Madison, Wis.	360	WMAZ	Kalamazoo College	Kalamazoo, Mich.	240
WHA5	Clark W. Thompson	Iowa City, Iowa	283	WMAZ	Porlsmouth Kiwanis Club	Portsmouth, Va.	360
WHA6	Colo. Intero. Co.	Galveston, Tex.	360	WMAZ	Boyd M. Ham	Williamston, Del.	360
WHA7	Marquette University	Galveston, Tex.	360	WMAZ	Pennsylvania National Guard, 2d Battalion, 112th Infantry	Erie, Pa.	242
WHA8	University of Cincinnati	Galveston, Tex.	360	WMAZ	Woodmen of the World	Omaha, Nebr.	526
WHA9	Hafer Supply Co.	Galveston, Tex.	360	WMAZ	Franklin J. Wolf	Trenton, N. J.	240
WHA10	Radio Equipment & Mfg. Co.	Galveston, Tex.	360	WMAZ	Penck Hughes Co.	Stamford, Tex.	360
WHA11	Roberts Hardware Co.	Galveston, Tex.	360	WMAZ	Palmer School of Chiropractic	Davenport, Iowa	484
WHA12	Lansing Capital News	Galveston, Tex.	360	WMAZ	Iowa State College	Ames, Iowa	360
WHA13	University of Rochester (Eastman School of Music)	Galveston, Tex.	360	WMAZ	Pine Bluff Co.	Pine Bluff, Ark.	360
WHA14	Ota B. Kuhns	Galveston, Tex.	360	WMAZ	John Wanamaker	Philadelphia, Pa.	509
WHA15	Sommes Motor Co.	Galveston, Tex.	360	WMAZ	Western Radio Co.	Kansas City, Mo.	360
WHA16	Paramount Radio & Electric Co. (W. H. A. Pulus)	Galveston, Tex.	360	WMAZ	L. Bamberger & Co.	Newark, N. J.	405
WHA17	Courier-Journal & Louisville Times	Galveston, Tex.	360	WMAZ	Missouri State Marketing Bureau	Jefferson City, Mo.	441
WHA18	Wilmetton Electrical Society Co.	Galveston, Tex.	360	WMAZ	Pennsylvania State College	State College, Pa.	360
WHA19	Rensselaer Polytechnic Institute	Galveston, Tex.	360	WMAZ	Donalson Radio Co.	Okmulgee, Okla.	360
WHA20	Sweeney School Co.	Galveston, Tex.	360	WMAZ	W. A. Wieboldt & Co.	Waco, Tex.	360
WHA21	Way-Virginia University	Galveston, Tex.	360	WMAZ	W. A. Wieboldt & Co.	Waco, Tex.	360
WHA22	Wardlaw Co. (Warren R. Cox)	Galveston, Tex.	360	WMAZ	W. A. Wieboldt & Co.	Waco, Tex.	360
WHA23	George Schueler	Galveston, Tex.	360	WMAZ	W. A. Wieboldt & Co.	Waco, Tex.	360
WHA24	Joslyn Automobile Co.	Galveston, Tex.	360	WMAZ	W. A. Wieboldt & Co.	Waco, Tex.	360
WHA25	Galveston Tribune	Galveston, Tex.	360	WMAZ	W. A. Wieboldt & Co.	Waco, Tex.	360
WHA26	Howard R. Miller	Galveston, Tex.	360	WMAZ	W. A. Wieboldt & Co.	Waco, Tex.	360
WHA27	Gustav A. DeCortin	Galveston, Tex.	360	WMAZ	W. A. Wieboldt & Co.	Waco, Tex.	360
WHA28	Continental Radio & Mfg. Co.	Galveston, Tex.	360	WMAZ	W. A. Wieboldt & Co.	Waco, Tex.	360
WHA29	Herz	Galveston, Tex.	360	WMAZ	W. A. Wieboldt & Co.	Waco, Tex.	360
WHA30	Fox River Valley Radio Supply Co. (Quinn Bros.)	Galveston, Tex.	360	WMAZ	W. A. Wieboldt & Co.	Waco, Tex.	360
WHA31	Journal-Stockman Co.	Galveston, Tex.	360	WMAZ	W. A. Wieboldt & Co.	Waco, Tex.	360
WHA32	School of Engineering of Milwaukee	Galveston, Tex.	360	WMAZ	W. A. Wieboldt & Co.	Waco, Tex.	360
WHA33	Chronicle Publishing Co.	Galveston, Tex.	360	WMAZ	W. A. Wieboldt & Co.	Waco, Tex.	360

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WQAE	Moore Radio News Station (Edmund B. Moore)	Springfield, Vt.	275	WSAN	Allentown Radio Club	Allentown, Pa.	229
WQAF	Sandusky Register	Sandusky, Ohio	240	WSAP	Seventh Day Adventist Church	New York, N. Y.	360
WQAH	Brook-Anderson Electrical Engineering Co.	Lexington, Ky.	254	WSAR	Doughty Weld Electrical Co.	Fall River, Mass.	254
WQAL	Coles County Teleg. and Teleg. Co.	Mattoon, Ill.	258	WSAT	Donohoo-Ware Hardware Co.	Plainview, Tex.	268
WQAM	Electrical Equipment Co.	Miami, Fla.	360	WSAW	John J. Long, Jr.	Canandaigua, N. Y.	275
WQAN	Scranton Times	Scranton, Pa.	280	WSAX	Chicago Radio Laboratory	Chicago, Ill.	268
WQAO	Calvary Baptist Church	New York, N. Y.	360	WSAY	Irving Austin (Port Chester Chamber of Commerce)	Port Chester, N. Y.	233
WQAQ	Ablene Daily Reporter (West Texas Radio Co.)	Ablene, Tex.	360	WSAZ	Chas Electric Shop	Pomeroy, Ohio	258
WQAS	Prince-Walter Co.	Lowell, Mass.	266	WSB	Atlanta Journal	Atlanta, Ga.	429
WQAV	Huntington & Guerry (Inc.)	Greenville, S. C.	258	WSL	J. & M. Electric Co.	Utica, N. Y.	273
WQAW	Catholic University	Washington, D. C.	236	WSY	Alabama Power Co.	Birmingham, Ala.	360
WQAX	Radio Equipment Co.	Peoria, Ill.	360	WTAB	Fall River Daily Herald Publishing Co.	Fall River, Mass.	248
WRAA	Rice Institute	Houston, Tex.	360	WTAC	Penn Traffic Co.	Johnstown, Pa.	360
WRAE	Taylor Radio Shop (G. L. Taylor)	Marion, Kans.	224	WTAD	Robert E. Compton and First Presbyterian Church	Carthage, Ill.	229
WRAF	The Radio Club (Inc.)	Laporte, Ind.	248	WTAF	Louis J. Gallo	New Orleans, La.	242
WRAH	Stanley N. Read	Providence, R. I.	231	WTAG	Kern Music Co.	Providence, R. I.	258
WRAI	Northern States Power Co.	St. Croix Falls, Wis.	248	WTAH	Carmen Ferris	Belvidere, Ill.	236
WRAJ	Lombard College	Galesburg, Ill.	244	WTAI	The Radio Shop	Portland, Me.	236
WRAK	Black Hawk Electrical Co.	Waterloo, Iowa	236	WTAL	Toledo Radio & Electric Co.	Toledo, Ohio	252
WRAO	Radio Service Co.	St. Louis, Mo.	360	WTAM	Willard Storage Battery Co.	Cleveland, Ohio	390
WRAU	Amarillo Daily News	Amarillo, Tex.	360	WTAN	Orndorff Radio Shop	Mattoon, Ill.	240
WRAV	Antioch College	Yellow Springs, Ohio	360	WTAP	Cambridge Radio & Electric Co.	Cambridge, Ill.	242
WRAW	Avenue Radio Shop (Horace D. Good)	Reading, Pa.	238	WTAQ	S. H. Van Gorden & Son	Ossco, Wis.	226
WRAX	Flaxton's Garage	Gloucester City, N. J.	268	WTAR	Baliance Electric Co.	Norfolk, Va.	236
WRAY	Radio Sales Corp.	Scranton, Pa.	280	WTAS	Charles E. Erbstein	Erie, Ill.	275
WRAZ	Radio Shop of Newark (Herman Lubinsky)	Newark, N. J.	233	WTAT	Edison Electric Illuminating Co.	Boston, Mass. (portable)	244
WRB	Radio Corporation of America	Washington, D. C.	469	WTAU	Ruegg Battery & Electric Co.	Tecumseh, Neb.	360
WRK	Doron Bros. Electric Co.	Hamilton, Ohio	360	WTAW	Agricultural & Mechanical College of Texas	College Station, Tex.	280
WRL	Union College	Schenectady, N. Y.	360	WTAX	Williams Hardware Co.	Streator, Ill.	231
WRM	University of Illinois	Urbana, Ill.	360	WTAY	Iodan-Oak Leaves Broadcasting Station	Oak Park, Ill.	226
WRN	City of Dallas (police and fire signal department)	Dallas, Tex.	360	WTB	Thomas J. McGuire	Lambertville, N. J.	283
WRP	Tarrytown Radio Research Laboratory (Koenig Bros.)	Dallas, Tex.	360	WTG	Kansas State Agricultural College	Manhattan, Kans.	286
WSAB	Southeast Missouri State Teachers College	Cape Girardeau, Mo.	360	WWAB	Hoehniz, Sverrn & Co. (John Rasmussen)	Trenton, N. J.	226
WSAC	Clemson Agricultural College	Clemson College, S. C.	360	WWAC	Sanger Bros.	Vaco, Tex.	360
WSAD	J. A. Foster Co.	Providence, R. I.	261	WWAD	Wright & Wright (Inc.)	Philadelphia, Pa.	360
WSAG	City of St. Petersburg (Loren V. Davis)	St. Petersburg, Fla.	244	WWAE	Alamo Dance Hall, L. J. Crowley	Joliet, Ill.	227
WSAH	A. J. Leonard, Jr.	Chicago, Ill.	248	WWAF	Galvin Radio Supply Co.	Camden, N. J.	236
WSAI	United States Playing Cards Co.	Cincinnati, Ohio	309	WWAX	Wormer Bros.	Laredo, Tex.	360
WSAJ	Grove City College	Grove City, Pa.	360	WWB	Wentworth Printing Co.	Canton, Ohio	268
WSAK	Foster Etnier (Daily News, Pomeroy, Ohio)	Middleport, Ohio	258	WWI	Ford Motor Co.	Dearborn, Mich.	273
WSAL	Franklin Electric Co.	Brookville, Ind.	246	WWJ	Detroit News (Evening News Assn.)	Detroit, Mich.	517
				WWL	Loyola University	New Orleans, La.	280

Canadian Stations

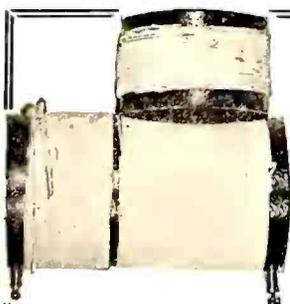
CFAC	Calgary, Alta., Can. Western Radio Co., Ltd.
CFCA	Toronto, Ont., Can. Toronto Star.
CFCB	Vancouver, B. C., Can. Marconi Co.
CFCE	Halifax, N. S., Can. Marconi Co.
CFCF	Montreal, P. Q., Can. Marconi Co.
CFCH	Iroquois Falls, Ont., Can. Aibitbi Power & Paper Co., Ltd.
CFCI	Walkerville, Ont., Can. Motor Products Corp.
CFCN	Calgary, Alta., Can. W. W. Grant Radio, Ltd.
CFX	London, Ont., Can. The London Advertiser.
CFPC	Port Franks, Ont., Can. International Radio Develop. Co.
CFTC	Toronto, Ont., Can. The Bell Telephone Co.
CFYC	Vancouver, B. C., Can. Victor Wentworth Odium.
CFZC	Montreal, Que., Can. Can. Westinghouse Co., Ltd.
CHBC	Calgary, Canada, W. W. Grant Radio, Ltd. (Morning Alberta.)
CHCA	Vancouver, B. C., Can. Radio Corp. of Vancouver, Ltd.
CHCB	Toronto, Can. Marconi Co.
CHCC	Edmonton, Alta., Can. Can. Westinghouse Co., Ltd.
CHCF	Winnipeg, Man., Can. Radio Corp. of Winnipeg, Ltd.
CHCG	Calgary, Alta., Can. Western Radio Co., Ltd.
CHCX	London, Ont., Can. London Radio Shoppe.
CHCY	Montreal, Que., Can. B. L. Silver.
CHCZ	Toronto, Ont., Can. Globe Printing Co.
CHCO	Vancouver, B. C., Can. Can. Westinghouse Co., Ltd.
CHVC	Toronto, Can. Metropolitan Motors Co.
CHXC	Ottawa, Ont., Can. B. Booth, Jr.
CHYC	Montreal, Que., Can. Northern Elec. Co.
CJBC	Montreal, Que., Can. Dupuis-Freres.
CJCA	Edmonton, Alta., Can. Edmonton Journal, Ltd.
CJCB	Nelson, B. C., Can. James Gordon Bennett.
CJCD	Toronto, Can., T. Eaton Co.
CJCE	Vancouver, B. C., Can. Vancouver Sun.
CJCF	Kitchener, Ont., Can. News Record, Limited.
CJGG	Winnipeg, Can. Manitoba Free Press.
CJCH	Toronto, Ont., Can. United Farmers of Ontario.
CJCI	St. John, N. B., Can. McLean, Holt & Co., Ltd.
CJCN	Toronto, Ont., Can. Simmons, Agnew & Co.
CJCS	Halifax, N. S., Can. Eastern Telephone & Telegraph Co.
CJCY	Calgary, Alta., Can. Edmund Taylor.
CJCG	London, Ont., Can. London Free Press.
CJNC	Winnipeg, Man., Can. Tribune Newspaper Co.
CJSC	Toronto, Ont., Can. Evening Telegram.
CKAC	Montreal, Can. La Presse.
CKCB	Winnipeg, Man. Can. T. Eaton Co., Ltd.
CKCD	Vancouver, B. C., Can. Vancouver Daily Province.
CKCE	Toronto, Ont., Can. Ind. Telephone Co.
CKCF	Regina, Sask., Can. Leader Pub. Co.
CKCR	St. John, N. B., Can. Jones Elec. Radio Co., Ltd.
CKCS	Montreal, Que., Can. The Bell Telephone Co.
CKCX	Toronto, Ont., Can. Westinghouse Co., Ltd.
CKCK	Toronto, Ont., Can. Radio Equipment & Supply Co., Ltd.
CKOC	Hamilton, Ont., Can. Wentworth Radio Supply Co., Ltd.
CKOQ	London, Ont., Can. Radio Supply Co.
CKZC	Winnipeg, Man., Can. Salton Radio Eng. Co.

Army News by Radio

For several years the ships of the navy and outlying naval stations have been able to get the news daily from what is known as the Navy Press, which goes out by radio from NAA at Arlington each night. A similar scheme is now under consideration by the war department for sending news, especially army news, to its forces stationed at foreign ports and posts out of the regular news channels.

If the present plan goes through, army posts at Hawaii and the Philippines will receive news bulletins at least once a week from a high-powered Pacific Coast station. These radio bulletins would also be sent to army forces stationed at Alaska, Panama, Porto Rico and Cuba, and be picked up by some of the isolated posts in this country, where little if any army news percolates.

Orders affecting all posts might also be announced via radio in the future to save the expense of telegraph and cable tolls.



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COCKADAY
4 CIRCUIT TUNER?
—IF NOT—HERE'S HOW—

Correct hookup and correct construction coupled with the proper instruments are the only means of obtaining the wonderful results that this remarkable tuner is capable of producing. Get the original hookup and constructional data by Lawrence M. Cockaday, the inventor, together with price list on best instruments for perfect results. **22c.** For a limited time only

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Special Cockaday Cam Vernier Condenser, 17 plate. Prepaid **4.00**

RADIO INSTRUMENTS COMPANY
17 North Wabash Avenue Chicago, Illinois

Pickups and Hookups

(Continued from page 34.)

Chicago Radio Traffic Association, has written the following letter to Frank D. Pearne, technical editor of RADIO AGE, describing how he knocked off thirty-three stations at one sitting. Mr. Marco's letter follows:

RADIO AGE,
Gentlemen:

While essentially a transmitting radio amateur at heart, the writer has followed with a great deal of interest the progress of radio broadcasting, particularly through the columns of your paper, noting therein many of the records set by local receiving stations, especially on silent night. Thinking that possibly some of these records might be broken with the oncoming cold weather, last Monday, October 22, the writer prepared to better the previous record of twenty-six stations on a single silent night by carefully polishing the antenna wire, pepping up the "A" battery, and consulting the weather man, with the results as shown on the appended sheet. The weather man, however, suddenly changed his mind and after starting out nobly during the early part of the evening altered conditions about 8:30, causing it to be a rather poor night.

A careful log was kept of all stations heard, together with times and distances and is herewith presented for the edification of your readers. All work was done on a three-tube set without radio frequency amplification. All stations were audible on loud speaker and in every case except that of KPO, no antenna was used, the pickup device merely being a four-foot loop. The signals from KPO were audible on the loop but hardly strong enough for loud speaker work.

The writer wishes to take this opportunity of expressing the appreciation of himself and the Chicago Radio Traffic Association for the assistance rendered in the recent Second National American Radio Relay League Convention in Chicago, for the cooperation you displayed in bringing our organization before the public eye through the medium of your publication.

Cordially yours,

FRED MARCO.

Secretary Chicago Radio Traffic Association.

Following is the log kept by this sharp-shooting Mr. Marco:

Location and Call	Time	Distance
Philadelphia, WIP.....	5:28	700
Pittsburgh, KDKA.....	5:34	625
Pittsburgh, WCAE.....	5:35-5:46	625
Buffalo, WGR.....	5:50	500
Detroit, WOX.....	6:12	250
Kansas City, Mo.		
WDAF.....	6:18	425
Philadelphia, WFL.....	6:28	700
Newark, WOR.....	6:33	750
Dallas, WFAA.....	6:56	800
Davenport, WOC.....	6:59	175
Schenectady, WGY.....	7:07	750
Washington, D. C.		

WRC.....	7:25	650
St. Louis, WCK.....	7:47	300
Ft. Worth, Texas,		
WBAP.....	7:53	800
Cincinnati, WLW.....	8:06	300
Columbus, O., WBAV.....	8:10	300
Atlanta, Ga., WSB.....	8:18	600
Jefferson City, Mo.,		
WOS.....	8:20	350
St. Louis, KSD.....	8:45	300
Detroit, WWJ.....	8:51	250
Memphis, Tennessee,		
WMC.....	8:55	500
Troy, N. Y., WHAZ.....	9:25	750
New York City,		
WEAF.....	9:27	750
Omaha, WOAW.....	9:40	450
Minneapolis, WBAH.....	9:55	350
Philadelphia, WDAR.....	10:07	700
Los Angeles, KFI.....	10:27	1,800
Denver, KFDL.....	10:41	950
Los Angeles, WHJ.....	11:00	1,800
Waupaca, Wis.,		
WPAH.....	11:30	200
Milboard, Kansas,		
KFKB.....	11:45	600
Calgary, Alberta, Can.		
CFCN.....	11:55	1,400
San Francisco, KPO.....	12 midnight	1,800

Total miles.....22,100
Off 12, midnight; a total of thirty-three stations.

And then, again, here's a New York reader who has a word to say to one of our Kansas City readers:

RADIO AGE,
Gentlemen:

Referring to S. A. Stevenson's letter on Page 17 of your October issue: I picked up practically all his stations and many more, from Luzerne, N. Y. (about 1,400 miles further east). This was accomplished on a modification of the Erla circuit published in a spring number (May) of RADIO AGE. With the exception of WFAA—which was received upon our outdoor aerial—I have heard all of them on an indoor antenna and mostly in August and September.

Very truly yours,

PHILIP G. SCHERMERHORN.
67 West 52nd St., New York.

The editor wishes to thank Mr. Schermerhorn for his letter and for the suggestion accompanying it regarding certain changes in the complete list of broadcasting stations. Letters such as his prove that in trying to help the radio art along (and thereby pay for our own tubes) we haven't been on a dead spot.

If your newsdealer has sold out his supply of RADIO AGE you are likely to miss just the hook-up that you have been looking for. To avoid any such chance fill out the coupon in this issue and send in your subscription. Then you will be safe. And don't forget that with each subscription at the special price of \$2.00 a year, or \$1.00 for six months, we send you free the popular Reinartz Radio booklet FREE. Address Radio Age, 500 N. Dearborn Street, Chicago, Ill.

A Selective Type of Receiver

(Continued from page 10.)

of the rotor windings and connected to the set. These leads must be long enough to allow the rotor to be moved back and forth freely. The ends of the wires on the rotor as well as those on the stator can be anchored by drilling two small holes through the tube, and threading them through. All the turns of wire on both coils should be varnished with shellac, as this will serve to keep them from coming loose.

The method of connecting the taps from the stator A is plainly indicated in Figure 3 and if the coupler is correctly wired in circuit in conjunction with a variable condenser it will provide as good a tuner as can be desired.

A good twenty-three plate variable condenser with a vernier should be purchased and is a necessary unit in future, more pretentious circuits which will naturally follow.

A number of sensitive minerals are used for crystal detectors. Time given to selection of a good detector of this type is well spent, for it is the heart of the circuit. Sometimes high sensitivity discovered in mineral through patient testing permits of a receiving range comparable to that of a tube detector. It must be handled carefully and when a sensitive spot is found care should be taken not to disturb the adjustment. A Galena detector may be mounted in a glass tube. However, it may be desirable to purchase a good fixed crystal detector as there are a number of efficient types on the market.

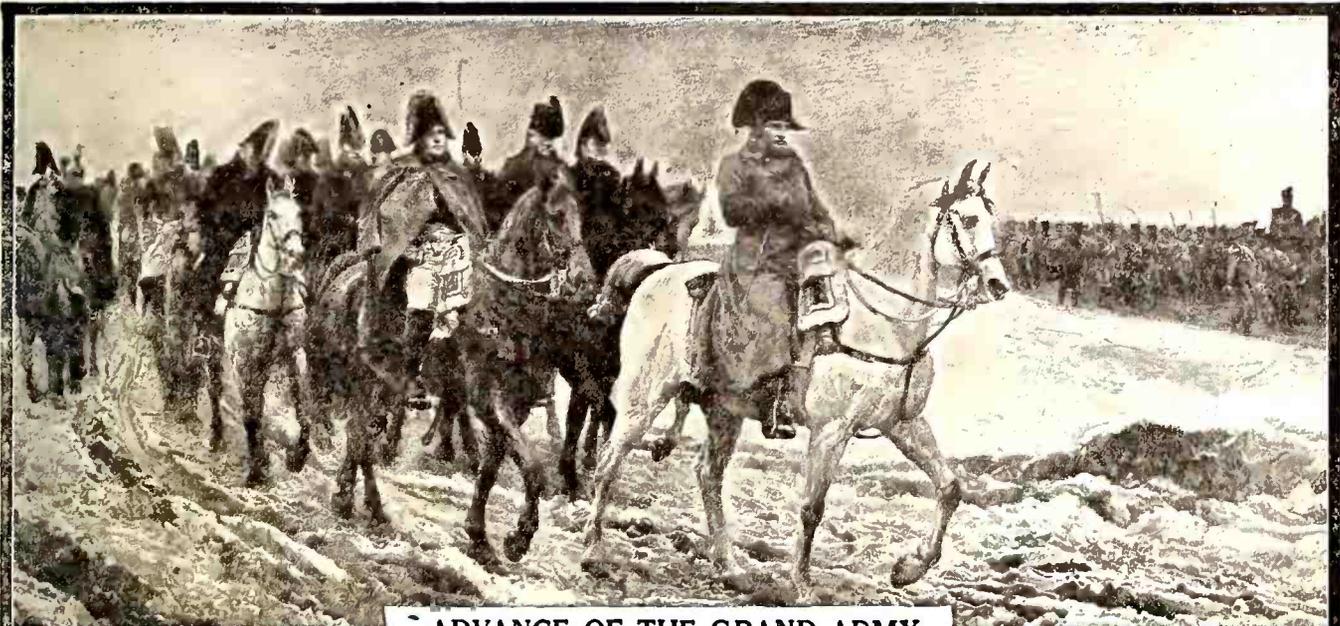
Making Phone Condenser

A 'phone condenser can be easily constructed. Cut out two strips of tinfoil 3 inches wide and 2 feet long, and three strips of thin paraffined paper, 4 inches wide and 2 feet, 3 inches long. After pasting the tinfoil sheets on each side of one of the paper strips, sandwich the whole between the remaining two paper strips and roll it up, binding the roll with tape or cord. Connections are made to the two tinfoil sheets.

The telephone receivers require no description. However, the ultimate success or failure of reception depends in a large measure upon the quality of the telephone receivers. A discriminating selection of dependable 'phones constitutes a wise investment.

The units which comprise this receiver are mounted upon a bakelite panel, which may then be fastened to a small cabinet. Great care should be exercised in soldering. Use a paste flux, as a soldering liquid is liable to run and cause a short or special program on its own. Instruments should be spaced at about two inches, keeping leads as short as possible.

A Schenectady woman, wife of a schoolteacher, asked WGY to broadcast a request for a flat. She described and specified the number of rooms she desired and the rent it was possible for her to pay and also mentioned the streets she preferred.



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NAPOLEON'S name fills more pages in the world's solemn history than that of any other mortal. The advance of his Grand Army into Russia is the turning point of his career and marks the beginning of his downfall. During the World War mighty armies marched over the battlefields where Napoleon fought over a century ago. All the causes of this mighty struggle may be learned from the pages of history. The one complete, accurate, authoritative and reliable history, depicting the rise and fall of every empire, kingdom, principality and power, is the world-famed publication,

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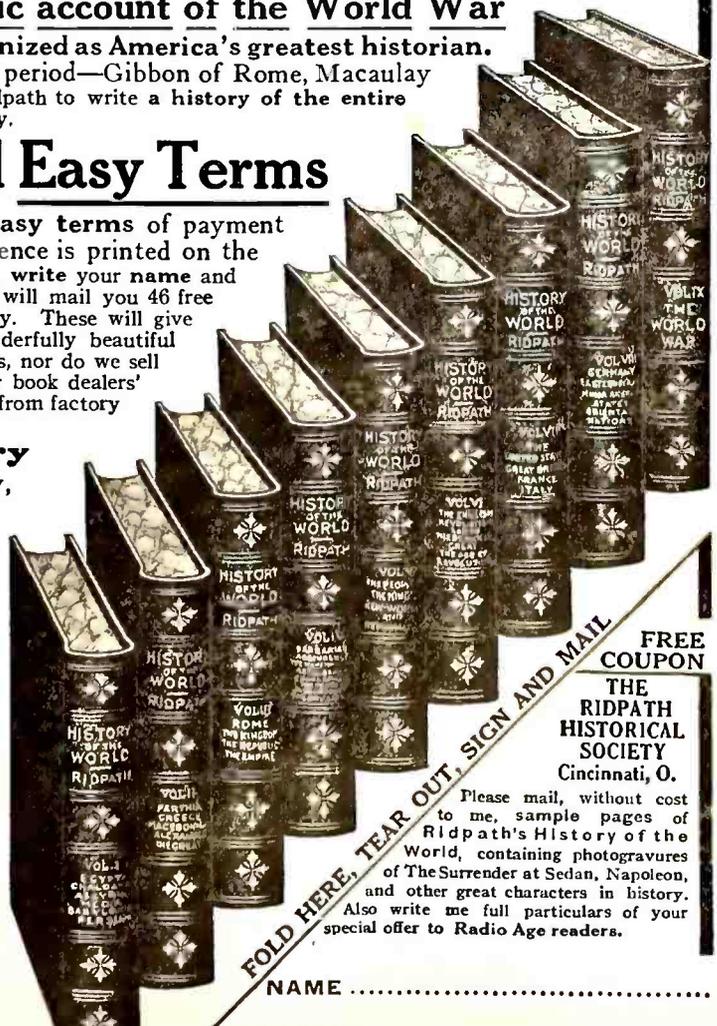
RIDPATH takes you back to the dawn of History, long before the Pyramids of Egypt were built; down through the romantic troubled times of Chaldea's grandeur and Assyria's magnificence; of Babylon's wealth and luxury; of Greek and Roman splendor; of Mohammedan culture and refinement to the dawn of yesterday, including a full authentic account of the World War. He covers every race, every nation, every time, and holds you spellbound by his wonderful eloquence.

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SERVICE DEPARTMENT FOR READERS

Please remember that Radio Age has one of the best radio instructors in the United States, who is ready to answer any technical question. This costs subscribers nothing.

Building the Haynes DX Receiver

(Continued from page 6)

battery, but it must be remembered that for loud reception, the large tubes must be used.

The plate battery should be of the 22 1-2 volt, adjustable type so that just the proper voltage for the particular tube used may be obtained. Figure 1 shows the general layout for the panel. This shows a fixed grid leak, supported by the wires which connect to it, but as before mentioned, the variable arrangement is better and when used should be mounted on the panel, or in the same way as shown in the drawing. As it is never changed after once being adjusted to the tube used, it will perhaps be just as well to mount it as shown.

Figure 2 is the skeleton circuit showing the conventional idea of wiring. The method of winding the bank-wound coil is shown in Figure 3. Some of our readers will no doubt wish to add two steps of audio frequency amplification to the set, so this has been shown in Figure 4. The rheostat shown in Figure 1 is the carbon type, but this is not necessary, as any standard type will answer just as well, although the resistance of it will depend upon the type of tube used. For the large 200 or 300 tubes, this resistance should be about 6 1-2 ohms, but if the WD-11 tubes are used, a rheostat having 25 ohms resistance will be required.

List of Material

- One cabinet to fit 7x10 inch panel.
- One bakelite panel, 7x10 inches, 3-16 of an inch thick.
- One bank-wound variocoupler.
- One switch lever.
- Four switch contact points.
- Two switch stops.
- Eight binding posts.
- One variable vernier 11-plate condenser.
- Two dials. (Standard bakelite.)
- One rheostat.
- One socket (To fit the particular tube used.)
- One variable grid leak.
- One mica grid condenser .00025.
- Thirty feet No. 14 tinned copper wire.

In selecting the socket, be sure to obtain one which can be mounted on the panel, as shown in Figure 1.

The above list covers the parts necessary for the construction of the

set only. The accessories which will also be required are as follows:

- One detector tube.
- One set of "B" batteries (22 1-2 volts adjustable).

- One pair of good headphones.
- One storage battery, or dry cell (depending upon the tube used).

In wiring this set, be very careful to solder all connections and if flux is used, clean off the soldered joints with alcohol after completion.

German Restrictions

Recognizing that radio telephony in Germany has now become an important economic institution, valuable as an agent of communication with foreign countries and within Germany itself, the Federal Ministry of Posts and Telegraphs, which has hitherto exercised a restrictive monopolistic control over all wireless operations, is contemplating an early relaxation of existing restrictions for the benefit of the general public. Consul Richardson reports from Berlin.

Broadcasting has been meagre in Germany. The "Eildienst Gesellschaft" at Berlin has been disseminating financial and commercial news to a clientele of subscribers. The company secured a lease from the government of the wireless station at Koenigswusterhausen in the province of Brandenburg whence it distributes bulletins received periodically from the higher power installation at Nauen. This was a strictly business proposition; the general broadcasting of music, lectures, information and features prominent among radio activities in the United States and elsewhere, has never been done in Germany.

A club, comprising principally amateurs interested in wireless, was formed in Berlin in the early months of this year. One of its declared objects was to induce the government to sanction the free installation of private receiving sets and encourage radio progress. Apparently good results have followed the club's efforts.

It is now understood that a public organization will combine and circulate a program of political, scientific and popular lectures of all sort, as well as music, etc. The federal telegraph administration will probably establish a number of sending stations. Any individual who secures a permit at his postoffice will be authorized to receive this service. The permit, which may be had at a small annual fee, will entitle the holder to use a receiver.

Unauthorized "listening in" will be considered an offense against the Post and Telegraph regulations and will be punishable. Receiving apparatus will be procurable by license holders at specially designated shops. Manufacturers are to be allowed to deliver receiving sets only to such persons as possess the required permits. The sets must correspond with all the technical

conditions of the Telegraph administration, and the selling firms must declare their readiness to pay the government a certain proportion of the profits of each sale.



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Tested and approved by amateurs and experts. Enables you to tune distant stations easier and more clearly. Simple as A B C. Installed from outside, no dismantling of your set necessary. Audibility made more natural or less distorted by the final adjustments obtained. One Hunt's Device handles all dials on set or several sets. Costs only one dollar on guarantee of money refunded if not satisfied. Ask your dealer or order direct from

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Complete Regenerative Vacuum Tube Receiver.

	Approximate range 1,000 miles.	Our Price	Others
Panel 7"x12" already drilled.....	\$ 1.75	\$ 2.50	
Cabinet k. d. of 3 ply wood to fit.....	1.50	2.50	
2 three inch dials at 30c each.....	.60	1.00	
16 switch points with nut at .01c.....	.16	.48	
4 switch stops with nut at .01c.....	.04	.12	
8 binding posts, nickel plated at .03c.....	.24	.48	
2 switch levers with 1/2" radius at .25c.....	.50	.80	
1 filament rheostat. Good grade.....	.50	1.00	
1 180° vario-coupler—16 taps.....	2.75	3.50	
1 23 plate variable condenser.....	1.75	2.80	
1 tube socket of high quality.....	.45	.75	
1 phone and 1 grid condenser at .15c.....	.30	.50	
1 set transfers for marking panel.....	.20	.30	
10 feet spaghetti tubing at .01c.....	.36	.54	
1 tube socket support.....	.20	.30	
20 feet soft copper connecting wire.....	.20	.30	
1 1 copy "Radio Construction for the Amateur".....	.50	.50	
	\$11.95	\$18.32	

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 Transformer — Audio frequency
 "Rhamsino"..... 3.00 4.00
 Detector tube—6 volt—"Independent"..... 2.95 4.00
 Two step amplifier parts complete..... 13.95 21.50

What They Say

A great many unsolicited testimonials with reference to the above k. d. outfit have been received. A couple are:

Roxbury, Connecticut.
 Am getting excellent service from one tube single circuit receiver which was bought knocked down from you. Have heard ninety-four stations including PWX at Havana, Cuba and my friends think it is great.
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 The set which we made from your parts is giving good satisfaction. We have heard 1,500 miles or more air line. Have heard KJZ, KWI, KHH, the last two being in Los Angeles, California.
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Leviathan's Life Boats

Two of the Leviathan's life boats, both ten knot motor boats, have radio transmitting and receiving sets and calls of their own. Life boat No. 67 is WSNA in radio talk, and No. 68 is WSNB. The Leviathan's own call is WSN, her two tenders carrying an additional letter. This is a new departure in American shipping, planned as an additional sea safety precaution. If the Leviathan's radio apparatus should get out of order, or she should be sunk, her two motor boats could communicate with relief ships, within about fifty miles, guiding them to the scene. Each of these radio-equipped craft carries a spark set, and one Kilowatt gas engine generator; they communicate on wave lengths of 300 and 400 meters.

New Army Stations

The army signal corps is busy installing a radio station at Fort Douglas, near Salt Lake City, Utah, which will be the largest radio telegraph station of the army. It will have but one tube, the new ten kilowatt radiotron developed by the General Electric Company, which is building the equipment.

Another similar station is being erected at Leavenworth, Kans., but this station will operate with two tubes and will have a telephone circuit as well as the radio telegraph. The radio circuit between these two stations, the Arlington, Va., station and a land line from Leavenworth to San Francisco, will span the United States. Each of the two interior stations will be equipped with two steel 300 foot towers.

It is the plan of the army radio service not to use coastal stations, that part of the work being handled by the naval communication service, and the army does not desire to interfere with ship to shore communication.

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So easy to construct that anyone who can handle a screw driver can build the set complete in a surprisingly short time—about 1 1-2 hours. Everything is so simple and easy.

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One tube hook-up makes set equal to any other two tube set ever invented. Erla two tube set equals four tubes of the best of other hook-ups.

Erla three tube hook-up has no equal up to seven tubes of other sets. This hook-up brings in the most distant stations with a volume equal to powerful local stations. In volume this hook-up equals that of any seven

tube set ever devised. And for naturalness of tone has no equal in any other set of any number of tubes. The results from the Erla 3 tube is naturalness itself and cannot be improved upon. Actual size working diagrams make every thing simple and easy.

Every piece of apparatus and every wire is pictured in its exact place—every article needed is listed on the diagrams.

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Amateurs to Compete in Picking Up Calls

HARTFORD, Conn., Nov. 25.—The fourth series of transatlantic tests of the American Radio Relay League between December 22 and January 10 will be a receiving contest as far as American and Canadian amateurs are concerned. They will keep their transmitters silent during the entire period listening for signals from European operators.

Believing that their skill in transmitting has been tried and proved, amateurs on this continent are now going to show the European radio men the courtesy of allowing them to do the sending, while their own sets and ears are sharpened and tuned to catch the incoming signals.

During the first three transatlantic tests North American amateurs were determined to get their signals across the water. Transmission was the big thing and meant everything to them. Even last year when signals from United States transmitters were hurled across the ocean by the hundred, there was only a mild interest in the receiving end. This was a great disappointment to the French and British hams.

With the conditions for the present tests changed and the motives practically reversed everything depends on the receiving and the time previously used by each operator in getting his entire apparatus into trim will now be given almost wholly to the improvement of the receiving circuit. This opens the way for the free-for-all two-way tests which immediately follow the last day of the transatlantics.

The program that has now been arranged by F. H. Schnell, traffic manager of the A. R. R. L., calls for transmission by the British amateur and French operators on alternate nights between 8 p. m. and 1 a. m. eastern standard time, with the latter starting on December 22.

Another feature of the tests is the offer by prominent manufacturers of thousands of dollars worth of radio apparatus for prizes, including a \$1,100 transmitter by A. H. Grebe and Company, Inc.

In previous years this season found the American ham going over every detail of his transmitter, devising new ways of crowding stray watts into his set to increase his range. Now the same careful attention is being given to the receiver, while the CW sending set stands idle with the aloof dignity of accomplishment.

It is no novelty for the relaying amateur to rebuild his receiver and it is directly in line with the present movement calling for the installation of the super-heterodyne, or another of the new types of receiving circuits that are fast gaining in popularity. This means as radical a change as it was for the amateur to revert from the old thunder-spark set to the smooth-toned CW in transmission.

The complete failure of the first transatlantic amateur tests in February,

Appeal to Amateurs

THE American Radio Relay League makes an appeal to the American and Canadian transmitting amateur.

The A. R. R. L., in co-operation with the leading radio societies of Europe, is conducting the fourth Trans-Atlantic Tests from December 22, 1923, to January 10, 1923. It appeals to the transmitting amateur asking him to please keep his transmitter silent during the period of the tests. An absolutely quiet air every night during the test is desired.

The American and Canadian amateurs are not scheduled to transmit at any time during the tests as the league desires to lend its best efforts at receiving European amateurs and to try to establish two-way Trans-Atlantic Amateur Communication. First of all, Americans must show that they can copy foreign amateur signals.

Hours of transmission by European amateurs (French and British) will be from 0100 to 0600 Greenwich Mean Time; 8:00 p. m. to 1:00 a. m., Eastern Standard Time; 7:00 p. m. to Midnight, Central Standard Time; 6:00 p. m. to 11:00 p. m. Mountain Standard Time; 5:00 p. m. to 10:00 p. m., Pacific Standard Time. Wave lengths will be from 180 to 220 meters.

The tests are open to the broadcast listener who is able to copy the code. The European transmissions will be at no more than ten words a minute. Over \$3,500.00 worth of prizes will be awarded for the best reception reports turned into A. R. R. L. Headquarters, 1045 Main Street, Hartford, Conn.

1921, only acted as an incentive for those that followed. Transoceanic amateur radio loomed up as a tremendous achievement. The next year the experiment was considered worthy of sending an American amateur, Paul Godley, to Ardrossan, Scotland, to listen.

There in a fishing village some twenty miles to the west of Glasgow, Godley heard nearly thirty stations and one compete message. The job of getting across was finished to all purposes; it had been proved amateurs could reach over the broad Atlantic on low power.

The business of organizing the third transatlantics was by way of demonstrating that transoceanic amateur radio could become a common thing and was well within the realm of the practical. The signals went over to the tune of more than a score a day, and when the final total was made up, more than 300 stations had landed.

In the "west bound" tests a total of about twenty American amateurs heard European amateur signals primarily from three stations French,

SAB, British, 5WS and British, 2FZ. American hams plan now to surpass all receiving records.

Seven Standard Stations

Seven radio stations have been named by the Bureau of Standards as maintaining sufficiently constant transmission frequencies to serve as standards for calibrating wave meters and radio-receiving apparatus. Two, KDKA and WGY, are broadcasters.

The stations, located in Massachusetts, New York, New Jersey, Pennsylvania and Maryland, include one naval station, four radio corporations, one general electric and one Westinghouse station. The Tuckerton station of the R. C. A. leads the seven in accuracy, deviating only 0.1 per cent in thirty-six tests of its assigned frequency; all the other stations are, however, not deviating on an average of over 0.3 per cent, and should serve as fairly accurate measures of frequencies.

The seven stations follow with their frequencies and other data:

Station	Owner	Location
WQL	R. C. A.	Coram Hill, L. I., New York.
NSS	U. S. N.	Annapolis, Md.
WQK	R. C. A.	Rocky Point, L. I., New York.
WGG	R. C. A.	Tuckerton, No. 1, N. J.
WSO	R. C. A.	Marion, Mass.
WGY	G. E.	Schenectady, New York.
KDKA	W. E. M.	E. Pittsburgh, Pa.

Commenting on the standard frequency situation, the Bureau of Standards says: "If every radio transmitting station maintained exactly the wave frequency assigned to it, there would be available a standard frequency wave every time any station was in operation. However, at present this is the case only with certain stations, and because it is a matter of difficulty to maintain exactly the assigned frequency, and also because this is of great importance, the bureau has been collecting some interesting data on the subject. As a result of these measurements, it is possible to give out information from time to time on stations which maintain a sufficiency accuracy to be useful as frequency standards. Several stations, which use special means for maintaining constant frequency, have very nearly attained the goal of remaining within two kilocycles of the assigned frequency, as recommended by the Second National Radio Conference.

Transmissions from seven stations may be used in standardizing apparatus, by the methods given in Bureau of Standards Letter Circular 92, "Radio Signals of Standard Frequency and Their Utilization."

Your Radio Problems Solved for 30 Cents in Stamps

IF YOU are constructing a receiving set, a battery charger, a loading coil, a condenser, or a transformer and you need help in the way of clear diagrams and full detailed descriptions of that very thing you may have it by return mail.

We have laid aside a limited number of back numbers of Radio Age for you. Below we are listing the hook-ups and circuit diagrams to be found in these magazines. Select the ones you want, enclose 30 cents in stamps for each one desired.

We advise immediate attention to this as the stock of back numbers is diminishing rapidly.

May, 1922

- How to make a simple Crystal Set for \$6.

June, 1922

- How to make a Receiving Transformer.
- Aerials under ground and under water.
- Electric light wires as auxiliary to radio.

September, 1922

- Bank uses radio to serve public.
- How to construct the Reinartz Receiver.
- Federal Act regulating radio.

October, 1922

- How to make a Tube Unit for \$23 to \$37.
- How to make an Audio Frequency Amplifying Transformer.

November, 1922

- Photo-electric Detector Tubes.
- Design of a portable short-wave radio wavemeter.

December, 1922

- Home-made battery charger for \$3.00.
- Principles of radio receiving equipment.

January, 1923

- How to make a sharp-tuning Crystal Detector.
- Fixed condensers in home-made receiving sets.
- Description of loading coil for simple sets.

March, 1923

- Layout and drilling for Reinartz Tuner, with amplification.
- How to make the Crystal Set do long distance work.
- Wired wireless.
- How to make an Audio Frequency amplifier.
- Symbols used in radio diagrams.

April, 1923

- The Kopprasch circuit.
- How to make a one-tube loop aerial set.
- A two-circuit Crystal Set.

May, 1923

- How to make the Erla single-tube reflex receiver.
- How to make a portable Reinartz set for summer use

June, 1923

- How to build the new Kaufman receiver.
- What about your antenna?
- Use of Rubber for radio parts.

July, 1923

- The Grimes inverse duplex system.
- How to read and follow symbols.
- Proper antenna for tuning.

August, 1923

- Construction of the Cockaday four-circuit tuner.
- An efficient two-stage amplifier.
- A simple buzzer transmitting set.

September, 1923

- How to load your set to receive new wave lengths.
- Simple Radio Frequency Receiver.
- Radio with the MacMillan expedition.

October, 1923

- The Four-Tube Neutrodyne.
- Your First Tube Set.

November, 1923

- The Super-Heterodyne.
- A Three-Circuit Tuner.
- How to Learn Code.

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THE AMERICAN RADIO RELAY LEAGUE
HARTFORD, CONN.
RADIOGRAM

TO: Radio Station
FROM: Radio Station
DATE: _____

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REGENERATED GREATLY ENHANCED THE SOUND & THE QUALITY. WE ARE EXTENDING RANGE
FROM ALL OVER THE UNITED STATES

Inside the Arctic Circle, nine degrees from the North Pole, a little 89-foot schooner is frozen fast in the ice of Smith Sound. Aboard this schooner a group of brave men are enduring, as best they can, the desperate cold of the Arctic—cold that often drops to 60 degrees below zero. Human atoms in a boundless field of ice!

Cold is hard to endure, but far more terrible is the Arctic solitude—unbelievably oppressive. Radio, at length, has broken this spell forever!

Concerts from Honolulu!

Daily, by means of powerful sending and receiving apparatus, the crew of the "Bowdoin" are in communication with relatives and friends in the far-off States. Daily they listen to concerts as far away as Chicago, Dallas, and Honolulu!

When the sanity, the very lives of one's shipmates may depend upon contact with the outside world, none but the *best* is good enough.

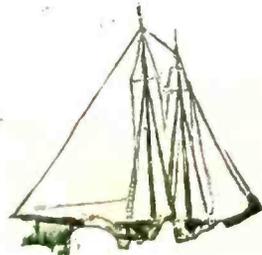
Dr. MacMillan's Choice—the Zenith

Out of all the radio sets on the market, Dr. MacMillan selected the Zenith exclusively—because of its flawless construction, its unusual selectivity, its dependability and its tremendous *reach*.

Already his operator, on board the "Bowdoin" in *Northern Greenland*, has tuned in several hundred stations. You along the Atlantic who brag a little when you tune in Catalina Island—what would you say if you tuned in Hawaii *from the Arctic Circle*?

The set that Dr. MacMillan has is a standard Zenith receiving set. And you can do all that MacMillan does, and more, with either of the two new models shown at the right. Their moderate price brings them easily within your reach. Write today for full particulars.

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Model 4R—The new Zenith 4R "Long-Distance" Receiver-Amplifier comprises a complete three-circuit regenerative receiver of the feed-back type. It employs the Zenith regenerative circuit in combination with an *audion detector* and *three-stage* audio-frequency amplifier, all in one cabinet.

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The Zenith 4R may be connected directly to any loud-speaker *without* the use of other amplification for full phonograph volume, and reception may be satisfactorily accomplished over distances **\$85** of more than 2,000 miles



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The new Zenith 3R has broken all records, even those set by its famous predecessors of the Zenith line. Satisfactory reception over distances of 2,000 to 3,000 miles, and over, is readily accomplished in full volume, using *any ordinary loud-speaker*. No special skill is required.

The Zenith is the only set built which is capable of being used with all present-day tubes as well as with any tubes that may be brought out in the future. The Model 3R is compact, graceful in line, and built in a highly finished mahogany cabinet **\$160**

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