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Complete Corrected List of Broadcasting Stations

More Good Circuits

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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.

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Frederick Smith

—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.
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 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
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 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 Postal entries.

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.

If your newspaper 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 it 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. 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, 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-

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FIGURE 2.

This shows the electrical connections of the instruments as illustrated isometrically in figure 1. The accompanying article describes in detail the winding of the coils.
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 59 turns, wind 4 more turns, bringing out a tap every 2 turns. Thus the primary coil is tapped at the 35th, 36th, 57th, 59th and 61st 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. As the 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)
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, carbon, and hornite, 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. Richwen, of the Seattle office, who died recently. Mr. Richwen, 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. Redfearn.

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

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 wonderfully portrayed.

Radio reception is what the beginner of today usually starts with, because of its simplicity. The truth of the matter 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
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 cardboard 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 cardboard 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 the tube at one side to extend through a panel, allowing length enough for fastening of an insulating knob. It need only extend on 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 as A, 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 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 88).
THE near future will see small compact and stable 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 tenant 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 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.

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
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 individuals 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 94 of this issue of RADIO AGE.
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 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 p.m. 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 Company's station WCAP, the newest radio station in the country, which was put on the air from the Metropolitan Opera House, N. Y. The former British premier's speech was broadcast from that auditorium by station WEAF. (Kadel & Herbert.)
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 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

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 for 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 micro-phone.

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

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 from their backs.

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

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

- **AERIAL**
- **GROUND COUNTER**
- **PHONE**
- **LOUD SPEAKER**
- **LOOP AERIAL**
- **TUNING COIL**
- **COIL = 2 SLIDERS**
- **NO CONNECTION**
- **BATTERIES**

- **CHoke COil**
- **Vario or looSE COUPLer**
- **VarioMeter**
- **HomeCOMB COil**
- **Tapped COil**
- **Rheostat**
- **POTENTIOMETER**
- **GRID LEAK**
- **CRYSTAL DETECTOR**
- **METER**

- **ConDenser**
  - Fixed
  - Variable
- **Radio Frequency Transformer**
- **Audio Transformer**
- **Jacks Plug**
- **Condenser**
- **Audio Frequency**
- **Connections**
  - **Parallel Series**

- **VarioCOUPLer CONNECTIONS**
- **Tube Socket Connections**
- **Vacuum Tube**
- **Filament Circuit**
  - **A - Grid Circuit**
  - **B - Plate Circuit**
- **Oscillatory Circuit**

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**Circuit Diagram**
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 honeymoud crystal 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 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 type 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 1. This is another arrangement possible, using the instruments of the long-distance crystal set in a one-tube hookup. The varoiometer is split and used in the circuit as shown. The set is highly regenerative and gives unusually loud signals.](image-url)
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 1/4 x 6 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 I have had 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 4 the set with two stages of amplification on.

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.

G. 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 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 WD11 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 you 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 graphite type, having a maximum resistance of 10,000 ohms. The battery marked B should have a voltage of from two to four volts.
connections 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 carbon- and copper-oxide and boronite 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 over-all efficiency 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 Westinghouse 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 to new or rewiring or any service 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 come across six different 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 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 determining the over-all efficiency of your 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 try 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 water-piping ground were just about a standoff. However, the type 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.

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 Reinhartz 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 WD 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 Reinhartz 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 par 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 varico coupler 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.
Antenna Facts
By Beverly Dudley, Member A. R. R. L.

A SHOT antenna has the advantage of being long on 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 antennas 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—the includes lead-in and ground—under 100 feet so that amateur signals from American Radio Relay League stations may be received as well as for 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 lower one; however the higher one suffers from the disadvantage of being more vulnerable to Electrical storm damage. Nevertheless, the taller one is preferable.

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 the terminals. Glazed porcelain insulators are the best with genuine electroscopic 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 otherwise at insulated points.

Amplifier Advice

Use the proper transformer on a certain tube.

Grind the cores of the transformers, 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 radio transformer for the second stage, if the second stage amplifies 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, and well soldered.

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

Connect the grid and plate to the proper leads through leads which are outside of the primary of the transformer. 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 it?

You would not demonstrate the power of the A batteries by short-circuiting the terminals and showing the heavy spark you could 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 treated with 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., operator WCP, 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. About ships this feature would eliminate cost, space and weight. It would make the lowering of small 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 weight, cost of installation and 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 manilla 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 made in such a way that MacMillan'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, good!" 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 non-breakable character. The headband 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.
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, and 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 adjustments to extreme positions on either side.

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; 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, which ever 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 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 transmitter 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 breath of air 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 broadcast 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 radiation 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 Buenos Aires. The technical programs from the Vina del Mar station were 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 are also discernibly 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 Aristia.'"
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 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 dididAHdi di di dAHDididi, (PB 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 signature or vibrator 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 dididiDAHdi 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 "pump hand 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
transmitting before you really know how to handle the key, you will only acquire jerky, ill-paced sending, and nothing will be accomplished. Make your dashes three times as long as your dots, and longer if you find trouble in making them short. The space between 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 one-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 DAHditDAHdit, making this sound like a pair of short dots while the letter, while the combination N should be sent DAHdit—DAHGdit 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 dot group 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 dots or dashes to the old 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 to receive and copy.

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 and 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 to the foregoing procedures, 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 'Ts' and dot your 'Is' when copying. But on the other hand there is always a single out there, 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 discouraged—here is where the real trial comes in.

Choose one of the signals of code that is going along at a rate 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 yourself advanced far enough 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 in as much 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 in the mistakes in copying, 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 you are listening to this process of calling, you should 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 one 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 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, Morris, 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 Puerto 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:

EIGHTH DISTRICT:
Headquarters at the Federal Building, Detroit, Mich. The eighth district comprises all of the state 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, Iowa,
amateurs in transmission, and is significant of the spirit of good will and friendship existing between amateurs. 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

USE NATIONAL AUDIO FREQUENCY TRANSFORMERS

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<th>Price</th>
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Jobbers and Dealers write for Sales Proposition

Chicago's First Radio Market-Place

Amateurs and fans—get together in buying, selling or trading radio sets or parts. Hundreds of fans are meeting each other to mutual advantage by way of Chicago's only radio market-place—the Chicago Herald and Examiner "Radio" Want-ads—where they can deal directly with one another in buying, selling and exchanging equipment. Read the Herald and Examiner "Radio" Want-ads. If you can't find what you want, or if you have something to sell or exchange, phone a Want-ad to Main 5000.

Herald & Examiner "Radio" Want-ads
more here now so be sure to 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 di DAH for O. K.
73 for Best Regards.
wlom for Well O11 Man.
g 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—end.
msg—message.
tfc—traffic.
cul—see you later.
c—see.
sg—going.
u—you.
r—are.
ur—you are, your.
oc—Oh I see.
red, r—received.
abt—about.
min—minute.
fix—fixed.
w—well.
wm—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.
listen—listen.
QST—stand by and listen. Copy what I have to say.
fm—from.
eo—to.
spk—spark.
cw—continuous wave.
becuz—because.

arr!—American Radio Relay League.

er—12 fm chgo eo (address)
and then the signal ——-
crd. recd. taks. w1 qs1.

sg

9DQS

There are many other abbreviations and forms of signaling words for which no rules can be formed. In code, the quickest, simplest and most effective way possible is used 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 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 ORV 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 er 1 fm hr eo john smith 1234 western st., los angeles cal bk crd red ltr follows with dope on cw set. pse qsl. sk gn 9BDL hw ! 9DQS de 9BDL k (9BDL giving the message to 9DQS and asking how he got it.)

R 9BDL de 9DQS ok 1 qrv 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 saturday, gess nilw 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 hr nw so cu 173 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.

9BDL announcing his willingness to sign off) usually followed by the signal di 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 Troubleshoter department.

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

SK de 9DQS es 9BDL.
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 comrade, Señorita Fernandez Ramos, with formidable field. And it was formidable, for Cuban 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 Havana 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 Fernandez's operator friends determined to take her pose before the camera of the socially-favored specialist in feminine portraits, Joaquin Blez, than whom there was none more excellent.

Bathed in a Parisian gown by Mne. Cunard, 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, and he had long been adjudged incapable of 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 Fontanilla, 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 cornei 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 order. 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 Reinkartz Radio booklet FREE. Address Radio Age, 500 N. Dearborn Street, Chicago, Ill..
PICKUPs AND HOOKUPS

By Our Readers

Comparing results is one of the most entertaining diversions offered by radio, outside of listening. That next morning post mortem on what stations were heard the night before is usually one of the joys of being the proud owner of a radio set. When you hear Havana or POZ or some other distant station, you know that the other fellow will be interested in knowing how you did it, and you naturally pass it on to the other bugs, being as modest about it as you can. That's the kind of spirit that keeps the game going. That's the way it started. If everybody were selfish and kept his results a dark secret, the game wouldn't move very fast.

Therein lies the keynote of the popularity of the Pickups By Readers department. Every day we get many letters from readers telling us how they feel about this and that circuit, offering improvements and kinks, and sometimes challenging the other readers to "raise" their record for pickups. If this spirit of generous good will and good natured rivalry is continued there will be an increasing interest in radio. We want you to feel free to write this department, when you accomplish something or have some little improvement or other that would be interesting. You use the questions and answers department when you are having trouble—why not let the Pickups By Readers' department hear from you when your set is doing its darndest?

C'mon BCL! Let's have your lists and pet kinks.

THE EDITOR.

Last month we featured letters from those who were getting results from the Cockaday circuit described in the August issue, and immediately we get letters from fellows using Reinartz, Erla and other circuits who good naturedly remark with a shrug of the shoulders "that's nothing, listen to this one!"

RADIO AGE, Gentlemen:

I have been interested in noting your "Pickups By Readers" for the November issue. The fact that 1,000 miles reception on a two-stage Cockaday or Reinartz has been considered good performance impels me to report results obtained with my set. This is also a two-stage Reinartz set, using power tubes, in the conventional two stage transformer coupled amplifying circuit.

I experience no difficulty in tuning out our local stations WWJ and WCX, and picking up out-of-town stations. We receive stations as far distant as 1,250 or 1,300 miles so well on loud speaker, that they can be heard in the flat below us, and on the street, also. Los Angeles (2,451 miles) and Havana, Cuba (1,500 miles) come in nearly as well, except that their tuning is very sharp. I tune in most long distance stations without the phones on—using a loud speaker unit on my victrola.

My set is "homeade," using an outside antenna of three wires only thirty-five feet long, and about twenty-five feet from the ground, and in a relatively poor location, inasmuch as it is surrounded by trees, telephone wires, and power lines.

The results I have secured make me a staunch Reinartz enthusiast and I would recommend it to anyone desiring a good moderately priced circuit.

What were the long distance receptions you mentioned in connection with reception by W. Lehr of Chicago?

Very truly yours,

L. E. TREADWELL.
1051 Baldwin Ave., Detroit, Mich.

This letter makes R. R. C. (the Reinartz Radio Circuit) advance a couple of points in the field of radio circuits. Mr. Treadwell makes quite clear that the Reinartz is a consistent long-distance getter. With reference to Mr. Lehr's record: Mr. Lehr sent us a list 'way back in January at the beginning of the year, which we published in the January-February number, and the day after RADIO AGE came out, the postman staggered in through the door with a load of letters from fellows inclosing lists of stations heard on their Reinartz sets. If you want to get a line on what some of the other fellows accomplished with this circuit take a peek back into the March, 1923, issue of RADIO AGE.

Back in May we published data relative to the construction and operation of the Erla reflex circuit. Just glance at this and see what it did for one of RADIO AGE's regular readers:

RADIO AGE, Gentlemen:

I have read quite a number of excellent "Pickups" in RADIO AGE and some of the fellows certainly have been going some. Now I don't feel like I have accomplished wonders, but let some of the BCL's, especially those who want volume read these.

On Saturday night, October 13, between 9 and 10:30 p. m., the following stations were heard through an Art Mache unit with a diecast wood horn loudspeaker, connected to the single tube Erla reflex circuit constructed by myself, with the aid of RADIO AGE. All the following stations were heard clear and distinctly, and with enough volume to be heard throughout a large room: WGY, WJZ, WTAM, WOC, WOA, WOC, WFAA and WHAS, my local station.

Figure 1. This shows the circuit constructed by one of our readers, which is giving unusual results. L1 is a spider web coil, having 10 taps, with taps at every seventh turn, making the coil 70 turns in all.
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 Reinarz 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 RCL who are 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.

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 spider coil of sensitivity about 100,000 S.C. C., with taps at every tenth turn. With it we can get all stations on the new wavelength, clearly and with surprising volume.

The stations we have logged are: KSD, WLW, WSAI, WIAS, WJAX, WWJ, WJKD-KDK, WCAE, WEAF, WGY, WGR, WLAG, WMC, WSB, WHB, WFAA, WBAP, WOAW, WOC, WRM, WJAZ, WPAD, WDAP, WMAQ, KYW, WIAS and others.

This set, using all reliable material, can be built and installed at a 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
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.

Where's 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.: WAP, 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:

"Any one 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 ear drums 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 an antenatal 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 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 correspondents. Suggestions concerning additions and additional data will be welcomed from readers. Broadcasters: Send in your program schedules.

Waves

KDFK Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. (east end of New York Community.)
KFOM Westinghouse Electric & Mfg. Co., Cleveland, Ohio.
KDRW Telgeveck Publishing Co., Salt Lake City, Utah.
KSYO Oregon Institute of Technology, Portland, Ore.
KSFY Grace College, Denver, Colo.
KOTG White Avenue. Cleveland, Ohio.
KAGC State College of Washington, Pullman, Wash.
KJAV University of Colorado, Boulder, Colo.
KDDI King's College of Southern California, Los Angeles, Calif.
KBMA A. R. Allen, Creekside, Ill.
KFAI State College of Washington, Pullman, Wash.
KFIR State University of Iowa, Iowa City, Iowa.
KFDJ University of Idaho, Moscow, Idaho.
KFCH Oregon Farm Bureau Federation, Oregon.
KFDI Independent School District of Boise City, Boise High School, Boise, Idaho.
KFDF The Radio Item (W. D. Amberg), Santa Ana, Calif.
KFBB F. A. Butterly & Co., Havre, Mont.
KFAN Boise High School, Boise, Idaho.
KFBN St. Louis, Mo.
KFBI Grand Rapids Broadcasting Association, Portland, Ore.
KFBI Independent School District of Boise City, Boise High School, Boise, Idaho.
KFBB Nebraska State University, Lincoln, Neb.
KFCH University of Arizona, Tuscon, Ariz.
KFBO Washington State University, Pullman, Wash.
KFBI F. U. C. E., Millford, Conn.
KFBI Pacific Electric, Portland, Oreg.
KFBI Master Electric, Inc., Denver, Colo.
KFBI United Photographic Supply Co., New York City.
KFBI Citizens Society of Mechanical Engineers (K. H. Leary), New York City.
KFBI M. S. Creasy, Philadelphia, Pa.
KFBI E. L. Howard, New York City.
KFBI W. K. Smith, Los Angeles, Calif.
KFBI J. H. White, Dallas, Tex.
KFBI R. B. C., New York City.
KFBI K. S. Davis, San Francisco, Calif.
KFBI E. L. constitutional, New York City.
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Complete Corrected List of U. S. and Canadian Broadcasting Stations

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<th>Station</th>
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Note: The list continues with more stations and cities across the United States and Canada, including various frequencies and formats, such as news, music, and educational broadcasting stations.
Complete Corrected List of U. S. and Canadian Broadcasting Stations

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<tr>
<th>Station</th>
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Canadian Stations

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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 Manila, Hawaii, and other outlying stations will receive news bulletins at least once a week. The new radio station is operated by the Swimming pool at Camp Roosevelt, Alaska. 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.

Are You Getting 100% Results From Your 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 hookups and constructional data by Lawrence M. Cockaday, the inventor, together with price list on best instruments for perfect results.

Purchase Prepaid

Cockaday Coils A, B, C and D complete with diagrams, wound for the new high wave length $3.00

Special Cockaday Cam Vernier Condenser, 17 plate $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. Pedal, amateur 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, early Monday, October 22, the writer prepared to better the previous record of twenty-six stations on a single silent night by carefully polarizing the antenna wire, replacing the "A" battery, and baptizing 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 not strong enough for loud speaker work.

The writer wishes to express 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, WPX ...... 5:34 625
Pittsburgh, WCAE ..... 5:35-5:46 625
Buffalo, WGR ...... 5:50 500
Detroit, WOX ...... 6:12 250
Kansas City, Mo.
WDAF ............. 6:18 250
Philadelphia, WFL ...... 6:25 700
Newark, WOR ...... 6:33 800
Dallas, WFAA ......... 6:56 500
Davenport, WOC ....... 6:59 175
Schenectady, WGY ....... 7:07 750
Washington, D. C.

WRC ............. 7:25 600
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, WJW ......... 8:51 250
Memphis, Tennessee,
WMR .......... 8:55 500
Troy, N. Y., WHAZ ... 9:25 750
New York, City,
WEAF ............. 9:27 750
Omaha, WOA W ...... 9:40 450
Minneapolis, WBAH ...... 9:55 350
Philadelphia, WDAR 10:07 700
Los Angeles, KF I ..... 10:27 1,800
Denver, KFJD ......... 10:41 950
Los Angeles, WHJ ...... 11:00 1,800
Wausaua, Wis.,
WP AH ... 11:20 200
Milford, Kansas,
KFKP ............. 11:45 600
Calgary, Alberta, Can.
CFCN ............. 11:55 1,400
San Francisco, KPO 12 midnight 1,800

Total miles, midnight: 22,100

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), and accomplished on a modulation of the ERA 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. SCHERM HORN, 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 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 Reineartz Radio booklet FREE. Address Radio Age, 500 N. Dearborn Street, Chicago, III.

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 connection 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 on the knob should be purchased and is a necessary unit in future, more pretentious circuits which will finally be constructed.

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 a circuit of much lower range comparable to that of a tube detector. It must be handled carefully and if 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 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 phonographs is essential. 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 corrosion. 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 flute. 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.
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,

Ridpath's History of the World
Including a full authentic account of the World War

Dr. John Clark Ridpath is universally recognized as America's greatest historian. Other men have written histories of one nation or period—Gibbon of Rome, Macaulay of England, Guizot of France; but it remained for Dr. Ridpath to write a history of the entire World from the earliest civilization down to the present day.

A Very Low Price and Easy Terms

We will name our special low price and easy terms of payment only in direct letters. A coupon for your convenience is printed on the lower corner of this advertisement. Tear off the coupon, write your name and address plainly and mail now before you forget it. We will mail you 46 free sample pages without any obligation on your part to buy. These will give you some idea of the splendid illustrations and the wonderfully beautiful style in which the work is written. We employ no agents, nor do we sell through bookstores, so there are no agents' commissions or book dealers' profits to pay. Our plan of sale enables us to ship direct from factory to customer and guarantee satisfaction.

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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 Babylonia'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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Ridpath is endorsed by Presidents of the United States, practically all university and college presidents, and by a quarter of a million Americans who own and love it. Don't you think it would be worth while to mail us the coupon and receive the 46 sample pages from the History? They are free.

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To insure 100% value to readers of advertisements, as well as 100% value to the advertisers themselves, radio equipment is now being tested and endorsed by the

RADIO AGE INSTITUTE
500 NORTH DEARBORN STREET
CHICAGO, ILLINOIS

No charge is made for testing and approval, and all merchandise will be returned as soon as possible, transportation expenses to be paid by the manufacturer. Lists of makers of approved radio goods will be published from time to time.

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 roheostat.
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 Richardons reports from Berlin.

Broadcasting has been meagre in Germany. The "Eldien Gesellschaft" at Berlin has been disseminating financial and commercial news to collaborating radio stations. The company secured a lease from the government of the wireless station at Koenigswusterhausen in the province of Brandenberg 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.

Overcomes Body Capacity

Gives micrometric adjustment outside the field of induction

Tested and approved by amateurs and experts. Realizes you to tune distant stations easier and more clearly. Simplest equipment. The tubes are not lost from outside, no dismantling of your set necessary. Audiophones made from inside to be connected to it or to be placed on top of it. No transformer. (Depending upon the final adjustments obtained.) Your tube dealer handles all dial or set models. Our free guarantee of money refunded if not satisfied. Ask your dealer or order direct from

HUNI COMPANY
485 Shrine Bldg., Memphis, Tenn.

PRICES REDUCED

Send card today asking for our complete list of knocked down outfits and radio parts at reduced prices. Our book "Radio Construction for the Amateur" will prove a big help to you. Price only fifty cents. Save your money. Savings follow. You may order any part or parts you desire.

Complete Regenerative Vacuum Tube Receiver

Approximate range 1,000 miles.

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Particulars

- Parts are exchangeable.
- Any parts can be obtained.
- We pay all postage.
- Complete list of parts at our complete list.
- Price list on request.

We guarantee all work and all materials. We refund money if not satisfied.

Send card today asking for our complete list of knocked down outfits and radio parts at reduced prices. Our book "Radio Construction for the Amateur" will prove a big help to you. Price only fifty cents. Save your money. Savings follow. You may order any part or parts you desire.

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It Covers The Field!

Over three hundred pages of fully illustrated instructions on how to build and operate sets! Truly a treasure trove for the home radio experimenter!

Written by experts, diagrammed by experts, tested and proved by experts. And all so simple and clear that the beginner can understand.

All kinds of circuits, with instructions on how to make them and amplify them. Readers' circuits on which they have made distance records.

Long Distance crystal sets. How to hook 'em up. How to make the aerials do their darndest.

How to make battery chargers. How to make transformers, coils, condensers, variocouplers, loading coils, dry-cell circuits, audio-frequency amplifiers, one-tube loop aerial sets, two-circuit crystal detectors.


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500 North Dearborn Street
CHICAGO

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 WSNB 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 go out of order, or if 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.

RADIO BARGAINS

REAL VALUES and the best of Merchandise. OUR PRODUCTS ARE GUARANTEED. We enable you to keep the cost of the building and upkeep of your set at the lowest figures and offer you only the most scientific and reliable products.

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ERLA BLUE PRINTS

Erla Receivers out-distance all other sets with an almost unbelievable volume and a naturalness that cannot be distinguished from the source of reception.

This is the famous Erla Reflex Hook-up. Less than one year old—but has taken the entire nation by storm. Every listener-in raves about it and wants a set of his own immediately.

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.

NO SOLDERING WHATEVER—ONLY A SCREW DRIVER NEEDED.

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 everything simple and easy.

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

With such wonderful results to be obtained from an Erla hook-up at a very low cost you cannot afford to waste time and money building other sets that cannot possibly begin to equal Erla hook-up performance.

Diagrams sent same day your order is received. Send P. O. or Express Money Order or Bank draft or Bank Cashier's check. Do not send stamps or personal checks.

Erla Hook-up Diagram Prices
3 sheets for making 1 tube set 25c
3 sheets for making 2 tube set 35c
3 sheets for making 3 tube set 50c

FRANK D. PEARNE

Sole Distributer of Erla Diagrams for U. S. and Canada
829 Waveland Avenue, Chicago, Ill.

Dealers, Write for Quantity Prices
Amateurs to Compete in Picking Up Calls

ARTFORD, 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 listing 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 their detailed apparatus and charts, 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 which was the biggest 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 ears.

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 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 hams 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 accomplishing in popularity. 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-heterodine, or another of the new types of receiving circuits that are coming into vogue. The fact is that the old receiver is far from extinction, but the relaying amateur is working on the improvement. It will never be the same 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, 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 complete 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 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, 8AB, British, 5WS and British, 2FZ. American hams plan now to surpass all receiving records.

Apology 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, plans a four-day Trans-Atlantic Tests from December 22, 1923, to January 10, 1924. It appeals to the transmitting amateur asking him not to 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.

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 Westminster 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, 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 sufficient 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.

RADIO AGE, Inc.
500-510 North Dearborn Street, CHICAGO, ILL.
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.

**Zenith Radio Corporation**

McCormick Building

CHICAGO

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**Model 4R**—The new Zenith 4R "Long-Distance" Receiver-Amplifier combines 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.

Because of the unique Zenith "selector," unusual selectivity is accomplished without complication of adjustment.

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 of more than 2,000 miles.

**$85**

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**Model 3R**—The new Zenith 3R "Long-Distance" Receiver-Amplifier combines a specially designed distortionless three-stage amplifier with the superb efficiency of Zenith three-circuit regenerative tuner.

Fine vernier adjustments—in connection with the unique Zenith aperiodic or non-resonant "selector" primary circuit—make possible extreme selectivity.

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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Zenith Radio Corporation,

332 South Michigan Avenue, Chicago, Illinois

Gentlemen:

Please send me illustrated literature on Zenith Radio.

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