Mid-Summer Edition

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RADIO
MANUAL

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NEW YORK
CONFIDENCE is the backbone of this business. From the beginning the policy of the Rova Radio Stores has been not merely to make a sale but to make a customer, and our entire organization has been trained along these lines to this end.

With the remarkable improvements in radio the Public's need for an institution upon which it can depend absolutely for reliability and accuracy, was completely fulfilled by the Rova Radio Stores.

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In the Middle of this Book
Buying the Radio Set

Simple Suggestions That Will Help the Beginner Select the Most Desirable Receiver From the Bewildering Array That Confronts Him.

If, as has been variously reported, there are upwards of two and often half million radio enthusiasts in this country, then the simple, fundamental question, "What kind of a receiving set should I buy?" has been asked at least that number of times. In fact, it is probable that the same question has been asked repeatedly by each neophyte before he could gather sufficient courage to take the initial plunge. For it is a difficult question to answer, and out of ten persons to whom it is addressed there will be on the average four contradicting replies. With this preamble, which more or less will excuse the apparently contradicting statements to be made, the following paragraphs will attempt to simplify the selection of the first set for the man, woman or child who has yet to go through this interesting experience.

There are two general classes of radio receiving equipment. The classification—one is made according to the type of detector utilized in the outfit, namely crystal or vacuum tube; and while some receivers with crystal detectors have and are selling at higher prices than some brands of sets with vacuum tube detectors, the crystal set is usually considered the cheaper and simpler.

The simplest receiving set that could be employed would consist of a collector wire called an aerial or antenna, a small coil or wire wound around the collector wire, and a detector. Such an array of equipment could be purchased complete for $2, but its ability as a receiver of radio broadcasts is not considerable. Even with an antenna of high quality this set would be useless if installed in a locality more than a few miles from a broadcasting station. At this distance the signals, if heard, would be exceedingly weak.

In another particular—that of interference from both broadcasting and code stations—this ultra-simple crystal set has its outstanding drawbacks. Though the broadcasts were heard satisfactorily, the lack of selectivity which is inherent in the apparatus would permit the intermittent dots and dashes of amateur and commercial code stations to interrupt the music and speech. Moreover, it is probable that more than one broadcasting station would be heard simultaneously, thus destroying the programme of each.

How to Select the Receiving Set.

In order to form some basis on which the prospective purchaser of a radio set may base his selection, let us imagine an imaginary case in which Brown, the man's name, lives fifty miles from a city, such as Chicago or New York, where there are several broadcasting stations of high power. He has heard about radio from his friends and has decided that he must get a set for himself and family. But as usual each of his friends has an idea of his own. Jones uses a crystal set and hears two stations more or less regularly. He paid $18 for the complete outfit, including enough wire for an antenna 150 feet long and 40 feet high.

"Buy a set like mine," says Jones. "You'll hear the two best stations around here. You won't have to buy a storage battery or dry cells. There are no turns to burn out." Adams, his next door neighbor, is a man of means. And now, after spending a few progressive stages, he is operating a four tube receiver that is a "Rolls Royce" compared to the "flivver" crystal set of Jones.

"Don't put your money in a cheap set," he tells Brown. "That's the way I started and now the set is giving me fits in the attic. A radio set is no good unless you can reach around two or three hundred miles every night and pick the station you want to bear.

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The Handy Man Can Build His Set.

If you were a mechanic or were handy with tools, could read simple drawings and knew how to read the parts, you mean that with the $25 you could buy a receiving set having a vacuum tube, batteries, head phones, and antenna materials, which is what many of these sets cost at the stores. The complete set would be twice as expensive, in fact, if purchased at the store. This price includes a hundred feet of wire, a complete set of parts for making the set, and the necessary batteries for $40. The set is a complete set and is ready to receive a call, but it does not work well enough to be useful. With only $40 spent there remains $15. Perhaps this little story will emphasize again the importance of making sure that a radio receiving set is a real one. It is more apt to be held in a medium position or body distorts the sounds coming from the receiver. To get back to that $65 which is waiting to be spent on a receiver, in company with an expert, the prospective owner goes to a radio shop and finds that he can buy a complete set of parts for only $20. But he must buy his own batteries and antenna wire, and so forth. A two tube set, you know, is better for distance and loudness. The second tube magnifies or, as they say in the trade, amplifies the sound as it comes from the first tube.

But I know you have not had the training that would make it advisable for you to assemble a receiver of this type. So you should buy one complete.

With $60 to spend, you should forget all about the crystal type of receiver. A vacuum tube set is your goal.

One of the Newer Sets. Flashlight Batteries Operate the Tubes.

The "all-wool" sets are usually the simplest in construction and design. Skilled engineers have "cut" beautiful cabinet and equipped with more dials than the switchboard of a submarine. It is a matter of taste. The "all-wool" set costs about $65, but it is better for distance and loudness. The second tube makes it advisable to have two. For its builders know that the few extra dollars are spent on a larger panel and a slightly larger cabinet make it more convenient for precision on the newer one is a better choice. The "all-wool" set can be taken apart, connected to an antenna and head phones, and made to work, merely by following the few instructions that come with it. Six months later he will have a complete set.

The Ideal Set Contains a Loud Speaker.

With only $60 spent there remains a balance of $30. If the buyer is a family man there is only one answer to this riddle, viz.: use the money to buy a second pair of head phones. A loud speaker cannot, as a rule, be operated from a receiving set having only one vacuum tube. Hence if there is more than one person in the family these will be frequent calls for two sets of phones. Two sets can be made by connecting two telephone sets together.
The Aerial and the Ground
How to Select the Proper Type and Location—How to Arrange for Stringing the Wires and Installing the Precautionary Measures Demanded by Insurance Companies.

The problem of the antenna, once a serious one, is no longer such a determining factor in radio reception. Better antennas have been developed, and the transmission, higher power at the transmitting stations, and more efficient receivers have made of the antenna one of the lesser parts of a receiving set.

But this objection does not hold in every instance. The single step of radio frequency amplification will help but little on local stations, but it will assist greatly on signals from distant stations or very weak impulses from nearby stations. This has named feature comes in handily when an outside antenna is not possible. In such cases a loop antenna consisting of about sixty feet of conductor arranged in the form of a square will absorb so little energy that an interior—albeit a little virtual—will not catch it. But if a stage of radio frequency is insufficient to get the detector, the necessity of employing a greater amplification may be discovered, and a wire loop may be found more the detector's taste.

The ideal antenna still remains as old as a single wire as high as possible, as long as the wave length will permit. The length of the antenna is determined by the shortest wave length to be received. As broadcasting circuits this is now about 350 meters. To work efficiently the natural wave length of the antenna must be amplification. The cost complete with tubes and batteries varies from $125 to $200.

Reflex Receivers Build Up Energy
Still another type of receiver is the reflex receiver, so called because of the fact that the energy is amplified without any direct connection. Now it is possible to step up the stages of radio frequency amplification.

During the last year the number of receiving sets using one or more stages of radio frequency amplification has increased. It is this type of set which now will be discussed.

In general the use of a single stage of radio frequency amplification is not considered warranted by the results obtained. This is due to the fact that when radio frequency is employed in addition to audio frequencies, the use of the receiver brings about the regeneration of the audio frequency by interaction with the radio frequency, due to the fact that the detector has a rather than the length of the lead-in wire. In the form of a square the detector of the wave will be at least ten times around the main wire at least ten.

As would be expected, the success of the sounder can be attributed to the fact that a wind storm is apt to rupture the wire. The lengths of the lead-in wire and that of the ground connection by the length of the lead-in wire and that of the ground connection—by the number 1.4. This will give the result in meters. Thus, if the length of the lead-in wire is less than 100 feet, the wave length will be 140 meters. Therefore it can be seen that the very high frequencies the wave length is greater than 175 feet. Usually this means that the main portion of the antenna is either 125 feet or more.

When the antenna is to be elevated, it is good practice to use a support for the wires so that it hangs free and clear of the branches.

There are no certain rules as to whether it should be fixed or not. It is well known that a wind storm is apt to rupture the wire. If the wire is insulating set is apt to less than the figure.

The lead-in wire works best and will give the longest signals, but the radio enthusiast takes a particular house with no access to a roof or is in a crowded section of the city or town where a stretch of wire is out of the question. By arranging each turn close to the main wire at least ten times around the main wire at least ten.

To work efficiently the natural wave length of the antenna must be amplification. The cost complete with tubes and batteries varies from $125 to $200.

Electro Light Wires are near the antenna. It is best—but not absolutely essential—to place the antenna wire at right angles to the outside antenna should enable the owner after a little experience to hear stations at a distance of ten and beyond.

There is no rule in radio concerning the length of the lead-in wire. It can be anything from 250 to 12 feet. It is possible to step up an outside antenna a few simple rules should be followed: Keep the wire away from trees. It is a rule in radio to avoid placing an outside wire close to the dry branches, other wise joint air. If the antenna is to be elevated, it is good practice to use a support for the wires so that it hangs free and clear of the branches.
The Crystal Set
How the Simplest Receiving Set Operates, When It Should Be Used, and How a Workable Outfit Can Be Made at Home With a Few Tools.

The Galena Crystal Requires a Fine Contact Wire.

In ordering upon the radiophone as a hobby, the beginner is confronted with a tremendous problem in the choice of apparatus. He may buy the parts and build his own receiving set and transmitter; he may buy the separate pieces of apparatus, all finished and ready to be connected with other instruments to form a complete set; or he may buy a complete receiving set and sending set wired ready to be used.

If the average beginner is only interested in radiophone receiving service and does not care to be troubled with oven an elementary knowledge of radio, then by all means the simplest type of radio apparatus is urged. In that event it is well to purchase a complete receiving set already wired and as compact and self-contained as possible. Such a set need only be connected to the aerial and ground for immediate results.

If the beginner wishes to do a little experimenting and thereby master slowly the theory and data of radio, it will be well for him to purchase separate radio masts, each one complete with some suitable receiver. All that is needed in the aerial, which for this purpose may be a single wire elevated twenty or more feet off the ground and extending about 100 feet. The use of this aerial or antenna is in absorbing the energy in the transmitted radio wave, concentrating it and redirecting it into the receiving set. When seeking stations at long distances, the natural period of the aerial is sometimes decreased by the use of a lightning return to the receiving station.

Aside from this simple aerial a further gain in efficiency, especially at medium wave lengths, may be obtained by adding leading coils.

The Perikon Detector Consists of Two Magnets in Contact.

Carborundum Works Best With A Sifted Pellet.
The description of the variocoupler in the document is as follows:

**Description of the Variocoupler**

There are two rods and sliders for the secondary tubing. Two binding posts make a connection with two flexible leads. There are two brass rods for the secondary tubing to slide on. The primary is composed of a tapped winding about four inches long wound with number 22 single cotton covered wire for about six inches of the primary tube, leaving a clearance of about one inch at either end. A thin coat of shellac will serve to hold the winding in place.

White or orange shellac can be used if thinned down with a little wood alcohol.

The winding of the secondary consists of a tapped winding about four inches in length wound with number 24 single cotton covered wire. The beginning and ending of the secondary coil should be brought to two taps, as shown in the illustration. There should be four other taps taken from points in between the two taps mentioned.

**Winding the Tubes**

One thing that must be watched when winding the tubes is the direction of the winding. The two coils should be wound in the same direction. The winding should be begun at the right-hand end of the coil to bind the tube to the other end. The inductance, which is one of the wave length determining factors, increases according to the number of turns from the ground end of the coil to the binding post marked A and the slide rod with post 1. The function is to adjust the wave length of your set in the wave length of the transmitting station.

Two sliders on the coil permit greater selectivity; in fact, the tuner then operates like an auto transformer, the tapping between the aerial slider and the ground end of the coil considered as the primary and the turns from the ground end of the coil to the other end of the slider considered as the secondary. Some-
A schematic diagram shows the method of connecting the test buzzer to the receiver. This hole should be one-half inch from the top.

Making the Secondary of the Variacoupler.

A three-inch rotor ball should be purchased from a radio shop. If one cannot get a three-inch rotor ball a piece of insulating tubing one and one-half inches long and of such diameter as to allow it to rotate freely within the primary tube will suffice. On this should be wound forty to fifty turns of number 22 or 24 single cotton-covered magnet wire. A quarter-inch hole is drilled through the primary and then through the centre of the secondary tube and fastened with lock nuts. The shaft passes through these holes in the primary and a knob and dial fastened to the shaft end. Connections from the secondary winding is made by pieces of flexible cord twisted about the shaft. Enough slack should be left in the piping to allow the secondary to rotate freely inside the primary through a 180 degree angle.

Selection of Parts for Crystal Sets.

If no provisions is made for tuning, a receiving set must perform as a low order of efficiency. Furthermore, all signals come in at the same time as several transmitters happen to be working in the immediate vicinity. By providing the simplest kind of tuning device the efficiency of the crystal receiver is immediately improved.

There are several types of tuning devices, most of which were described in the previous pages. We have explained the one-and two-tap tuning coils and the inductive coupled receivers employing the lense coupled or variacoupler. Most crystal sets are of the direct coupled type, with the sliding arrangement on the tuning cell.

There is still another element other than inductance which is used to vary the wave length. This is parallel to the coil, the wave length is increased in proportion to the amount of capacity used. The value of the condenser lies in the fine adjustment of which it is capable.

A crystal detector ordinarily consists of a mineral crystal, set in a suitable cup or clamping device. Contact is made with the crystal by means of a short piece of silver or bronze wire. The crystal is set in an easily fusible alloy such as lead sulphide is probably the most common. It requires no battery current whatsoever and requires only a needlepoint adjustment. When using this mineral cleanse the surface once a month with a slight application of alcohol. This liquid carries away the grease spots from the fingers. A better method is to keep the crystal covered in an airtight case.

Testing for Sensitivity in Crystal.

For those desirous of making sure of their crystal detector adjustment it is best to work what is known as "the buzzer test." This calls for a small buzzer, such as used to bell circuits. The buzzer is connected in the usual manner with a push button and one cell of dry battery, but a wire is brought out from one side of the buzzer interrupter to the ground connection of the receiving set. When the buzzer is operated the electro-magnetic waves given off by the buzzer interrupter are impressed on the receiving set and the detector can be adjusted for sensitivity in the same manner as though the operator were searching for a transmitting station.

A schematic diagram shows the method of connecting the test buzzer to any crystal receiver.

Crystals lose their sensitivity easily, due to jars or to powerful signals from a nearby station. When the buzzer is connected in the usual manner and the buzzer current whatsoever and requires only a needlepoint adjustment. When using this mineral cleanse the surface once a month.
The Vacuum Tube

A Simple Explanation of Its Early Development From the Original Two-Element Tube and a Discussion of the Modern Three-Element Tube.

To go into the most minute action of a vacuum tube would require more space than a treatise of this nature allows. Moreover, such treatment would be unwarranted, for when the experimenter arrives at the point where he must acquire an intimate knowledge of the fundamentals of a three-element tube he would naturally seek one of the comprehensive books on the subject. The most that can be expected in these few pages is a skeleton outline of the action which takes place within the little glass tube when used as a detector and as an amplifier. For although there is no outward change when the same tube is made to operate as a detector or amplifier, the operations themselves are entirely independent, otherwise it would be impossible for a tube to function in the circuit known as regenerative. Reflex action also would be impossible and much of the efficiency of the vacuum tube would be missing.

When a minute fibre of graphite or other resistance material, such as the filament in an electric bulb, is heated to incandescence, millions of tiny charges fly away from the boiling surface. These electrons are negative. Now the term positive and negative when applied to any electrical action are to a certain extent merely arbitrary. But, as will be remembered from early experiments with horseshoe magnets, any metal that is charged with negative electricity will be attracted to the positive pole of the magnet and vice versa.

If a sheet of metal is now placed across the glass tube in which the filament glows—the plate may be either inside or outside—and if this sheet is connected to a small dry battery in such a way that the positive end of the battery is nearest the sheet of metal, the negative electrons will be attracted away from the glowing filament at an even greater rate.

The filament in this experiment corresponds to the filament of a vacuum tube and the metal sheet to the plate of the tube. This combination was first discovered by Thomas Edison and has since been known as the Edison effect. A little later and independently, Professor Fleming in England noticed the same action while experimenting on wireless telegraph detectors. He immediately recognized the value of the phenomenon for the detection of radio signals and patented the device known as the Fleming valve. For several years the Fleming valve, with its filament and plate was considered the most sensitive detector known. Even today, now that the patents on the Fleming valve have expired, firms are making them, a little better and a little more sensitive, and selling them to radio hobbyists to take the place of crystal detector.

The valve, however, is seldom an improvement over the crystal detector and has the added disadvantage of requiring a battery to operate it.

One of the most ardent experimenters with the Fleming valve on this side of the Atlantic was Dr. Lee De Forest. After hundreds of experiments looking toward a further improvement in the valve to adapt it to radio, Dr. De Forest finally stumbled on the one improvement that has accomplished more for wireless and radio telephony than any single invention, not excepting the epochal Armstrong regenerative patent. Dr. De Forest retained his filament and the plate and in the position of the third element which he termed the grid.

Hereupon the Fleming valve acted as a rectifier, due to the fact that current passed in one direction from the plate to the filament with greater ease than in the opposite direction to the plate. Thus the oscillating come-and-go waves of the entering signals were reacted with and the direction of movement was in one direction and accelerated when the movement was reversed.

But the insertion of the grid changed the action of the tube completely. The incoming energy—the signal waves—were brought in on the grid and the filament performed a secondary circuit which operated normally independent of the primary circuit. But the grid, being placed between the filament and the plate, had the last say in the matter of electron transportation.

In this respect the grid can be considered as an all-powerful gatekeeper. When the grid opened, the electrons flew off the filament and to the positive end of the battery, and the plate was subjected to a positive wave, but if the grid shut against the plate, it then of the plate had the last say. It was the grid which gave the device its name.
5. Newmony.

in unsatisfactory as an ampli-fi er; quite naturally, therefore, you advise your friend to buy none other than a FISCHER.

When the UV201 is utilized as a detector, its control is less delicate, and noisy and harsh and distorts the sounds.

Because of the gas which remains a "soft" tube. These two tubes are identical in appearance; the only difference in construction lies in the fact that the UV201 is called a "hard" tube while the UV200 is sealed off while a small volume of gas remains in it.

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YOU, who struggled through the experience of building set after set, trying one make after another, and were plagued with loose connections and loose wires, and then listened with disgust to the dealer's apologies—you finally found your difficulties ended by using FISCHER; and knowing that FISCHER makes good his guarantee, you could do otherwise than warn your friend to buy none other than FISCHER?

GRID Plate

When Grid is neutral

When Grid is negative

When Grid is positive

This Diagram Illustrates the Three Conditions of the Vacuum Tube.

When the grid is made positive the electrons from the filament are drawn at an increased rate through the grid to the filament. It is much as if the electrons were running a gauntlet, but instead of being impeded as they pass down the lane they are given slight added pushes which increase their speed.

But now, an instant later, the grid is negative, and the action is entirely altered. Negative repels negative; they abhor one another. So the negative charge on the grid acts as a traffic policeman with a "stop" sign. The electron flow is cut off instantly, the degree of stoppage depending on the intensity of the negative charge. An instant later the grid is again positive and the electrons go their merry way.

During this time something must have happened in the wire which connects the plate with the battery. It is in this circuit that the "phones" do their work. The various phases of action of the vacuum tube would have been evident through the change in sounds. As long as waves were not striking the antennae, the current through the plate circuit—which also means through the "phones"—was constant. It did not vary. But as soon as these little impulses from the antenna passed down the wire to the grid the placid current in this plate circuit was thrown into the wildest excitement. Each time the slightest change was brought about the action was made evident in the "phones by a movement of the thin diaphragm, and this 'phone diaphragm movement coincided exactly with the variations in the waves striking the antenna. Thus if these waves formed a message in dots and dashes the 'phones reproduced them. If the incoming waves were part of a radio 'phone concert the 'phones reproduced the sound of the human throat or that of the musical instruments with absolute precision. 

Different Types of Vacuum Tubes.

When the radioophone was in its infancy in 1920 those interested in the new form of entertainment had but two types of vacuum tubes from which to make a selection. These were denoted by the terms UV200 and UV201. Each tube performed a particular kind of work. The UV200 was and is mainly a detector tube and is unsatisfactory as an amplifier. The UV201 is primarily an amplifying tube, although popular with some experimenters as a detector.

The two tubes are identical in appearance; the only difference in construction lies in the fact that the UV201 is called a "hard" tube while the UV200 is sealed off while a small volume of gas remains in it. The UV200 is a so-called "hard" tube and the UV200 a "soft" tube. These terms merely indicate the degree of vacuum within the bulbs.

Because of the gas which remains in the UV200, the tube requires a much more delicate control to operate its action properly. Moreover, unless adjusted to the exact operating point, the tube is either insensitive to the incoming signals or is noisy and harsh and distorts the sounds.

When the UV201 is utilized as a detector its control is less delicate, but it does not compare with the soft tube in sensitivity.

Both of these tubes require a source of current with a potential of 6 volts. This means that a storage battery must accompany each set, and a storage battery...
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WJZ and WJY Transmit Simultaneously From This Antenna
Radio receivers are usually distinguished by the type of circuit employed in their construction. There is the single-circuit, double-circuit, and vacuum-tube and frequency. Sometimes the difference between them is made even more distinct, by specifying them as inductively or capacitively coupled, as the case may be.

These various receivers will be treated individually at their proper places in the Radio Manual. At this time only the single-circuit set will be described in detail. This is perhaps the simplest receiver to build, although not always the easiest to operate. It becomes necessary to insert a condenser into this system in order to construct the antennas. The construction of the antenna comes first. All that is necessary in a single wire elevated thirty or more feet off the ground and running not longer than one hundred feet. With a much longer wire it becomes necessary to insert a condenser in series with the aerial, which reduces its efficiency.

In the construction of the antenna, the position of the condenser must be determined in such a manner that it would be behind the line of contacts. Next to the aerial is a condenser, a vacuum tube detector, a tube socket with necessary connections, a rheostat, a twenty-two-volt battery, and the proper accessories. The phones should be at least of two thousand ohms of resistance.

### Constructional Details of the 130° Varicoupler.

This piece of apparatus is really the heart of the whole receiver, and its selection therefore should be weighed with care. It is best to use a condenser, one hundred and eighty-degree variable condenser, a vacuum tube detector, and the proper battery. The phones should be at least of two thousand ohms of resistance.

### Parts Required to Construct This Simple Set

In order to keep down both size and cost the set has been simplified to the last degree. Most of the parts can be done with the variable condenser. A varicoupler is used as the inductance, with the wire wound rotating ball arranged to produce regeneration. With these parts and a vacuum tube, the set may be inserted in a cabinet to fit, the combination producing a receiver that is attractive and workable.

The actual parts needed for this set are listed below. The aerial should consist of one hundred feet of stranded copper aerial wire, one that the coupler is ruggedly made, its range and should revolve easily without jerks. Two ulas are needed, one for the condenser and the other for the socket. These should make firm contact with the condenser. A varicoupler is used as a detector tube. A better way is to use a grounded ball arrangement to produce regeneration. With these parts and a vacuum tube, the set may be inserted in a cabinet to fit, the combination producing a receiver that is attractive and workable.

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When you build a new set or improve your old one consult our tube experts. If it's a tube question we can answer it.

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the other details in the circuit are the same as that required in any other single-tube regenerative type; that is, grid leak and condenser, plate and filament batteries, vacuum tube, tube socket, and phones.

The connection on the aerial side of the variocoupler stator is the peculiar feature in the circuit. At this particular circuit which causes it to differ from other single-circuit receivers lies in the fact that it does not re-radiate unless the natural period of the aerial is exactly the same as the wave length that is being received. Such a combination is extremely rare. A condenser with only a small maximum capacity must be used in the primary circuit in order to secure the best results in tuning; a large condenser will make adjustments difficult. It is also advisable to use a well-constructed variocoupler that will allow 180 degrees change in the inductive coupling.

Regenerative Circuit of the Inductive Type.

Regenerative receivers with inductive feedback arrangements of the tickler coil, as explained previously, are in common use at many amateur stations. Another method of obtaining regeneration action which does not require coils is through the use of condensers as in the circuit known as the Eaton oscillator.

The diagram illustrates one way in which the Eaton oscillator may be incorporated into a receiving set of two units. One unit contains the tuning elements and the other the vacuum tube apparatus.

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And you who buy radio headsets should know that an organization offering its products on a “money back” guarantee has learned the lesson that quality counts. In Berwick Supreme Headsets you buy an efficient product of sound Mechanical and Electrical Construction. Made by experienced men who use Good Materials with Painstaking Craftsmanship.

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Resistance up to 10 Megohms; smooth gradient, no jumps. Wonderfully efficient in obtaining quality and restoration of both vocal and instrumental work on any circuit.

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The simplest, cheapest and best method of utilizing Victrola or loud speakers with any tube-amplified set. Send for descriptive circular.

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Send Stamp for Catalog No.48S

A Ground Clamp Simplifies the Ground Wire Problem.

Radio Manual

Diagram of Connections of Popular Varicoupler-Varicoupler Set.

Bridging condenser (BC) is important in the adjustment of the system for the reception of damped and undamped waves. For receiving damped waves, the condenser (BC) is set at maximum, while for undamped waves it is adjusted to minimum. The circuit may be operated without employing the bridging condenser (BC), but spark signals will not be received with their normal character or tone.

In operation a certain amount of the plate potential is fed back and impressed upon the grid by the condensers C1 and C2, which form a capacity feedback in contrast to the inducitive arrangement usually employed.

The circuit may be applied to any loose coupler or varicoupler and tube detector without materially changing the circuits or dismounting the apparatus. The condensers C1 and C2 are two fixed condensers in connected series across the secondary terminals, with the grid on one side and the filament in the middle with the plate on the other side.

While not particularly adapted to short wave work it has been possible to get down to 200 meters with this device. Good regeneration is obtained up to several thousand meters. A receiver of this type is comparatively simple to operate.

So far we have spoken about regeneration when referring to the vacuum tube when used as a detector. With crystal receivers regeneration is impossible. The detector tube requires careful adjustment of the plate battery for best results. As a matter of fact, there are no two tubes possessing the same characteristics either in the filament current or the plate voltage.

It is very easy to make adjustments on the filament, since the rheostat gives fine control of the current. A verifier is even better for proper filament control. One form of those vernier rheostats has an extra arm built on the same shaft as the regular arm, but travelling over a single wire tightened around the body of the instrument. This enables the operator to regulate the filament temperature very closely.
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Radio is for the home, for the school, for the automobile, for the farmhouse, beach or bungalow—radio is for everybody, anywhere. Rain or shine radio delivers. A turn of a dial or a knob and you flood the atmosphere with music, lectures, news, etc.

But—are you getting the most out of your set? Are you perfectly satisfied with its performance? Have the parts in your outfit been made by experts who know how? Dependable parts are the assurance of absolute satisfaction. Buy your needs where your choice is unlimited and where every item is backed by our guarantee. Sets and accessories are rated at the R-O-V-A Stores in extensive varieties. Every part is made to last and serve.

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No. 25—Tuned Loud Speaker Phone With Ear Buds 4.50

WE prefer having you buy from your regular dealer. If for any reason you cannot supply you write to us direct.

"RICO" TUNED Phones and Melotone Loud Speakers are superior in every respect.

In effect June 1, 1923.

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WONDER OF THE RADIO WORLD
NO AERIAL USED

An excellent one-tube super-regenerative receiver. Its performance is such that it is possible to carry regeneration far beyond the critical point. As would be expected, if the idea of a vacuum tube was put to a more or less elaborate outfit. And the results are not surprising.

Modern Receiving Sets

The Armstrong Super-Regenerative Receiver and Others

Similar to It Based on the Same General Idea—Future Outfits May Be Developed From One of These Forms.

Unless scores of pages were available you would rather not attempt to explain in any detail the electrical fundamentals of the super-regenerative circuit. It is an electrical circuit in the theory of alternating currents the total inductance is both impossible and

Any user of a regenerative receiver knows that when the tickler or variometer knob is moved just so far and the signals increased in strength to a certain point, a limit is reached after which further regeneration distorts the sounds and creates a hissing noise which elicits all that the distortion does not.

By this limiting factor early in his experiments with the simple regenerative set which he invented, Major Edwin H. Armstrong for years sought a method to eliminate this new arrangement. He finally succeeded in developing what he termed the "super-regenerative." In the arrangement of certain circuits he was able to make the vacuum tube oscillate at a frequency which had a ratio relation to the incoming oscillation of the energy waves. This new arrangement did not prevent the vacuum tube from starting to oscillate when the limit of regeneration was reached, but it did effectively prevent the generation of false oscillations. That is, as soon as the set commenced to oscillate a local action blocked it for an instant. Then the incoming signal registered an instant before the oscillations recommenced, but again the local action blocked it, thus making it possible to carry regeneration far beyond the critical point.

As would be expected, if the idea of a vacuum tube was put to a more or less elaborate outfit.
Battery Charging

Don't send your battery out for recharging-
Get away from inconvenience. Charge it at home with a
King Battery Recharger

with safety, ease and speed.
Both types—vibrator or bulb. Every safe charging rate for home use.
Be sure of the name—RADIO A for the vibrator type, and ELECTRON for the bulb type. Both have unusual features that make their operation simple, safe and sure.
All good dealers. Insist upon the product of the

KING ELECTRIC MFG. CO., INC.
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Eastern Sales Agency
35 Warren St., New York, N. Y.
Is the ot perhaps, tuned ln gain made easier by eliminated gatered stat.Jon should be easily tuned ls bolherome. It Is possible that the whistle working order is not to be it still so loud that the sounds are When the One disagreeable property "wbisp," as in any regenerative set. Once thg location oC the station bas clearly denoted by the ramlllar vernier. The position of the... to be et in by means of Lile condenser and the vernier. To "ear up the whistle is difticult it is probable that the oscUJaUons when the... move between the two coils. "Loosening up the whistle will work be heard. Their presence will... with a copper shPel This bit of work is... With a WDll tube this beat with a good antenna or a good ground, hence if either one is available plane should be made to utilize it. If no sounds results, adjust the two grid leaks either simultaneously or singly until a noise is heard. It may even be found necessary to vary the condenser slightly at the same time. If connections are followed and all parts are perfect one or more or these moves should result in the generation of oscillations by the tube. When these are observed the next move is to loosen the coupling between the... Condensers, Plugs, Jacks; Etc.

Pilot Radio Products!

MURDON DRY CELL TUBE is ideal under all conditions for clear and dependable reception. One dry cell, 1½ volt, will operate efficiently. The New Murdon Super .08 operates on two dry cells for first and subsequent relays. It draws .08 Amp. Also the Murdon A 5 works from 3 to 5 volts; draws ½ amp. Highly recommended for volume.

Each tube is fully guaranteed

New List Price on Each $5.50

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Radio fans inquire of your dealers.
Marconi Operator on S.S. Methven between Pasnet and Queenstown, off the Irish Coast, on Feb. 24, 1919. U. S. TOOL CONDEN- 
SERS and one tube, heard W. G. Y., Schenectady, N. Y.

Over 200,000 satisfied amateurs to date

the Votts, and the condenser in Ute

pl:lln tube circuit is the use or two

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brhlnd il. In radio work we

builder by superior and consistent re­

with such minute electrical Impulses

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additional outlay will well repay the

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One-Tube Herlex Receiver.

A

the plate

One tube that works particularly

sometimes could be expectf'd. The

main point, however, is to see that

simple> reason that the plate of the

cryst11I detector, which makes pos­

in and Mrong

Theory of These New and Sensitive Sets, With Suggestions

One of the remarkable devc>lop­

ments of this new making-year is in the
circuit. This circuit causes the same

ampifying tubes in set as magnifiers of

radio and audio frequency amplifiers

out interference in such a manner

that three tubes do the work of six

or two tubes do the work of four.

a reflex amplifier can be made

from a single electron tube and crys­
tal detector, the single tube serving both as a radio frequency and as an

audio frequency amplifier. It is

desired to have sufficient amplifica­
tion to operate a loud speaker is

usually necessary to add two stages

of audio frequency amplification.

e reflex circuit this is accomplihed

by two tubes. The first two tubes

serve as radio amplifier and also

as audio amplifiers. The third tube

acts as the detector tube.

A Workable Single Tube Reflex

Circuit.

The cireuit about to be described

is very simple and can be made up

by the beginner at a small cost. The

idea of this simple set is to make use

of the tube for both functions, as

previously explained. The incoming

oscillation is amplified at radio

frequency by the vacuum tube and

then passed on through the radio

frequency component. A crystal

detector circuit, where they are rec­

amplified signal; are then passed

distributor of the crystal detector, which makes pos­

able a distortionless rectifying cir·

cuit.

A circuit shown in a one-tube reflex

with crystal detector. If this set is

made up as above the set should be

the heads are kept short and direct,

thus making the set much more effi­
cient.

One tube that works particularly

well with the reflex is the new

of the rotor. The condenser in the

armal is optional. The tag who is

considering the conversion of his

crystal set into a vacuum tube set

should study this circuit, for he may

enjoy his crystal detector to good

advantage. The only additional items

needed in changing over that of the

plain tube circuit is the use of two

transformers and the crystal detec­
tor.

A One-Tube Reflex Receiver.

The circuit about to be described

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tor.
The by-pass condenser will be found of great value to the experimenter and constructor, especially when inserted around hand telephones or loud speaking devices. If this by-pass condenser is left out of the circuit around the hand telephone the "plug" have a tendency to act as a choke coil. These small

The only additional feature is the use of a by-pass condenser across the secondary of the audio frequency transformer.

In the two-tube reflex circuit shown, the tubes act as radio frequency amplifiers for the purpose of building up the incoming signal, to be later rectified by means of the crystal.

Reflexing With Three Tubes.

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Reflexing With Three Tubes.
value is obtained only by experiment.
In the actual application of this circuit there are several difficulties to be overcome. The tubes, for instance, must be coupled for both radio and audio frequency circuits, but in placing an audio frequency amplifying transformer in a circuit in which radio frequency currents are flowing the windings of the secondary act as a choke coil and prevent the radio frequency currents from passing. To overcome this result a condenser is shunted around the secondary of the audio frequency transformer. Unless, as sometimes happens, the secondary winding of the audio frequency transformer has a sufficiently high distributed capacity to make its impedance low.

If the CV201A is used the builder should purchase a 25-ohm rheostat in order to control the tubes properly.

Different tubes have a decided effect on the set as a whole and if properly considered the whole circuit may be a total failure. Many radio frequency transformers in combination with various radio frequency transformers have been tried out.

With this set either aerial or loop may be used. The loop is recommended and the one used successfully with this set was wound on a frame with fourteen turns spaced three-eighths of an inch apart, the outer turn having a diameter of 23 inches. Number 29 wire, either cold or hot-covered or bare, can be used to make up the loop.

When the amateur begins to tune in DX stations he will hear considerable howling, which can be easily eliminated. Some of this howling can be easily reduced by regulating the filament rheostat. Careful adjustment of the filament voltage of the second amplifier tube and detector will be found to be the critical adjustments.

It will be noted that for stations of the 50-meter class the detector filament will require more current than for some of the 455 and 432-meter stations. The variable grid leak is in an important factor. The "phones" are placed across the pins or

positive side of the 100-volt line and the primary side of the radio frequency transformer in the second tube amplifier. The coil used for the inductances in the set is a DL50 or DL75 with a .001 mfd. variable condenser.
The Storage Battery


A storage battery is an essential with receiving sets incorporating certain types of vacuum tubes. These, namely the UV15, UV201, VT1, and V75—require such a high current for heating the filament to full brilliancy that some high capacity source of electricity must be utilized. This is best supplied by the storage battery.

The oldest type of storage battery is made up of lead cells. There are two classes of lead cells, the classification being based on the method of forming the active plates. One of these methods has the active material of the positive plates formed directly on the surface of the plates, an invention attributed to M. Plante. The other is called the "Fawer" type and has the active material applied to the surface of the plates in the form of a paste.

The Plante type cell is considered heavier and stronger than the Fawer type, and possesses greater durability when subjected to severe working conditions. Since the Fawer type of cell is not so heavy for a given output it is usually adopted for use in vehicles.

To Illustrate the Principle of Plate-Formation.

If two clean lead strips are placed in a solution of dilute sulphuric acid and their uniseried ends conducted with a galvanometer or sensitive voltmeter no deflection is noticeable. If a current from a primary cell or from any direct current source be allowed to pass from one strip to the other through the acid solution for a few minutes, and the circuit then broken and the strips again connected to the sensitive voltmeter, a movement of the needle is observed. This deflection is caused by the hydrogen and oxygen produced at the plates being oxidized and reduced. The plates are made in various sizes, depending upon the capacity called for, capacity in turn being figured on area and size of plate, and the number of groups of plates assembled. When a cell is ready for assembly an even number of positive plates are connected to a strap, preferably burned together by a strap, preferably burned and not at the same thickness. It will sometimes happen that the rapidity of the process is so great that the acid is not entirely neutralized or that it is not possible to remove the oxygen film without dissolving the lead. This can be prevented by having the acid solution of dilute sulphuric acid at a temperature of about 100 degrees F. when cold. The final adjustment of the specific gravity should not fall below 1.25. Since mixing the acid and water to make the electrolyte, the water should be put into a galvanometer jar and the acid slowly added in a very fine stream to prevent excessive production of heat and possible explosion. Never pour the water into the acid. While mixing the acid with the water stir gently with a glass rod. Just after being mixed, the electrolyte is hot and has a lower specific gravity than when cold. The final adjustment of the specific gravity may be made by adding a small quantity of pure water to the cooled solution.

The electromotive force and internal resistance are dependent largely on the density of the acid electrolyte. The greater the density the greater the electromotive force. The resistance of dilute sulphuric acid is least at a specific gravity of about 1.260 and increases as the gravity decreases. The voltage of a lead cell when
The interior of the cell is kept fresh by inserting a separator which is a thin sheet of porous material placed between the positive and negative plates. This separator helps to keep the electrolyte in contact with the plates and facilitates the transfer of ions during the charging and discharging process. The separator is made of a material that is insulating to prevent short circuits and allows the electrolyte to pass through it.

Charging a battery from a direct current source is a process that involves the transfer of energy from the external source to the battery, increasing its charge. The voltage of the charging device should be maintained at or near the closed circuit voltage of the battery being charged. This ensures that the battery is charged at a rate that is safe and effective. The charging current, which is the rate at which energy is transferred, should be adjusted according to the manufacturer's instructions or the battery's specifications. A common practice is to charge the battery at a constant current for a certain amount of time, and then switch to a constant voltage charge until the battery reaches its full capacity.

Once the battery is fully charged, it is important to monitor its voltage to ensure that it is not overcharged. Overcharging can damage the battery by causing the electrolyte to decompose and the electrodes to deteriorate. To avoid overcharging, the battery should be disconnected from the charging source once the voltage reaches its full capacity.

In summary, charging a battery from a direct current source involves selecting the appropriate voltage and current, monitoring the battery's voltage, and disconnecting it from the source once it is fully charged. These steps are crucial for maintaining the battery's performance and extending its lifespan.
A little trouble in impressing on the operator of a set should be sure that both batteries are connected correctly, for if the B-battery happens to be connected to the ST站起来, It will try to overload a battery or discharge a battery too quickly.

The following tests of units for the storage battery user has been collected from battery experts:

1. Don't charge faster than the rate that would keep the temperature of the liquid below 110 degrees Fahrenheit.
2. Don't use any water except distilled water.
3. Don't let the electrolyte get below the plate.
4. Don't overcharge the cells.
5. Don't let the cells stand idle longer than five weeks without giving them a charge.
6. Don't let dirt or other mineral matter get into the cells.
7. A small charge a battery before removing the caps, so gas may escape.
8. Don't light any matches near the battery while it is being charged.
9. Don't let the cells stand idle too long.
10. Let the terminals show signs of a white deposit called "sulphation". A small amount of sulphation will tend to keep sulphation at a minimum.

For those who have direct current in their homes, a battery charger is moving one lamp, one ampere will be lost from the charging rate. The correct charging amperage is generally marked on the battery by the maker. It is always best to charge the battery at a low rate. Remember, the slower the rate of discharge the longer the battery will last. A battery should not be used for storage too long or the sulfation will increase.

When connecting up the battery to the set see that the terminals are cleaned off. Use a small piece of sandpaper. It may be noticed from time to time, as the battery is used, that the terminals show signs of a white deposit called "sulphation". A small amount of sulphation will tend to keep sulphation at a minimum.

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A One-Control, One-Tube Set That Operates a Loud Speaker.

A new Radio Circuit has been perfected. It is a remarkable circuit, that cannot be imitated. The receiver is so constructed that the circuit is kept secret. The receiver is built with that if it fails, the circuit is entirely disassembled and incapable of being copied.

To test recently made with this circuit, broadcasting stations over 1,000 miles were heard. It was possible to hear Philadelphia while WR was broadcasting. When signals are so powerful that head phones are uncomfortable, and a loud speaker, on this set can be heard over a large room, tuning is accomplished with a single-control.

The Wave Length Range of this set is such that it can easily tune to all the new long wave lengths, which broadcasting stations will soon be using.

The small dimensions of the set—2-inch x 8-inch x 6-inch makes it especially suitable for camping and other purposes requiring a light, compact receiver. It can be operated by any dry cell type.

By special selection of parts and improved methods of manufacture by The Atlantic & Pacific Radio Company, the price of the receiver has been kept down to $12.50.

Set Is Now on Demonstration at The Atlantic & Pacific Radio Co., 131 West 37th Street, New York City.

Complete Line of Standard Radio Sets and Supplies WHOLESALE & RETAIL.

In Stock for Prompt Shipment

We have on hand a complete stock of PARTS AND SETS Manufactured by the following radio manufacturers: B. R. P. Products, Metall, Western Electric, Cutter Hammer, Western Electric, Dictograph, De Forest, Fischer, D.C. A, Federal, Acme, Federal, Acme, Marlo Batteries, Marlo Batteries.

SEETS BUILT TO ORDER

Our Aerial Construction Department is under the supervision of George Mitchell, Associate Institute of Radio Engineers. Estimates Cheerfully Furnished.

Filaments of Amplifier Tubes May Be Lighted From A. C. Lines.

The filament of an amplifier tube may be lighted from A. C. lines. To do this, connect all the carbon rods, or centre posts, of the dry cells, and the outside wire to the outside post. This then makes the outside polarity, negative, while the filament, or centre post, forms the positive connections.

The use of a vacuum tube in a radio receiver involves a battery to supply current for the filament. This is usually greater than one which is operated on a battery. The A-battery in the case of the more common tubes is a six-volt battery, but the tube known as the 82 operates on an ordinary dry cell. Another tube, known as the UV-10, operates on two dry cells, while the 98 T.V., in operation on the 8-volt storage battery. Should the owner of a set require two dry cells for the filament, but desires to use dry cells he may readily do so, but it is advisable to begin operation with such an arrangement, as the life of dry cells is limited.

If dry cell tubes are used it is advisable to have them connected in parallel in order that their life may be prolonged. To do this, connect all the carbon rods, or centre posts, of the dry cells, and the outside wire to the outside post. This then makes the outside polarity negative, while the filament, or centre post, forms the positive connections.

The filament of an amplifier tube may be lighted from A. C. lines. The use of a vacuum tube in a radio receiver involves a battery to supply current for the filament. This is usually greater than one which is operated on a battery. The A-battery in the case of the more common tubes is a six-volt battery, but the tube known as the 82 operates on an ordinary dry cell. Another tube, known as the UV-10, operates on two dry cells, while the 98 T.V., in operation on the 8-volt storage battery. Should the owner of a set require two dry cells for the filament, but desires to use dry cells he may readily do so, but it is advisable to begin operation with such an arrangement, as the life of dry cells is limited.

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How to Locate Troubles in Radio Receivers

Whatever the type of receiving set, the first step is to test out each piece of equipment individually. A small flashlight lamp and battery form a simple testing outfit.

If no sounds are heard in the 'piece, begin at the lightening arrester and test one at a time, with the lamp and battery across the arrester. The lamp should not light. A light indicates a short circuit. Applying the test to the tuning unit, the lamp should light when the terminals are connected across the primary and, also across the secondary. It is a good idea to test out the various taps on the primary to see that none of the small pigtails have become broken inside the flexible tubing. When connected across the condenser, the lamp should not light. If it does, this indicates a defective condenser, whether it be variable or fixed.

The most satisfactory way to test a tube is to take it to some other receiving set known to be in working order and substitute it for one of the tubes in use. A tube with a filament that lights up when connected to a battery is not necessarily a good tube. There is always the possibility of grounds between the elements.

Regeneration and Its Effects

A Brief Talk on the Methods of Obtaining and Controlling

This Very Desirable Condition, Together

With Working Diagrams.

Three million good and honest American citizens or citizens-to-be are using receiving sets in which regeneration plays an important part. Many of these radio enthusiasts, most of whom are not very familiar with the working of the set, know how to produce it, but why the effect is mani

fested by such insignificances as a flashlight lamp which lights up at the most inopportune time. It is a single slide tuning coil is beyond their ken. As a matter of fact, they don't have to know. It is because of this last statement that this treatise, like many others intended for consumption by the average man, will not attempt to enter into the technicalities of regeneration. Rather, the phenomenon will be described clearly in terms of what is hoped will give a general idea of the cause and effect.

Regeneration can be secured on many forms of reed back. All that is necessary is to carry the regeneration to a higher limit beyond which this amplification cannot go. After a certain point in regeneration is reached the tube is set off into oscillations, which means that it is no longer acting as a pure amplifier but is also functioning as a transmitter. When this point is reached the signals will lose their real tone and will become mushy and distorted. With code signals this does not matter, but radio sounds are made unintelligible.

Regeneration can be secured in several ways.

There are several methods of obtaining regeneration. One method has already been mentioned, that of tuning the plate circuit of the tube with some kind of variable condenser used to control the regeneration. With the "tickler" as it is called, the plate circuit of the tube is tuned to the point at which the plate voltage becomes a maximum. Another method makes use of a wire-wound tube called a "tickler," which is used to increase the regeneration. This last method is the most satisfactory, although the radio fan will not become too enthusiastic about the design for fear of damage due to increasing volume. He has made use of one of the most astounding discoveries of the age and one that in later years was to affect the entire complexion of the radio industry, broadcasting as well as reception.

Small Currents in Grid Controls

Large Plate Current.

As was stated in the chapter devoted to the fundamental action of the vacuum tube, the presence of a very small amount of energy in the grid of the vacuum tube will control a much larger amount of energy in the plate circuit. If the two circuits are considered as being entirely independent of each other, the analogy is much like that of the motorman of a trolley car, who liberates a large amount of force at the air brake and thereby controls the movement of a car weighing many tons. In the vacuum tube, which is arranged for possible regeneration, this energy in the plate circuit can be tuned to be in phase or in step with the incoming wave, and thus increase the initial force on the grid. Of course, the complete action is instantaneous, but an idea of the manner of working may be clarified by the following word picture is understood.

For purposes of the example assume that a force of 1 pound is impressed on the grid of the tube. Through the amplifying action of the tube this original force is increased to 4 pounds. This quadrupled force is then arranged to be in step with the first force and fed back to the grid, where the two forces combine to form a force of 8 pounds. This force, being greatly amplified, after passing through the tube, is increased to 32 pounds in the plate circuit and so on. If this seems like perpetual motion the radio fan should not become too enthusiastic about the design for fear of damage due to increasing volume. He has made use of one of the most astounding discoveries of the age and one that in later years was to affect the entire complexion of the radio industry, broadcasting as well as reception.

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The primary as the permanent coil, one rotor in one end of the primary as the secondary coil and another rotor in the opposite end of the primary as the "tickler." In arranging these coils for regenerative circuits it sometimes happens that while the receiver will work the regenerative effect is lacking. This usually may be remedied by switching the connections leading to the two ends of the "tickler" coil.

**Variometer Outfit is for Short Waves.**

The variocoupler receiver or the variocoupler-varietometer outfit is suitable only for short waves from 150 to 500 meters. As now covered by regulations, these limits are sufficient to accommodate all broadcasting stations. But for experimenters who feel the urge to receive long waves may be utilized for the reception of broadcasts or of 20,000-meter code signals. All the owner need do is to tune the circuit to the desired wave length.

When a receiver is built for use with a 43-plate variable condenser and in Europe some other coils are used for receiving 15,000-meter stations. But for experimenters who feel the urge to receive long waves may be utilized for the reception of broadcasts or of 20,000-meter code signals.

**Radio Manual**

Right to tune the circuit to the desired wave length. The following table suggests the sizes to use for various wave lengths, the size in each instance having been figured for use with a 45-plate variable condenser (capacity 0.001) across them. The "tickler" is more frequently employed without this condenser.

**TABLE OF HONEYCOMB COIL SIZES FOR ALL WAVE LENGTHS**

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<th>Tickler</th>
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<td>DL50 DL100 DL50</td>
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<td>DL100 DL250 DL100</td>
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'Phones and Loud Speakers

Head Sets Are Essential for Crystal Sets and for Weak or Distant Stations, but the Ideal Receiver for the Home Requires a Loud Speaker.

The radio head 'phone has never had the credit it deserves. Without it there is no telling what intricate and supersensitive apparatus would be necessary to take it place and carry out its function of transducing the varying impulses of electricity into audible sounds.

The amount of energy picked up by an antenna is so small as to be measurable only by the most sensitive of special indicating instruments. Yet the headphone, in the case of the crystal receiver, is set into motion by those trains of almost insignificant energy.

A 'phone consists of several thousands of turns of very fine wire—No. 40 to 44 silk-covered or enamelled-wound carefully on two spools. Around the fast-moving impulses of electricity, which run cores of soft iron. Around the spool are several circuit pieces of somewhat harder iron which have been permanently magnetised. The fact that these are placed in the centre of the coil in such a position that the tops of the iron cores are slightly below the level of the outside of the coil, then across the top of the coil a thin diaphragm of iron is laid. The permanent magnets hold the diaphragm in a slightly dished position. The electro magnets formed by the wire-wound spools have no effect on the diaphragm until a signal impulse passes through the set. When a high-frequency wave strikes the grid of a vacuum tube the current in the plate circuit, where the 'phones are located, is also made variable, although the changes are not so rapid as those of the incoming wave. The windings of the 'phones hold back the actual high-frequency currents in the plate circuit.

When a sound is made with the voice and the sound waves impressed on a telephone transmitter, the shape of the electric impulses sent out over the wire or over the air, as the case may be, assumes the shape of the vocal sound. These waves are not regular in shape, but are a mixture of many odd-shaped waves. As these peculiarly modulated waves strike the grid of the tube they create a disturbance in the circuit in just the same way as with music or noise. These currents pass through the fine winding on the spool a temporary magnetic field is formed. This new magnetism may help or "buck" the magnetism of the permanent circular magnets. When they help, the diaphragm is drawn down with considerable force; when they 'buck' the total effect is less than that of the permanent magnet alone and the diaphragm tends to return to its normal position.

'SPhones Should Not Be Bought by Others.

In advertisements and store windows 'phones are usually specified according to the number of ohms, anything from 500 ohms to 2,000,000 ohms. The 'phones with higher ohmages are apt to carry a higher price tag, leading the unknowing purchaser to believe that the 'phones are better in proportion to the amount of resistance.

To elucidate this fact a bit further, the term ohms is merely a measure of resistance. Thus an electric bulb of the type used to light the home may have a resistance of 200 ohms. But no one buys a lamp according...
Radio Frequency Amplification

Higher Amplification, Greater Distance and Selectivity Are Possible With the Proper Application of This Feature.

"The audio frequency amplification for volume and radio frequency amplification for distance and selectivity." This is the admonition of radio engineers. Thousands have followed the advice without knowing why. A casual number has attempted to apply radio frequency units to receiving sets already in existence with utter failure, due to the fact that their understanding of the devices was meager.

When a broadcasting station transmits sounds in the form of waves these waves travel at a high rate of speed, depending on the wave length, through amplification to a point where they are powerful enough to be heard. The loudspeaker is thrown out of the set is understood that the beginner in radio cannot, nor does he want to, before buying any loud speaker, the amateur makes of, 3,000 ohm 'phones are the most suitable for the average receiving set.

The Ideal Receiver Requires a Loud Speaker.

For head 'phones, however, the reliable makes of, 3,000 ohm 'phones are the most suitable for the average receiving set.

Engineers Are Developing Better Loud Speakers.

No radio or acoustical engineer is so rash as to believe that the ideal loud speaker has been even approximated by those now available. The last year has seen some distinct improvement in this line of radio equipment, but there is still much to be desired. It is not a simple problem to amplify the entire range of sounds associated with radio transmission. These sounds range from the low notes of the bass singer and the church organ to the high notes of the violin and wind instruments. The perfect loud speaker must amplify these tones, and proportionately amplify the others, otherwise strange notes are sure to be introduced.

How to Connect a Radio Frequency Receiver Using Inter-stage Transformers.
Radio Frequency Amplification Utilizing the Reactance Form of Coupling Between Stages.

Radio Frequency amplification is obtainable in several widely differing forms. There is the transformer type, sketched in heavy outline above; there is also the reactance or choke coil type of coupling. For the short waves and corresponding high frequencies with which the radio equipment works the transformer type of coupling is by far the more suitable.

The reactance-coupled R. F. amplifiers have the advantage of being equally effective over a wide range of wave lengths, but as given wave lengths their effectiveness does not equal a well-designed transformer coupling.

The resistance or choke coil type of coupling is of interest to the experimenter who enjoys the careful manipulation and manifold adjustments required to fit the reactance to the particular stage of amplification and to the wave length being received.

The highest degree of amplification is obtainable with transformer coupling of the choke coil type. Unfortunately the amount of amplification and the stability of the amplifying tubes do not go hand in hand. One must be satisfied with the amplifier's output.

It should be mentioned here, however, that due to the characteristics of transformer coupled amplifiers the same transformer cannot be used for all wave lengths. There is usually one point at which the amplification will be best. Just how wide a band of wave lengths one transformer will accommodate will depend on the design. A transformer with an iron core will cover a wider band than another with an air core. But exceeding care must be used in selecting the iron and arranging the windings with respect to the core, otherwise the amplification will be uneven as the wave changes from a given value.

Radio Frequency Amplification Using Reactance Form of Coupling Between Stages.

Radio Frequency Amplification Utilizing the Reactance Form of Coupling Between Stages.

Radio Frequency Amplification Utilizing the Reactance Form of Coupling Between Stages.
AMBASSADOR PHONES

AMBASSADOR Phones have no superior as to sensitiveness, clearness, balance and long range. Their quality is the best because they are produced in a new modern factory by master builders and every phone is backed by a one-year, written money-back guarantee.

Your set is no better than the phones and if you want to locate stations hereafter impossible to hear, use AMBASSADOR phones.

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4. Contain powerful magnets and are magnetized by a special process.
5. Are securely wound with special wires to give maximum number of turns and correct frequency.
6. Sold under a written money-back one-year guarantee.

Is There Anything You Don't Quite Understand About Radio Frequency Amplification?

You don't need to wade through involved mathematical discussions to find the explanation you want. Kenneth Harkness makes it all plain in this one volume written in straightforward English.

New!
"The Theory and Practice of Radio Frequency Amplification"

BY KENNETH HARKNESS

Let Kenneth Harkness, Chief Engineer of the Radio Guild, give you inside information on the design and wiring of commercial radio frequency amplifying receivers.

With scores of revealing photographs, drawings and wiring diagrams this book will tell you in simple and direct language:

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2. How you can construct at low cost your choice of three different types of radio-audio frequency receivers of standard makes—the most sensitive and selective on the market today.
3. Specifications of the best and patented type of radio frequency transformer. This information, with series of photographs, is released for the first time.
4. Complete details of a new and special tuning device for use with radio frequency amplification. It ensures the highest possible selectivity with long distance reception.
5. How to make a high frequency oscillator covering all wave-lengths.
6. The construction of a "New-volume" receiver, with all the latest details.

These are only a few of the many subjects of current interest which are described in detail in this remarkable book. Nothing like this has ever been published before in one volume. It fills your need for authoritative information on the subjects which are most important to you today—long distance reception and selective reception. It will tell you in easy-to-grasp language how to make a receiver which will be so far superior in both appearance and operation to the sets your friends have that they will envy your success. And this book will tell you WHY your set operates as well as HOW to operate it to the best advantage.

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(Outside U. S., $1.10 cash with order)
De Forest makes many types of receiving sets, but probably the most successful have been the reflex circuit sets, one of which is illustrated below.

D-7-A with indoor loop has many transcontinental receiving records clear from California to New Jersey. The reflex is also made in Portable form—“3,000 miles in one hand” which operates with the new De Forest DV-6-A tubes on dry batteries, self-contained in the cabinet.

At the left are illustrated some of the laboratory precision De Forest parts, which every real radio fan knows all about. Note especially the new DV-6-A tube, designed for operation either with the standard type of A Storage Battery or with dry batteries. This tube operates in all models of the reflex set. Send for catalog and descriptive literature of complete De Forest line.

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Jersey City, N. J.

The Famous De Forest D-7-A Reflex, Price with Indoor Loop, $125.00. Made also in Portable Form (D-10) with Dry Batteries Inside Cabinet, $150.00.

RadioCraft Regenerative Receivers Are Made of De Forest Parts!

The RadioCraft Company, owned by the De Forest Company, manufactures RadioCraft Regenerative Receivers under Armstrong patent No. 1,113,149.

The RadioCraft Company uses in the manufacture of these sets the well-known and tested De Forest parts. Illustrated are D-6 with a receiving range of approximately 2,500 miles, which uses outdoor antenna, and A and B batteries; and D-4, one of the lowest priced Regenerative receivers on the market, with a range of several hundred miles.

If you are interested in Regenerative sets send for the RadioCraft catalog.

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RadioCraft’s D-6 Receiver, Price $130.00.