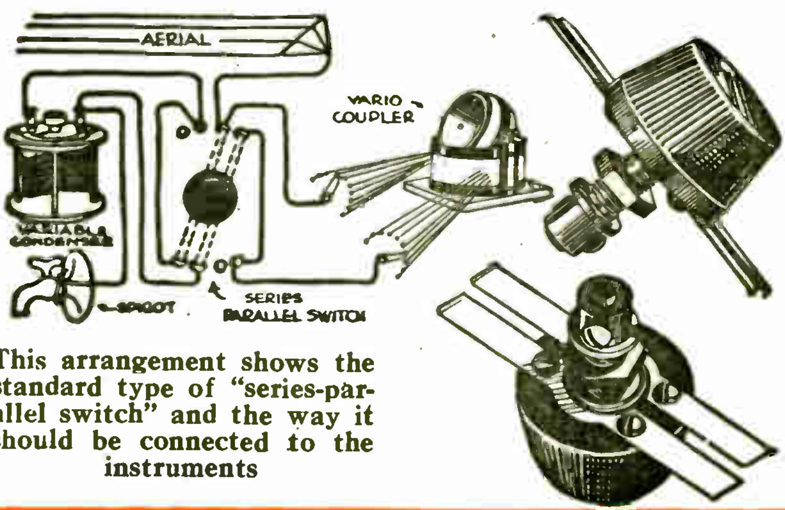
FEBRUARY, 1923 Price 20c

USING HONEYCOMB COILS

E-Z RADIO

VOL. I NUMBER X

THE STANDARD SERIES-PARALLEL SWITCH



This arrangement shows the standard type of "series-parallel switch" and the way it should be connected to the instruments

By Henry M. Neely

E-Z COMPANY, Inc.

614 ARCH STREET
PHILADELPHIA

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912,

Of E-Z Radio, published monthly at Philadelphia, Pennsylvania, for February 1, 1923.
State of Pennsylvania :
: ss.
County of Philadelphia:

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Herman N. Rudley, who, having been duly sworn according to law, deposes and says that he is the business manager of E-Z Radio and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations.

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, E-Z Co., Inc., 614 Arch Street, Philadelphia, Pa.

Editor, Henry M. Neely, Delanco, New Jersey.

Managing Editor, Henry M. Neely, Delanco, New Jersey.

Business Manager, Herman N. Rudley, 614 Arch Street, Philadelphia, Pa.

2. That the owners are:

Henry M. Neely, Delanco, New Jersey.

Herman N. Rudley, 614 Arch Street, Philadelphia, Pa.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of total amount of bonds, mortgages, or other securities are:

None.

HERMAN N. RUDLEY, Business Manager.

Sworn to and subscribed before me this 20th day of January, 1923.

(Seal) MISS ESTHER FEDERMAN, Notary Public.

My commission expires March 7, 1925.

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E-Z RADIO

BY

HENRY M. NEELY

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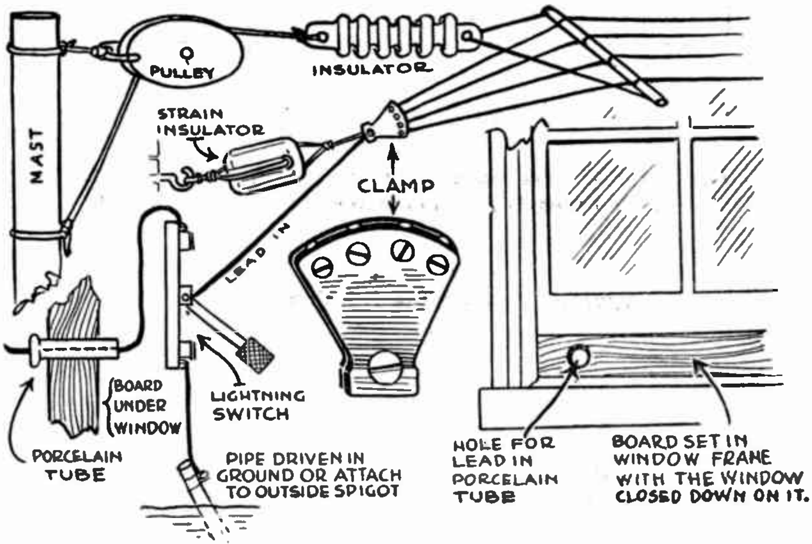
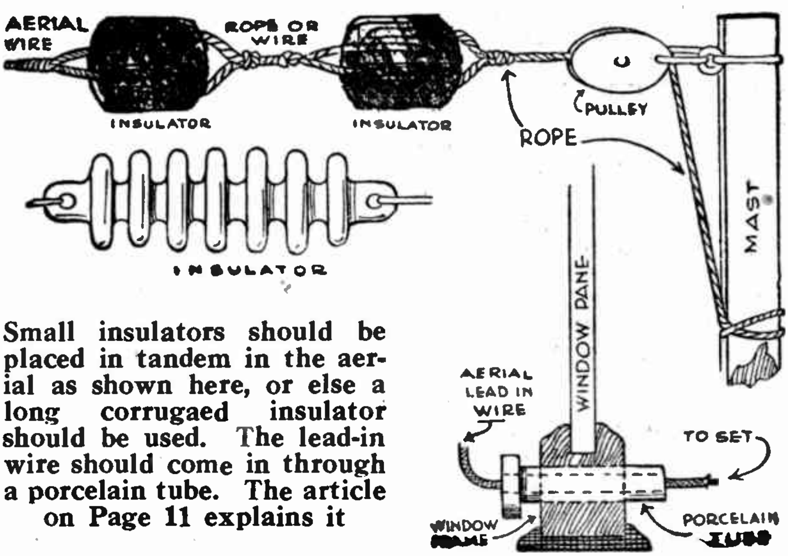
THE LEAD-IN FOR YOUR AERIAL



These sketches show the details of bringing the lead-in from your aerial into the house. It is explained in the article on Page 13

INSULATORS IN YOUR AERIAL



Small insulators should be placed in tandem in the aerial as shown here, or else a long corrugaed insulator should be used. The lead-in wire should come in through a porcelain tube. The article on Page 11 explains it

A TALK ABOUT MAGNETISM

The process of "induction" in radio may be roughly compared to the swirl of air blowing a paper when an express train passes. The article explains it.

The great majority of beginners in radio find it difficult to understand the reasons for the things they do in operating their sets principally because of their inability to get a clear mental picture of just what magnetism is and what it does.

Without this definite view of magnetism they cannot understand the principles of "induction," and as radio is founded upon the phenomenon of induction they are handicapped at the start in understanding their sets.

If I may be permitted to make a comparison that is not really an accurate one I will try to tell you something that may give you a better idea of this fundamental subject.

Almost everybody has stood on a station platform when an express train went thundering by and had to hold his hat on his head or have the hat blown off. When a train dashes by at sixty miles an hour along a track it creates in the air an extremely strong current, and this current, striking your hat or a piece of paper or the dust along the tracks, is capable of imparting definite movement to these objects.

You can easily see that this movement is due to the train, although the train and object are not in any way connected to each other. It is impossible for any object to move through the air without creating a greater or less amount of this force in the air, and this force striking another object will exert upon it a force that will depend in amount upon the mass and speed of the original object that is creating it.

Whenever a current of electricity flows through a wire it creates in the ether about it a force or an amount of motion that might be pictured mentally as something like the force or motion created in the air by the express train. The principal difference is that, whereas the air is sucked along in the direction of the train, the current of electricity throws its influence out at right angles to the direction of its motion.

Also you must remember that when we deal with magnetism we are not dealing with a motion in the air, but in the ether which is in every object that we know of. Just as it is impossible for any material object to move through the air without creating a disturbance, so it is impossible to send a current of electricity through a wire without creating a disturbance in the ether around that wire. We can make the similarity go farther by saying that just as the air current created by the train is capable of imparting actual motion to your hat, so the field of magnetism thrown out by the electric current in the wire will, if it be permitted to cut through another wire, create a current of electricity in the second wire, though they are not connected.

A direct current which moves steadily in the same direction builds up this field of magnetism and the magnetism is capable of adding to the momentum or force of that current, just as it is theoretically conceivable that the strong current of air created by the train might serve to push the train farther along in its own path if the engine were suddenly stopped.

When we have an alternating current of electricity the current induced in a nearbv wire will also alternate. This you can understand if you will imagine a double track railroad running north and south with a piece of paper lying between the two tracks.

When an express train goes north the paper is sucked in that direction. Then comes an express train going south and the movement of the paper is reversed and it goes in that direction.

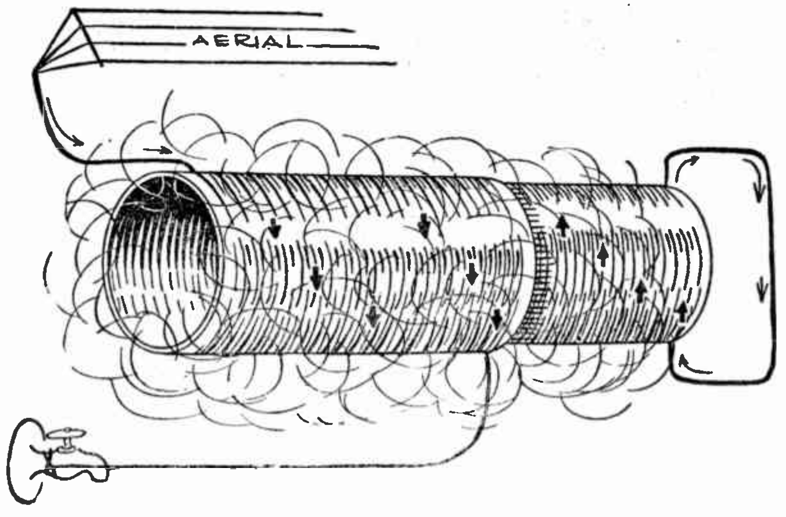
So it is with an alternating current of electricity, which is first positive and then negative many times a second. The field of magnetism created by the positive current is the opposite to the field created by the negative current, and if you have another wire within reach of this magnetism the current created or induced in this second wire by magnetism will alternate in unison with the alternating currents in the first wire though they will be in opposite directions.

It is important to know that you can insulate electricity so that it will not go through the insulation from one wire to the other, but there is no way of insulating magnetism. That is why we insulate wire on our coils.

It keeps the electricit·· in the original wire, but the magnetism rushes through the insulation and creates electricity in the second wire.

"COUPLING" IN THE TWO-SLIDE TUNER

"I cannot understand," writes a reader, "why it is we use two slides on a two-slide tuner and how it is possible for any of the current to get to the crystal and to the phones. I was always told that a current follows the path of least resistance, and I should think that it would come in from the aerial and go around the windings of the coil and escape directly to the ground without any of it going into any other part of the circuit."



A current of electricity flowing through the wire of one coil sets up a flow of magnetism in the ether about it. It is a magnetic cyclone. This magnetism cuts through the insulation on the second coil and creates a separate current of electricity in its wires

This brings up a very interesting phenomenon of the tuning coil, whether it is of the two-slide or the one-slide variety. In order to understand this, we must understand the meaning of the word "coupling" and the word "induction."

Everybody is familiar with the old-fashioned loose coupler and the modern variocoupler. In each of these instruments there are two separate coils of wire. One of them, the primary, receives the signals from the aerial and conducts them to the ground. In this process, the electrical currents send out a field of magnetic influence all around them and this magnetic field, rising and falling, creates an entirely separate, but similar, current of electricity in the wire of the other coil, which is known as the secondary.

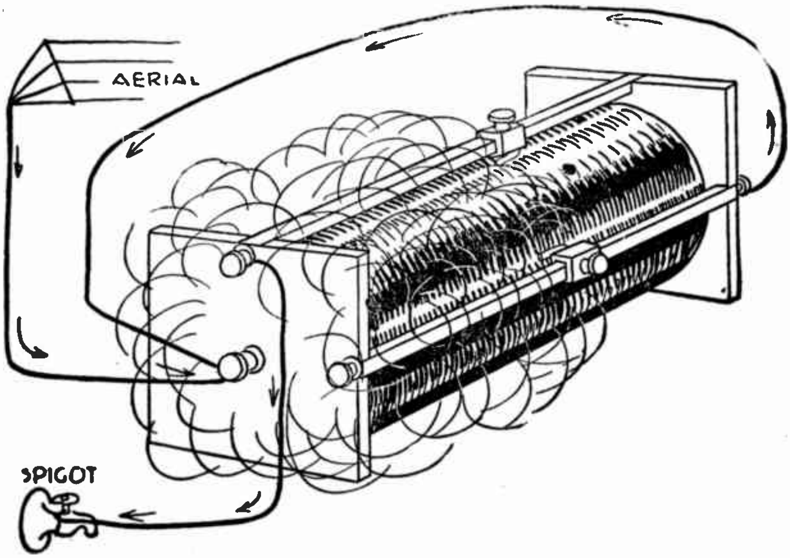
This creation of current in the second coil by means of the magnetism thrown out by the other coil is called "induction." The amount of induction is governed by the position of the secondary coil with relation to the primary coil. This position is varied in the loose coupler by sliding one in and out of the other and in the variocoupler by turning the ball-shaped form around on its axis. When the windings of the secondary coil are close inside and parallel with the windings of the first, we say that the "coupling is close"; when they are far away or turned in a different direction, the "coupling is loose."

When the coupling is close, the secondary coil, through the process of induction, will extract a great deal of energy from the primary coil and this may be of such an extent as really to amount to a resistance in the primary circuit and prevent a great deal of the original strength of the signals going to the ground.

The strength is transferred to the secondary circuit and goes around it through the detector and the phones. When the coupling is very close, the signals are strong, but it is impossible to tune out interference. We say that the signals in the primary circuit are "damped" too much.

In the next article, I will show how this process of induction and of damping is also present in the two-slide tuner.

MORE ABOUT THE TWO-SLIDE TUNER



The windings of a slider-coil act as both primary and secondary. The "coupling" depends upon the amount of wire that is used in common by both circuits

In the last article I explained how a current of electricity in one coil—the primary—sets up a miniature cyclone of magnetism in the ether about it, and how this magnetism, cutting through the insulation of another coil—the secondary — creates another separate current in its wires.

With a two-slide tuner the portion of the coil included between the aerial circuit and the slider which goes to the ground connection is the primary. The portion between the aerial connection and the other slider is the secondary coil.

Just as though there were two separate coils, the current in the primary induces a current in the secondary and this secondary current steals energy from the primary.

The amount of this stealing depends upon the number of turns of wire in the primary, which are also used in the secondary. The more turns of wire that are common to both circuits, the closer the coupling and the louder the signals, but this close coupling means a greater "damping" in the primary, and, therefore, less ability to exclude interfering signals.

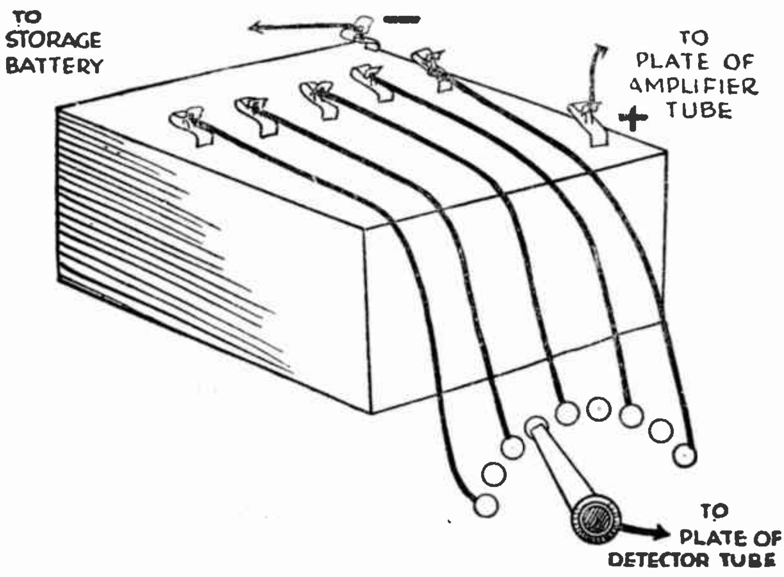
The fewer the turns of wire that are common to both circuits, the looser the coupling and the better the chances of tuning out interference, although the signals will be weaker.

Without a variable condenser in the circuit of the secondary it is necessary to have as many turns of wire in the secondary as are in the primary, if not even more. This means extremely close coupling and unsatisfactory tuning out of interference, but it is necessary because we must have the secondary respond to the same wave length as the primary, and without a condenser this wave length is very largely governed by the number of turns of the coil.

In order to permit us to use fewer turns of wire in the secondary we insert a variable condenser "across" the coil, and this gives us sufficient added wave length to enable us to cut down the number of turns of wire used in this circuit and, therefore, to loosen the coupling, because we are enabled to move the secondary slider closer to the aerial connection and thereby reduce the number of turns of wire on the coil that are common to both circuits.

For this reason a variable condenser in the circuit of either a single or double slide tuner is not only a convenience, but gives us a much better chance to tune out signals that we do not wish to hear.

TAPPING YOUR B BATTERY



The lead from the B battery to the detector bulb should be tapped with a switch blade so that you can vary the voltage which you use

In virtually every hook-up which is given for the audion bulb nowadays the telephones are shown connected to the positive side of the B battery, without any provision being made to change the amount of voltage which the battery is to supply through the phones to the plate connection.

In every case it is wise to put an attachment on your set, so that you can vary this voltage, within certain limits, so far as the detector tube is concerned. This statement applies both to the full size audion bulb and to the little peanut tube.

With amplifiers the amount of voltage does not seem to matter much. I usually put 45 volts on all of my radio frequency amplifiers, 60 volts on the first stage of audio frequency, and the full 90 volts on the second stage, and also on the third stage if I use three steps. This, however, is not absolutely necessary.

If you are using only 45 volts altogether, you can put that on all of the amplifiers at once, whether they are audio or radio frequency and even though you are using one type without the other. It is, generally, a safe rule to assume that the more voltage you put on your audio frequency amplifiers the stronger will be the signal in your phones or loud speaker.

This is true up to about 120 volts, though I do not advise any more than this with the ordinary type of transformer. It is likely to burn out the windings.

Most people use sets consisting of detector and two steps of audio frequency amplification. For them I advise two 45 volt batteries. The first step of amplification should have about 60 volts on its plate and the second step should have the full 90.

Now we come to the question of the voltage to be taken from the B batteries for the detector tube.

Most hook-ups indicate 22½ volts, but I have invariably found it a great advantage to be able to vary this voltage. This is because the most efficient voltage to put on the plate of the detector will depend very largely upon the brilliancy with which the filament of your detector tube is burning, and this in turn will depend upon the condition of your storage battery, or of your dry cells if you are using a peanut tube.

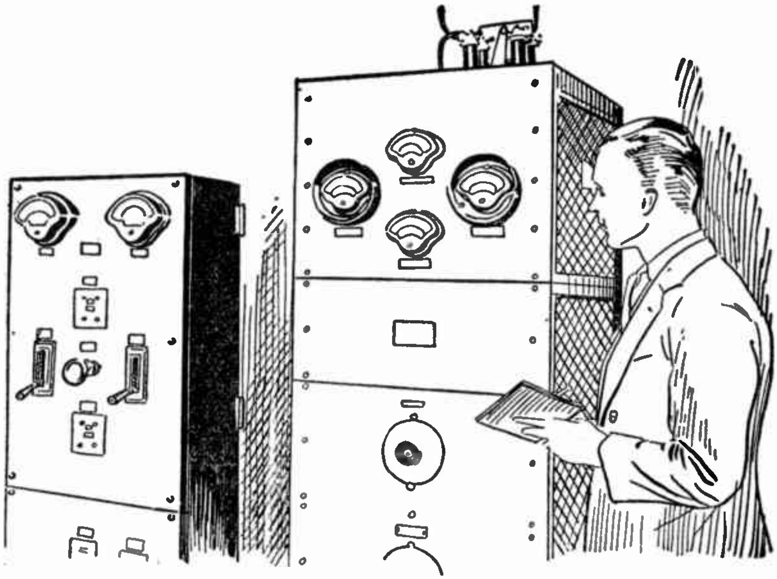
I am showing in the illustration the ordinary type of 45 volt B battery. This has one connection for the minus side. Then in the middle there is a row of five connections for the various voltages of the plus side, from 16½ to 22½ volts; finally, in the other corner, there is a connection marked plus, which gives the entire 45 volts.

You should put on your panel an arc of contact points and a switch blade, similar to the ones by which you tap your coupler. The wire from the switch blade shaft should go to the telephones and plate of the detector tube, and the contact points in the arc should be wired to the five connections in the row in the middle of the battery.

Thus turning the switch blade will enable you to vary the voltage on the detector from 16½ to 22½ volts.

You will notice that there is a blank contact between each two points that are wired to the battery. This is necessary to prevent the short circuit which would occur if the switch blade should happen to bridge two "live" contact points.

QUEER THINGS HAPPEN IN RADIO



This is the control panel by means of which the operator at the broadcasting station is able to watch the currents that are sending the concerts into the ether

Many times when you are listening in with your receiving set something will happen that will make you think one of your connections has come loose or your battery has gone dead or your aerial has broken down and you will jump up to make a hurried search for the trouble when, before you can even touch the set, the signals will come in perfectly once more. With certain types of concerts this will happen quite frequently and it is usually a great puzzle to the listeners in.

But the trouble is not in the receiving apparatus. It is at the transmitting station.

The correct transmission of a radio concert involves more skill on the part of the transmitting operator than the public realizes. He has to be almost as clever with his instruments as the pianist or the violinist is with his.

Only a few nights ago I was listening on my own receiving set to a very fine tenor singing an aria from "Faust." He came to a sustained high note, when suddenly the tone began to come in all chopped up as though he were slapping his lips with his hand while he was singing. The friends who were listening in with me at once thought that the singer was at fault. But he was not.

It is a remarkable feature of radio transmission that a high tone, even when sung fairly softly, will send more current into the transmitting aerial than a low tone sung very loud. Naturally these instruments must have some sort of safety valve to keep them from damage when the currents become too strong. Two of the most ordinary forms of safety devices are gaps across the aerial lead and circuit breakers in the instruments.

The safety gap is set at such distance that no spark will pass across it under ordinary currents, but, when the currents build up to such a strength that they might endanger the set they will jump across this gap in the form of sparks and so go directly to the ground. Each time there is a spark, the current is grounded and none gets into the aerial and so no signal goes out.

This is what happened to the tenor during that "Faust" aria. The currents built up under the influence of his high note until they were too strong to be safe and then they were passed into the ground through a series of sparks across this gap. The sparks were the cause of the chopping up of his sustained high note because they diverted the signal from the aerial straight into the ground.

Frequently, while the signals are coming in beautifully they will suddenly stop, there will be dead silence for a moment and the signals will go on again as though nothing had happened. This is because the circuit breaker has opened.

Here too you will usually find that this happens on a high note. The circuit breaker works by means of electro-magnets which get their electricity from the current that is going out into the transmitting aerial. When this current becomes so strong as to be dangerous to the set, these magnets build up sufficient force to pull a switch open and all transmission is stopped at once.

The pause that you will notice at this time means that the operator has quickly turned an instrument to reduce the current and has reached over to close the switch again.

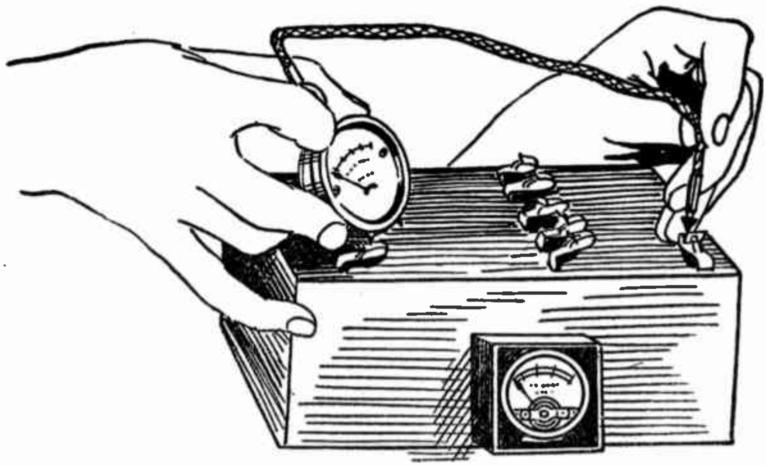
LOOKING FOR TROUBLE IN YOUR SET

Many a man has invested a tidy sum of money in a radio set and has heard it work beautifully in the store where he has bought it and then has failed to get any satisfaction out of it when he took it home. He will hear faint signals perhaps, but will not get anything like the strength of signals that he had every reason to expect.

In almost every case he blames the set or the salesman or he goes frantically over all of his wiring to find out where the trouble is, when, as a matter of fact, the whole fault lay either in his aerial or his ground connection. If you hear signals at all in your set you may be fairly sure that the various pieces of apparatus are correctly connected.

The trouble then narrows itself down to certain possible faults. It sometimes may be corrected by shifting the connection that goes from the minus side of your B battery. If it is connected to the plus of your filament battery try it on the minus or if it is on the minus try it on the plus.

It may be that the storage battery is not delivering sufficient voltage to the filament of your bulbs. If you have to turn your rheostats all the way on to the extreme position this is probably the case. If you are working with a storage battery you should test the solution with your hydrometer. and if it is below 1200 your battery needs a boost. If you are



When signals are fainter than they ought to be you should test your batteries for both volts and amperes

using a dry cell and a peanut tube get a new dry cell.

It may be that your B battery has run down and will not deliver sufficient voltage to the plate. Every radio fan should have a little voltmeter that reads up to fifty volts and should test his B battery whenever his signals are getting weak. Usuallv the B battery will give warning when it is beginning to die down. This warning takes the form of a loud crackling in the phones constantly. Users of the peanut tube should also have one of those little ammeters which sell for about $1 and which read up to 30 amperes. The dry cell that lights the filament should be tested with this constantly.

With this test you should place one connection of vour ammeter on a connection of the dry cell and then just touch the ammeter wire lightly to the other connection. Do not put it there and hold it there long. With a new dry cell the needle should shoot all the way over to 30. If the dry cell is about worn out the needle will not go above 15. Any reading below 20 means that you need a new dry cell.

The B battery for the detector bulb should test at least 18 volts and ought to test 22 for the standard bulb and should show at least 38 for best results with a peanut tube.

In other words the amperage on a B battery can fall quite low as long as the voltage keeps up close to its maximum.

INSULATORS IN YOUR AERIAL

There is another and altogether too common reason for weak signals beside those that I dealt with in the last article. This is either leakage or resistance in the aerial and ground circuits.

Bad insulation in the aerial is probably the most common fault of radio installations by novices. The average beginner will buy the cheapest aerial insulator it is possible to find and will use all of his money in improving his receiving apparatus. He totally loses sight of the fact that even the best possible receiving set will not function satisfactorily unless the aerial is correctly insulated and the ground connection is as free of resistance as it is possible to make it.

Bad insulation in the aerial will permit the currents to leak out of the circuit and be absorbed by nearby objects so that only a small part of the total strength of signals manages to reach the detector.

At the very best, the currents induced in the aerial by radio signals are exceedingly weak. We need every tiny bit of them in order to make our apparatus function properly. If we permit some of them to leak around faulty insulators, we rob the detector of the current it requires to function and it cannot therefore give us the service that we expect of it.

It is worth while in the very beginning to buy the best insulators. These should be at least six inches long and should be heavily corrugated if you are going to use the kind which has an eyelet in each end. If you are going to use what is known as "strain" insulators — that is, the kind in which the loops of the aerial and the rope pass through each other with the insulator between them —I advise putting two or three in tandem in each place where one is ordinarily called for.

The reason for this is quite simple. In these "strain" insulators the aerial wire and the rope are quite close together even though they have the material of the insulator between them. In wet weather the rope will become soaked with water and will then be a good conductor of electricity. Now, we know that two conductors of radio frequency currents, placed close together, act like the two plates of a condenser, and, even though the aerial lead-in will tend to carry the currents from the aerial wire to the set, the wet rope, acting as the other plate of the condenser, will absorb a great deal of this energy and steal it from the aerial wire before it has a chance to get to your detector. If you only have one of these small insulators a wet rope will rob you of a great deal of this current. It is therefore good practice to put two or three such insulators in series and each one will lessen the amount of this stealing.

You will find these insulators pictured on Page 2.

The ground connection is quite as important as the insulation of the aerial. Here we have a somewhat different problem. Our object is to furnish as easy a path as possible for the currents to escape from the receiving set after they have given us their signals in the telephones.

The very best ground that the amateur can have is a cold water spigot. This does not mean necessarily that you must run a long ground wire from the room in which you have your set all the way through the hallways of your house to the kitchen or the bathroom. It is almost always possible to run the ground wire out of the same window through which you bring in your aerial lead, run it along the side of the house and in at the bathroom window and there you can make a good connection to the cold water spigot or the pipe which leads to it. Before making this connection be very sure to scrape off the pipe so that it is perfectly clean and bright and solder your wire there if it is possible. If soldering is not feasible, get a regular pipe clamp which can be screwed up so that the connection is absolutely tight. Use regular seven strand aerial wire for this ground wire.

THE LEAD-IN FOR YOUR AERIAL

In most of the articles that the beginner sees dealing with the construction of an aerial he will notice that great attention is paid to the mast and the insulators and such things, but most writers seem to overlook instructions for telling what to do with the lead-in, which is the name that we give to the wire or wires leading from the actual aerial to the receiving set.

If you are putting up an aerial consisting of one wire, you know that this same wire should be continued on down to the lightning arrester and led from there through a porcelain tube into the house and attached to the aerial binding post on the receiving set.

Just here the beginner meets his first stumbling block. How is he going to bring that wire through a porcelain tube through the window frame?

One of the sketches in the illustrations on Page 2 shows the best way to do this.

Get a board about three inches by one inch and cut it such a length that you can raise the lower sash of the window, insert the board and close the window down tightly upon it so that it will not allow the cold air of winter to come in.

Then, instead of boring an unsightly hole through the window sash or frame, you bore the hole through this board, insert your porcelain tube, pull your lead-in wire through, stuff the porcelain tube full of friction tape to keep out the air, and you have a snug and neat job.

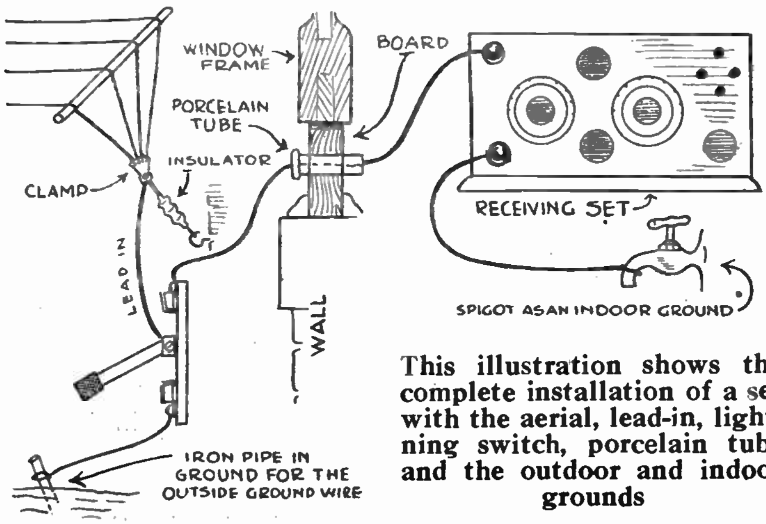
With an aerial consisting of two, three or four wires, we bring all of these wires down from the spreader just as though each one were a single wire aerial and then, just before fastening them to the lightning switch or lightning arrester, we clamp them in one of those handy little aerial clamps or connectors and then bring down a single wire from the connector to a strain insulator and then to the switch or arrester.

It is perfectly possible to bring this wire in directly, but the fire underwriters require that an arrester be used and common sense requires that you use such a switch as is shown in the picture.

This switch is not of much value in the winter time when there are no thunder storms but in the summer time, unless you put the switch in the lower position so that any electricity from the aerial will go directly along the switch blade to the outdoor ground, you are likely to endanger or damage your set from the fact that even distant lightning flashes will induce quite strong currents in the aerial and these currents may be strong enough to damage the delicate windings in your telephone receivers or your transformers.

It is also undoubtedly a fact that an aerial which is grounded by a lightning switch of this kind is the best lightning rod and the best protection for a house from lightning that any one has yet invented.

THE TWO GROUND WIRES



This illustration shows the complete installation of a set with the aerial, lead-in, lightning switch, porcelain tube and the outdoor and indoor grounds

With the aerial and the lead-in from the aerial disposed of, we can now turn our attention to the ground wires, and then we will have the aerial question finished.

Many amateurs ground their receiving sets on their lightning arresters or on the ground connection of their lightning switch.

Under ordinary conditions, this is all right, but it is bad practice in case of a severe lightning storm. The lightning switch on the outside of the house should have its own separate ground and this is usually not difficult to arrange.

Most houses have an outdoor spigot for a connection to a hose and this spigot makes an excellent ground. The wire from the lightning switch to this spigot can be a heavy solid wire or it can be three or four lengths of your regular aerial wire twisted together.

The spigot or the pipe to which it is attached must be scraped absolutely clean and bright and the wire fixed to it with a regular pipe clamp tightly screwed up. This connection can be greatly improved if you can fix it with solder.

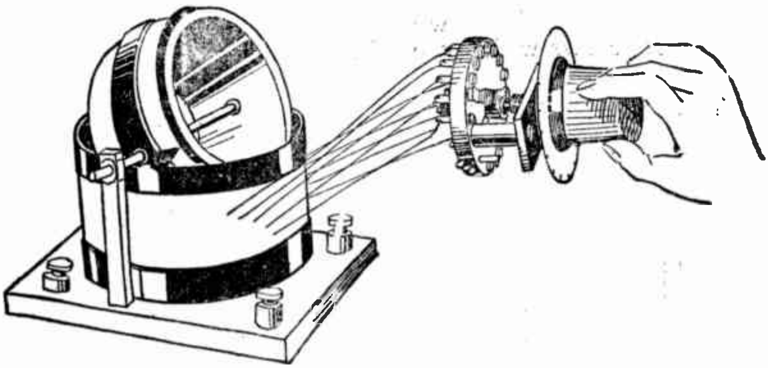
If such a spigot is not available, you can drive a galvanized pipe into the earth and fasten the ground wire in the same way to that. To make a good ground, however, this pipe should have its end in earth that is always moist, and it is better to use three or four such pipes and run one ground wire to each of them.

Inside the house, there is no better ground for the receiving set than the nearest cold water spigot. Make this lead from the set to the spigot as short as possible and be even more careful of a good bright connection between the wire and the spigot than you are in the case of your outdoor ground.

The ground wire indoors should be insulated, although this is not absolutely essential, but you must be careful that it does not come anywhere near one of the wires of your house electric lighting system. Most houses are lighted by alternating current and this current is capable of inducing other currents in any nearby wires.

If it should happen that such currents are induced in your ground wire they would travel up to your receiving set and would almost surely interfere with your signals.

THE HANDIEST KIND OF TAP SWITCH



This clever form of mounting for a tap switch and contact points makes it unnecessary to bore the circle of holes which have heretofore been such a nuisance to the amateur workman

How many radio fans have sworn softly under their breath at the job of drawing a circle for the contact points for tapping their coupler, and have done even worse, when, after measuring over carefully the spots for boring the holes for the points and boring through the panel, have had their drill slip and found the two metal heads touching? Everybody. That makes it unanimous. This has been the great bugbear of every man or boy who has tackled the job of mounting a radio receiving set on a panel. For a year or more we have all been doing it, and have grown gray haired in the attempt to master the problem.

During recent months, however, several firms have placed upon the market a little piece of apparatus which saves us every bit of this trouble and which, on that account, is well worth the price of something like two dollars that the different makers are asking for it.

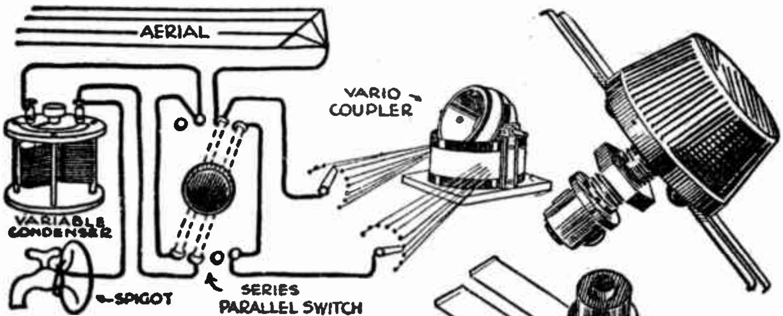
This device works on the principle of a rheostat. It has a knob and a dial for the front of the panel, and for the back of the panel it has a circular mounting, which contains ten or twelve switch points, and a blade which revolves from one to the other, just as the blade of a rheostat runs over the coil of resistance wire.

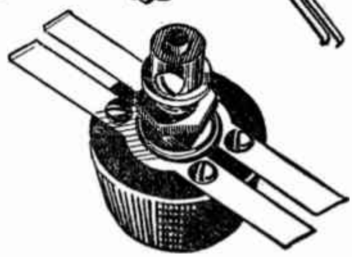
When you have this mounted, you make a little mark on the panel and, as you turn the knob, the dial on the front revolves with the knob, and the number that comes opposite the mark on the panel indicates which contact point the blade is resting on behind the panel.

For this piece of apparatus it is, therefore, necessary to bore only a big hole for the shaft to revolve in, and the one or two holes for the set screws which are to hold it snug and tight against the panel.

The contact points are also fine examples of the thought and care that are being given to radio to make the work as easy for novices as possible. One type which has particularly attracted my attention has a slit cut in the contact points and it is merely necessary to force the end of a wire into this slit, squeeze the two sides tightly together with the pliers and let a drop of solder fall upon it.

THE STANDARD SERIES-PARALLEL SWITCH





This arrangement shows the standard type of "series-parallel switch" and the way it should be connected to the instruments

In articles in the past we have given several forms of what is called a "series-parallel switch." All of these forms were home-made and would probably not appeal to the man who is very particular about the appearance of his set and who does not mind spending a little money to have everything the best that can be obtained.

For this man there is a special switch for this purpose, coming in the form of a neat knob with two blades attached to it and the shaft to go through the panel so that it can be turned from one side to the other. There are a number of different makes of this switch on the market, but they are all virtually the same.

For the benefit of those who have not seen our other articles, I might explain briefly that a series-parallel switch is one which is designed to change the connection between a coil and a variable condenser. The ordinary way of hooking up the tuning coil or the coupler with the aerial and ground is to have the variable condenser in what is known as "series." This means that the incoming signals must go through one of these instruments before they pass through the other one.

The effect of hooking the condenser up in series with the coil is to make the combination respond best to shorter wave lengths than the coil alone would pick up.

The other way of hooking the two instruments up is called "parallel" or "shunt" or "multiple"—that is, they are arranged in such a way that the incoming radio signals divide and go through both instruments at once from the aerial and then join again and go to the ground. This means that the combination responds best to the signals of a longer wave length than the coil would handle alone.

In almost every case it is a distinct advantage to have the instruments hooked up with this double switch. It gives flexibility in tuning that will some times mean the difference between good and ordinary signals.

The standard series - parallel switch which is shown in the illustration requires eight contact points and these are usually to be found inclosed in an envelope in the box with the switch. It is a very simple matter to make the connections necessary and the best method is probably the one shown in the diagram.

Hooked up in this way, the two instruments are in "parallel" when the switch is to the right and are in "series" when it is to the left. The dotted lines merely represent the two metal blades that come on the switch, and if you will follow them you can trace the course of the signals on the two settings.

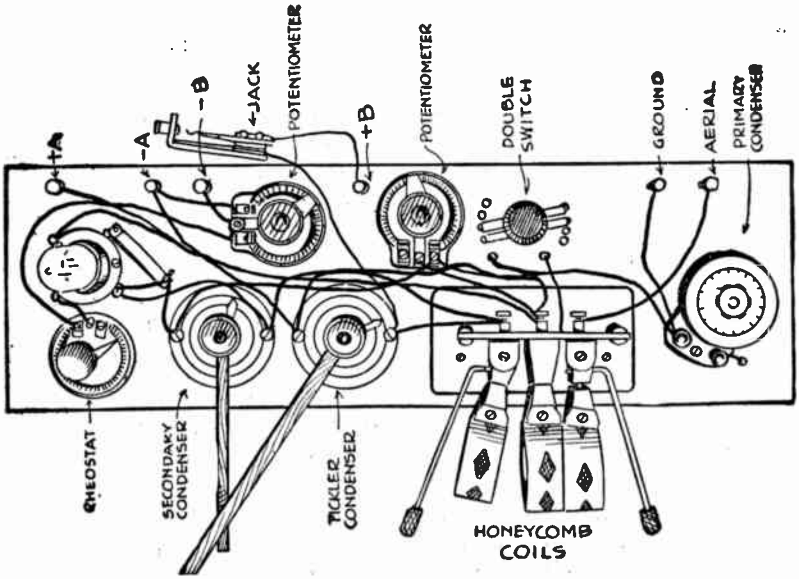
NOTES ON HONEYCOMB COILS

So many readers have written in lately asking about the three honeycomb coils that I recently threw together this hook-up, which I have not used for some time, and have been operating it so as to refresh my memory as to its peculiarities.

I think perhaps the interest in this arrangement is caused by the fact that so many of the radio enthusiasts are becoming fascinated with the dot and dash code, by which they can get away from the concerts entirely once in a while and try to copy the messages that are so constantly being shot through the air.

The illustration shows the simple way in which I always put together sets which I want to experiment with, and, while it is not given as an example of the way to mount a receiver for permanent use, I feel that those who like to experiment will get some hints from it. In assembling this set I included all of the various things which I have seen advocated to get special results and gave them a very thorough tryout so as to be able to tell you which are worth while and which are not.

The result is that I advise using two 23-plate condensers and one 43-plate hooked up by the method which I will give in my next article: but while the illustration shows two potentiometers I do not advise either one if you are going



This is a method for roughly hooking up the honeycomb coil set to test out various ideas. The long thin sticks are fastened to the dials of the variable condensers so as to avoid the electrical influence of the hand while tuning. This is known as "body capacity"

to confine yourself to a one-bulb set.

If, however, you are going to use amplifiers on the hook-up one of these potentiometers is well worth while, as I will indicate.

The condensers which I show in this illustration are what are known as "table mounted" types—that is, they can be set flat on a board and screwed down or can be used the same way on the front of a panel; they are not designed to have the plates on the back of the panel and the knobs on the front. They are very neat and compact units molded into a solid form and the 23-plate type is scarcely larger than the dial and knob which you will find on your panels.

I strongly advise the beginner to use this hook-up first with only one bulb until he becomes thoroughly acquainted with it. He can then take another one of the hook-ups recently given, one showing one stage of audio frequency amplification and the other showing two steps. He will find these on pages 27 and 28 of the December number of E-Z RADIO and can add a step of radio frequency.

With this outfit the whole world is right in your home and you will have not only the concert broadcasts but everything up to the trans-Atlantic stations, providing you make a collection of the proper sized coils.

These coils are usually referred to according to the number of turns of wire around them and there must be a combination of three—the primary, secondary and the tickler—and it is also necessary to know whether the double switch shall be set in the series or parallel position. Following are the usual combinations:

For the amateur station wave lengths from 145 to 350 meters, thirty-five turns for the primary, twenty-five for the secondary and thirty-five for the tickler; double switch in series.

For the broadcasts and ordinary commercial stations wave lengths from 300 to 700 meters, primary 75, secondary 50, and tickler 35; double switch in series.

For special commercial stations, wave length 635 to 1660 meters, primary 150, secondary 100, tickler 75; double switch in series.

For navy stations, wave lengths 845 to 1970 meters, primary 200, secondary 150, tickler 100; double switch in series.

For Arlington time, weather and press, wave length 1420 to 2850 meters, primary 300, secondary 250, tickler 150; double switch in series.

For navy ship arcs, wave length 2550 to 4250, primary 200, secondary 300, tickler 150; double switch in parallel.

For Navy land station arcs, wave length 4200 to 6300 meters, primary 500, secondary 400, tickler 200; double switch in parallel.

For foreign and press, wave length 6250 to 14,500 meters, primary 1250, secondary 750, tickler 400; double switch in series.

Foreign and press wave length 13,600 to 21,000, primary 750, secondary 1250, tickler 400; double switch in parallel.

THE COMPLETE HONEYCOMB HOOK-UP

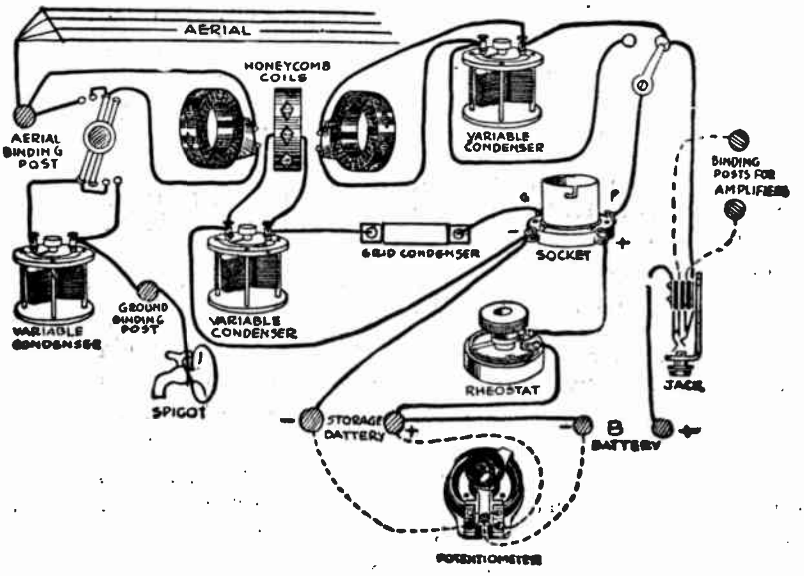
With the hook-up given in this article and a few observations that are to follow, I think that we may safely leave the three honeycomb coil receiving set, confident that any amateur, with a little patience, will be able to get very satisfactory results with it.

The diagram given here shows the arrangement just as complete as it is possible to show it. When the blades of the double switch are on the left-hand side, the primary coil is in "parallel" with the forty-three-plate condenser and the wave lengths are increased. When the switch blades are to the right, the coil and the condenser are in "series" and the shorter wave lengths will be received. This is an important part of the apparatus, and it is necessary to know in hunting for various signals whether your switch should be in parallel or series. That was indicated for each class of stations in the last article.

I am also showing here a single-bladed switch which engages either one of the two contact points, and when this switch is on the right-hand contact point the concerts will not interfere as the tickler coil is not in the circuit.

This is for the reception of spark signals without interference from those who use what is known as "continuous waves."

I am showing a double circuit jack in place of the phones in order to answer the natural question of those who will wish to add amplification later on. For those who do not, it is only necessary to say that the telephones are connected in the place of the two outside blades of this jack and the inner blades and the binding posts can be ignored.



This is the complete hook-up for three honeycomb coils. If you use potentiometer, disconnect wire from plus storage to minus B. Connect as in dotted lines.

I am also showing in dotted lines a potentiometer which I advise if you are going to use either radio frequency or audio frequency amplification.

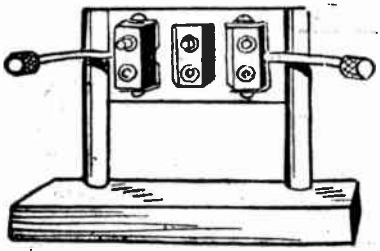
If you use this potentiometer you must not connect the plus side of the storage battery to the minus side of the B battery, as is shown by the solid lines. The potentiometer takes its place in this connection and enables you to make finer tuning. Connect it as shown by the dotted lines in this diagram.

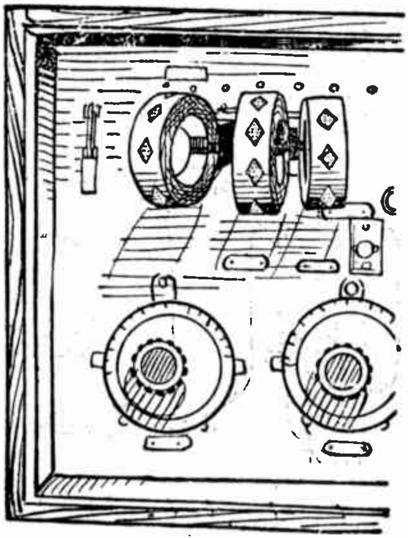
A SUMMARY ON HONEYCOMBS

Let us summarize the three honeycomb coils now and then drop the subject convinced that we have said about all that the amateur can use. First, the beginner will want to know just what size coils he will need for the various purposes.

Perhaps it might be well to give an idea of what can be done with this hook-up. I take from my log at my station in Delanco, N. J., fourteen miles from Philadelphia, some notes of Saturday evening, November 25.

Through the early part of the evening I naturally heard all of the Philadelphia stations, but had no difficulty in tuning them out and getting Newark and Pittsburgh and then later in the evening, using only one tube—and a "bootleg tube" at that — I heard the end of the concert by the St. Louis Symphony Orchestra from the St. Louis Post Dispatch station, "Miss Jones announcing," requesting all who heard the concerts to send a card to the radio editor.





These are the two standard mounts for honeycomb coils. To the right is the "panel" mount for the front of the panel. Above is one for mounting on a table or the top of your cabinet

Then I heard the concert from W D A J, the Atlanta and West Port Railroad Company broadcasting for train No. 36, and also the Atlanta Journal office.

Then came the Drake Hotel, Chicago, sounding as if he were in the next room, and thanking Mr. Sellers, of Chambersburg, Pa., for calling him on the long distance phone to say that his concert was coming in fine.

I also heard him give his regular lesson in the dot and dash code, the lesson for that night being the letter "C" and reviewing "A" and "B".

Perhaps it will be interesting for those who have tried the hook-up to know just how I tuned in the Drake Hotel.

I used a 75 turn coil for the primary, a 50 turn for the secondary, and a 35 turn coil for the tickler, with the double switch set in the parallel position.

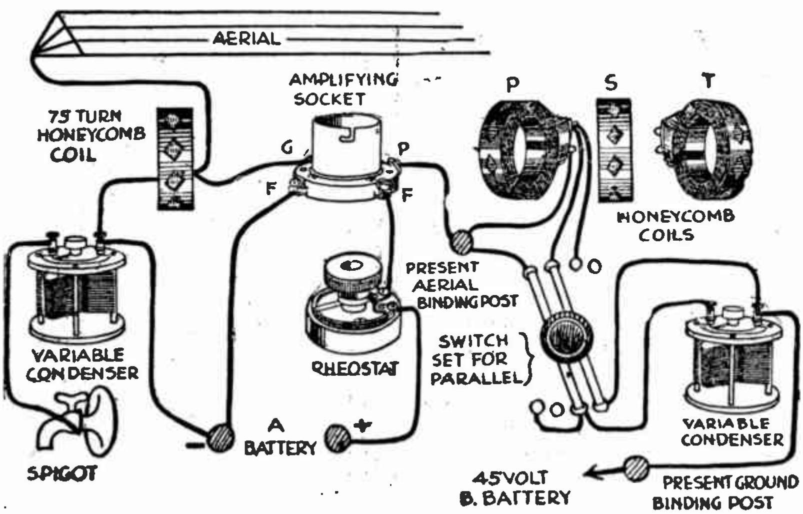
My 43-plate condenser was set at 58, my secondary condenser at 60, and my tickler condenser at 70. The rheostat which controlled the brilliancy at which the bulb was burning was set at just about one-half full value.

Incidentally let me say that the setting of the rheostat will do as much to bring in perfect signals as anything else.

"Body capacity" is one of the drawbacks of this hook-up, but I have avoided this by removing the knobs of my variable condensers, taking strips of thin wood about six inches long, boring a hole through one end and screwing the knob down again with this long stick under it so that I can move the dial by means of the stick, and thus get very fine adjustment with no trouble at all from body capacity.

RADIO FREQUENCY FOR THE HONEYCOMBS

The amateur who installs the three honeycomb coil set described in the last article will find it a perfectly simple matter later to put ahead of it a stage of radio frequency amplification. This is



This is the best method of adding radio frequency amplification to a honeycomb coil set without a transformer

designed to increase the distance over which a set will receive. This can be done without the use of an expensive transformer and the unit containing the step of radio frequency can be mounted in a panel that can be set alongside of the tuner and can be built to match it.

This step of amplification uses what we call a "tuned plate" circuit and enables the operator to get amplification over a much wider band of wave lengths than is possible with a transformer.

The apparatus necessary for this step of radio frequency amplification follows:

Single mount for honeycomb coil.

Forty-three plate variable condenser.

Bulb socket.

Rheostat.

Amplifying bulb.

Honeycomb coils of various sizes.

In the diagram I am showing on the right-hand side the series parallel switch and the first honeycomb coil of the tuning set described in the last article. You will notice that the binding post to which the aerial is attached in the other set is now connected to the plate screw on the amplifying socket and the binding post to which the ground was attached in the other set is now connected to the 45-volt positive tap of the B battery.

In this circuit the series-parallel switch of the tuner must always be set on the parallel side, which means that the upper blades are turned to the left.

This arrangement is a very good one, but it is impossible to give exact dimensions of the honeycomb coils required. The secondary and tickler coils of the tuning set will remain as they were before the addition of the radio frequency step, but the coil that was the primary will have to be changed and it is probable that the original primary coil can be inserted in the single mount of the radio frequency step.

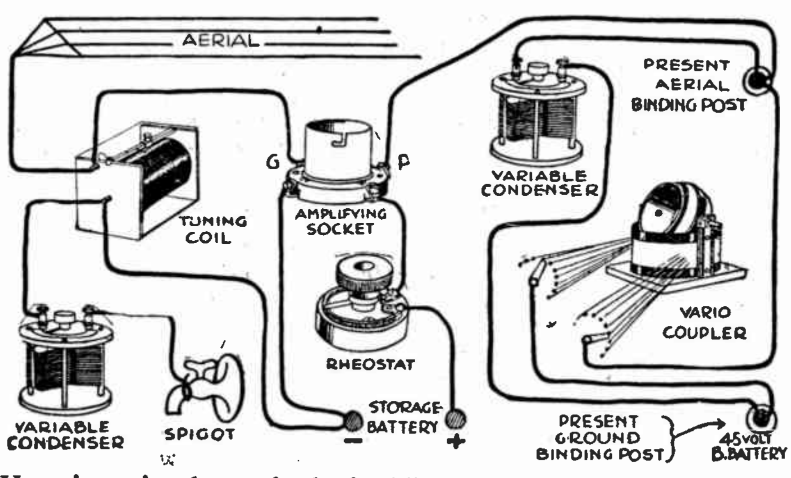
Its place in the three-coil mount will then probably have to be taken by a smaller coil.

In this set the wave length is first found by means of the single honeycomb coil and the variable condenser to which it is attached and the amplification is then gained by tuning the second variable condenser which is in parallel to the first of the three coils.

It will also be found necessary to alter the relative positions of these three honeycomb coils in a way that is different from that without the radio frequency amplification, but a little practice will enable you to master the difficulties of this set and you will find that while nearby stations are not amplified in volume the distant ones will come in considerably louder.

You will also notice that the rheostat on the amplifying tube plays a very important part in this tuning and that there is a critical point of brilliancy at which the amplifying bulb burns where you will get the most amplification and turning the filament a little dimmer or a little brighter will make you lose it. You must be patient with this hook-up, but you will find it well worth while.

RADIO FREQUENCY FOR A COUPLER SET



Here is a simple method of adding a step of radio frequency amplification to a coupler without a transformer

The radio enthusiast who is using a set consisting of a variocoupler and either one or two variometers and who desires to try the much-advertised radio frequency amplification can very easily do it without the expense of an amplifying transformer.

The system shown in this diagram uses what is called the "tuned-plate" circuit, and this simply utilizes the primary of his present coupler and the variable condenser which he is now using, but in this case it is absolutely essential that the variable condenser be hooked up in parallel with the coupler and not in series with it. This can be done by simply changing the wiring. Shift the connections so that one wire runs from the aerial binding post to one blade of your tap switches and another wire runs from the aerial binding post to one side of your variable condenser. Then a wire goes from the other side of your variable condenser to the ground binding post, and another wire goes from the ground binding post to the shaft of your other switch blade for the taps of your coupler.

I am showing here an ordinary single slide tuner connected ahead of the radio frequency, but its place can be taken by any kind of a tapped coil. As a matter of fact, your coil need not be tapped if your object is to receive only the broadcast concerts on 360 or 400 meters. You can use a spider-web coil containing eighty turns or you can wind a coil of forty or fifty turns around an oatmeal box or a salt box.

The adjustment of this first part will not be particularly critical, so far as finding the signals is concerned, although, of course, you will find one point at which you will get the greatest strength.

The most critical adjustment will be found in the second variable condenser, which is already in your receiving set. You will also find that the adjustment of the brilliancy at which your amplifying bulb burns is fairly critical, and there will be one point at which you will get the loudest signals, and these signals will rapidly decrease as you make the filament either brighter or dimmer than that particular adjustment.

Do not attempt to use this tuned-plate method of amplifying if your present tuner is what is called the "single circuit." If, however, you are using one or two variometers in what is known as the "short wave regenerative" circuit, this hook-up will be a very efficient means of getting greater distance for your signals.

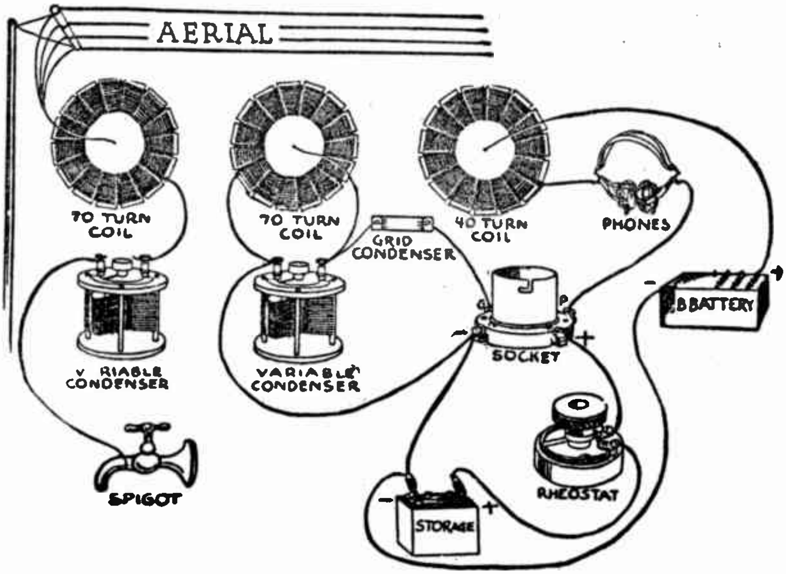
USING THREE SPIDER WEB COILS

The radio receiving set which uses three honeycomb coils has long been a favorite with amateur operators and has many advantages which justify its popularity. It is, however, rather an expensive outfit for the man who is just starting in or whose finances are very limited.

This fine hook-up, however, need not on this account be abandoned, because it is perfectly possible for anybody to make an excellent substitute for himself.

Three spider-web coils used in exactly the same hook-up and mounted according to the method which I will give will accomplish even better results on the wave lengths used in broadcasting than will the three honeycomb coils. The spider webs, however, by consideration of size, are limited in the band of wave lengths to which they will respond, but this limitation will not in the least affect the beginner, who is interested only in broadcasting. For him the spider webs make an ideal outfit.

The main expense attached to this hook-up lies in the necessity of two variable condensers, one of forty-three plates and one of twenty-three. These are made necessary because the spider web



Here is a fine hook-up by means of which three home-made spider web coils will bring in the broadcast concerts in great shape

coils as used here are not tapped and we must have some way of varying the wave length of the first and second coils which we call the primary and secondary.

In cutting out the cardboard forms for these coils you can use any odd number of spokes that you want, from five to fifteen, but it must be an odd number. They must always be wound on a form of which the inside or hub is two inches in diameter, as any smaller hub means cutting too close and will weaken the card-board. It is best to use the red fiber board that you can buy in a store that sells office supplies.

The primary and secondary coils should each have seventy turns of wire. In counting your turns do not forget that when you count thirty-five turns on one side of the spoke, there are also thirty-five turns on the other side and you have seventy turns in all.

Any kind of insulated wire will do for these coils, and it will not make much difference whether it is silk, cotton or enameled. The size can be Nos. 28, 26 or 24.

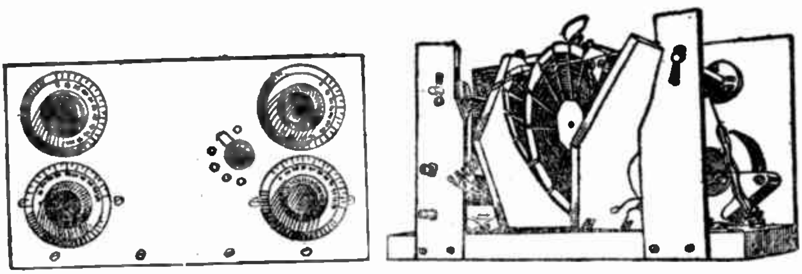
The third coil, which we call the tickler, should have forty turns on it, and the man who does not mind going to the trouble of soldering a few taps will get even better results by putting on fifty turns and tapping it at thirty, thirty-five, forty, forty-five and fifty. This tickler and, in fact, all ticklers, still seem to defy all attempts at making rules for them, and I have frequently found that I get best results by using thirty-five turns and later the same evening shifting to forty-five turns for exactly the same concert or else reversing the process. It is, however, perfectly possible to use an untapped tickler of forty turns, though there may be times when it may be somewhat difficult to prevent whistling in the phones.

When you wind these coils be sure to mark on both sides of your hub an arrow pointing in the direction in which you have wound your turns. This is very important, because, when you mount your coils, you must do it with all of the turns going in the same direction. This is not so important with just the primary and secondary coils, but when you introduce a tickler, the current from the B battery must flow in the correct direction with relation to the current in the secondary coil or you will not get the regeneration or boosting up the strength of signals, which is a great advantage in this hook-up.

You must also be very careful to connect the various pieces of apparatus to either the inside wire or the outside wire of each coil just as shown in the illustration.

If for any reason you are unable to make your bulb "oscillate" — in other words, to get a whistling or a groaning or a frying sound in the phones—the chances are that you are sending your currents in the wrong direction and you can correct the trouble by reversing the two connections to your tickler coil.

MOUNTING THREE SPIDER WEB COILS



Here are front and back views of an easily constructed mount for a hook-up employing three spider web coils

It is not a difficult matter to build a mounting for three honeycomb coils because honeycomb coils are small and compact and strong.

When, however, we attempt to substitute spider web coils for them we present ourselves with rather a difficult problem because spider webs of the size necessary will be at least five inches in diameter, and, as they are wound on cardboard forms, they will not be very stiff and strong. Consequently they will always be likely to vibrate, and a coil which vibrates or shakes will produce a most annoying wobble or tremolo in the phones.

It is therefore necessary to devise a form of support which will give the coils a solid backing and keep them from shaking when they are being moved closer together or farther apart.

I am giving here a very simple and efficient mount which I have devised for my own use, but it is perfectly easy for a man with a little mechanical cleverness to devise a better one. For those who do not have this cleverness this mount will be found very easy to construct and perfectly satisfactory to operate.

The main feature of this mount is, of course, the method by which the three coils are moved closer together and farther apart. The center coil, or secondary, is always stationary in a three-coil mount, and tuning is accomplished by moving the primary and tickler closer to it or farther away from it.

In this mount I accomplish the results by opening and closing the coils like the leaves of a book, but it could be just as well accomplished by mounting them on rods and sliding them back and forth like the coil of a loose coupler or by pivoting them and opening and closing them like a fan.

In this particular case I made one of the spokes of my secondary coil two inches longer than the others, and this extra length is used to fasten the coil to a little triangular piece of wood which is mounted on the back of the upper part of the panel just about in the middle. This leaves the whole coil suspended in such a way that it would shake badly and spoil the signals, and so to prevent this I bend a strip of brass into a right angle, screw one side of it firmly to the baseboard, and fasten the lower end of the coil to the upright portion by means of a paper clip.

On each side of this center coil I mount two pieces of thin board on hinges screwed firmly to the baseboard. These two pieces of board must be cut away at the corners wherever it is found that they will interfere with the strings which are used to operate them, and this can best be decided by setting the boards up before the hinges are screwed into the baseboard.

On each side of the back of the baseboard I mount two strips of board to take the brass shafts which are shown in the picture and which are used to wind up the threads that pull the coils together. This shaft need not be brass, as a matter of fact, and a good piece of round wood can be used just as well. Later I will give the details of this part of the apparatus, but at present it is only necessary to say that turning these shafts winds up the thread and pulls the opposite coil up to the center coil.

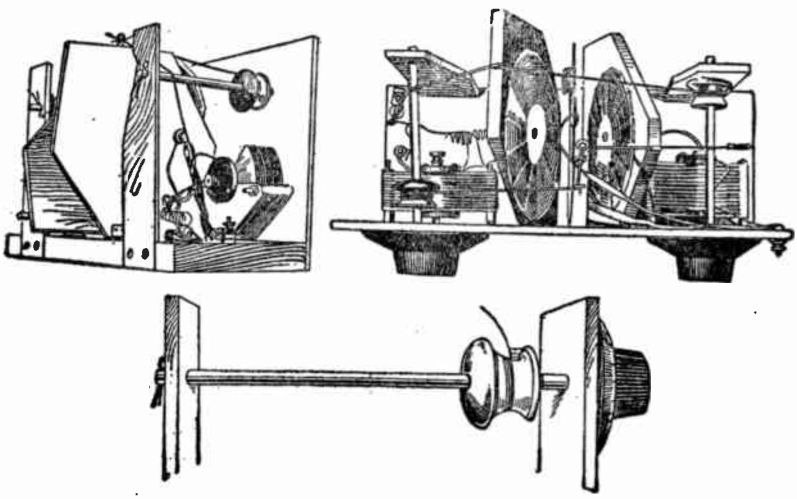
In order to accomplish the necessary pull in the opposite direction when you want the coil pulled away from the center one, you attach another thread and tie it to a rubber band strong enough to pull it back when the pull on the shaft is released.

These various threads can be led through screw eyes mounted wherever it is convenient, and there is no set rule for putting any of the operating mechanism together; the object simply is to keep both of the outside coils firm and steady and be able to move them back and forth in such a way that a fine adjustment is possible.

This fine adjustment is absolutely necessary in this hook-up, for a difference of a thirty-second of an inch or even less will mark the difference between clear signals and bad distortion.

SOME DETAILS OF THE THREE-COIL MOUNT

The pictures with this article will probably give the reader a better idea of the details of the three spider web coil mount



Here are some details of the construction of the mount for three spider web coils which has been described in these articles

which I have been describing than any written words could do. The most important part of it and the one which will puzzle the beginner is the method of mounting the part of the apparatus by which we wind up the threads which pull the two outer coils against the stationary center one.

As I have said, the rod used for this purpose can be of wood or brass or any other material, or a meat skewer will do as well as anything else.

The drum on which the thread is wound is simply a wooden tin pot knob or a furniture knob such as you can get in a five-and-ten-cent store, or a spool.

First bore through the knob a hole big enough to take the shaft and then drill through the side of the knob a smaller hole for an ordinary wood screw. When the knob is slid on to the shaft to the proper position this wood screw is screwed down tight and thus it holds the knob firmly on the shaft and also acts as an anchor around which the end of the thread can be tied.

On the front of this panel I have showed four dials, the two upper ones being for the shafts which move the primary and the tickler coils and thus vary the "coupling," and the two lower ones for the two condensers.

I am showing these two condensers mounted in this way only because of the prevailing craze to have all parts of the tuning apparatus mounted on the same panel, but I cannot too strongly emphasize the fact that these condensers should be kept farther away from the coils than is shown in this arrangement. Mounted as they are indicated here, they will do the work, but it makes an extremely difficult job of tuning because it seems to create more whistling in the phones than when the condensers are mounted on separate panels and are removed from too close proximity to the coils.

The switch blade and switch points which are shown in the front view given on Page 26 are used to vary the amount of the tickler coil employed in this circuit.

In using this arrangement it will be found that the brilliancy of the filament has a great deal to do with clear reception of signals. This brilliancy is, of course, controlled by means of the rheostat.

I usually start hunting for signals by bringing the top of my tickler coil within a half inch of the top of my secondary and have the primary coil about twice as far away. I turn the rheostat until the bulb begins to groan and then turn it down just enough to make the groaning stop. Then I vary the knobs of the two condensers and usually find a point on them where the bulb will start to groan again. This means turning the rheostat down a little more to stop the groaning.

With the condensers left at that point I vary the coupling of both the primary and tickler coils, and soon a point is found with the tickler coil quite close to the secondary where there is quite a whistling or hissing in the phones. This means that the bulb is oscillating and the signals are usually found very close to that point. It is usually cleared up by moving the primary coil a little farther away, and this usually brings in the signals.

For ordinary amateur aerials it will be found that the first condenser will be set around 30 or 40 and the second condenser around 10 or 20 for the broadcasting stations and the 600-meter code stations are brought in with the two condensers set somewhere between 60 and 80.

This will be found one of the most efficient sets that the amateur can build and some idea of its capabilities can be gained when I say that on this particular one shown in the picture, using only one bulb, I have many times clearly heard the broadcasting from Atlanta, Ga., in my station at Delanco, N. J., 800 miles away.

A SET TUNING WITH CONDENSERS

Probably nothing discourages the average novice from building his own receiving set more than the necessity of "tapping" his coils or else of mounting slides or switch blades upon them.

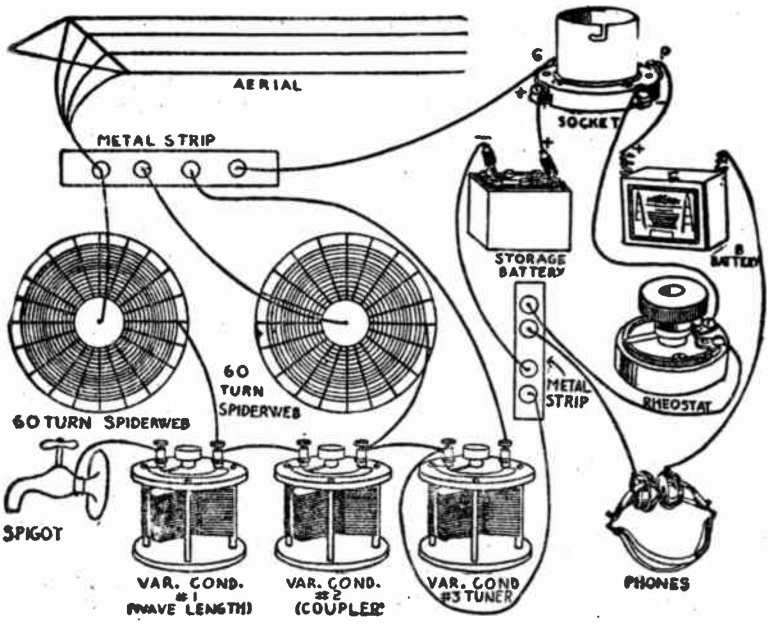
Tuning sets which do their tuning by means of changing the amount of wire employed are about the only ones that are put on the market and they are very widely written about in all radio publications.

It is, however, quite possible to put together a set which avoids all necessity for tapping coils and also does away with another annoying complication, and that is some arrangement for changing the "coupling" or the position of one coil in relation to the other.

I am giving here a hook-up for a set which uses two fixed coils and these coils can be placed anywhere on the table or on the panel without any coupling between them. In fact, they must not be sufficiently near each other to have any mutual influence.

This set is coupled and tuned entirely by means of three variable condensers and, as we speak of condensers as "capacity," we call this kind of set "capacitatively coupled."

The operation of this set is not



Here is a receiving set using only variable condensers for tuning. It is one of the easiest for the novice to make and operate

nearly so difficult as spelling or pronouncing its name.

All of the adjustments necessary for receiving the concerts are made by the three variable condensers shown and, as unmounted variable condensers are now quite cheap, it makes this set a very moderately priced one and perhaps the easiest one of them all for the beginner to build and use.

The left-hand variable condenser governs the wave length, the center one adjusts the balance between the two parts of the circuit or the "coupling," and the right-hand one does the fine tuning and eliminates interfering signals.

The hook-up as given is not the very best for such a set, but will be very satisfactory for the amateur who is not handy with tools and who has not much money to spend. It would be a better arrangement to insert a variometer in place of the wire running from the plus of the B battery to the plate connection on the socket. If you care to make this change—and it is well worth while—run a wire from the plus of your B battery to one binding post on the variometer and another wire from the other post on the variometer to the plate binding post on the socket.

The coils which I show in the picture are the spider webs and I am using them only because they are the easiest to make and occupy less room in the cabinet. It will be just as satisfactory to use coils wound around a salt box or a paper mailing tube or around anything else, but for a salt box the coil on the left should be only about twenty-five turns and the coil on the right should be slightly less.

Do not leave these two coils on the same salt box, but cut them apart, as they must be set about six inches from each other in receiving.

You can use any kind of cotton-covered wire from No. 28 to No. 22.

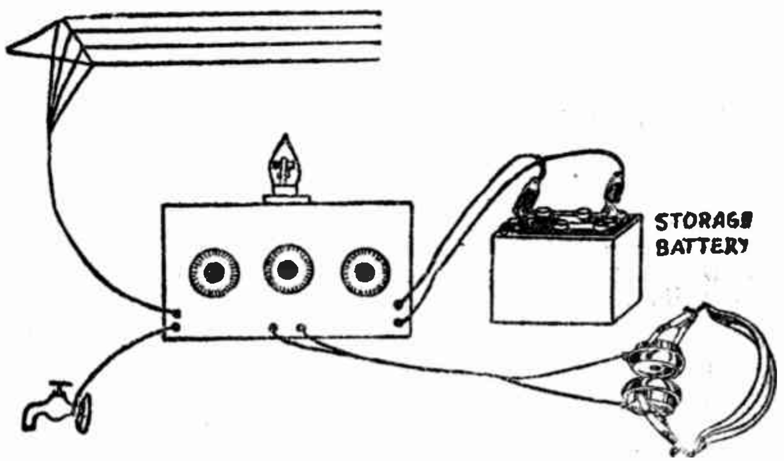
There are only two points in the illustration that need explaining and they are the metal strips each with four bolts or binding posts on them.

I am using them only because the average novice would find it very difficult to make satisfactory connections from the diagram of this set as usually given.

If you will study this picture you will see that one metal strip connects virtually all of the instruments on one side and the other strip connects virtually all on the other side. These strips may be brass or tin and you simply punch four holes in them to take bolts or binding posts or else solder the wires directly on them.

I have found this set to give signals just about as strong as the average one using tuning coils, but not quite so strong as the set using a variocoupler and two variometers. It is, however, much the easier set to operate and I find it unusually good in tuning out interference.

A "CAPACITATIVELY COUPLED" PANEL



Here is a neat panel mounting for the "capacitatively coupled" hook-up given on Page 30

The novice who tries out the "capacitatively coupled" circuit, which I have given, will undoubtedly want to mount it on a panel and for his benefit I am giving here a suggestion for a good-looking outfit and a list of prices which includes absolutely everything he needs so that any one contemplating using this set will know exactly what finances he must be able to handle.

Perhaps the question of cost should be taken up first because that is the one that most all of us have to consider primarily. Here, then, is a list of the things that you must buy:

Three variable condensers at $2	$6.00
Phones	5.00
Storage Battery	20.00
B Battery	2.50
Rheostat	1.00
Socket	.75
Grid Condenser	.35
Wire	.20
Bulb	5.00
Aerial Outfit	1.50
Panel Material	1.50
Total	$43.80

If you insert a variometer—and as I said in my other article it strengthens signals considerably—you will have to add to this list $3.00 to $6.50, depending on the make you buy. You will notice that I am not including any cost for coils in this list, because in this particular set there is no excuse for even a one-armed man not constructing the extremely simple coils required.

In fact, they are so simple that if you take two empty spools and wind a couple of hundred feet of insulated wire upon them you can call them coils and your set will operate.

And while we are on the subject of coils let me say that the best size will depend to a very large extent on your aerial and ground equipment and that, if your aerial is less efficient than the ones usually installed, you will need a few more turns of wire than I gave in my instructions in the previous article.

It is best to get the 43-plate type of condenser for all three used in this outfit.

If, in tuning in your first signals with this hook-up, you find that you are using your left-hand and right-hand condensers very near the 100 mark it will be wise to add a few more turns of wire to your coils. In estimating this, do not use the signals from a very near station to guide you because these signals will come in so strong that you will not need very accurate tuning to get them.

But, if you hear a fairly distant broadcasting station using a 360-meter wave length, and you find either of your condensers set close to the 100 mark for best strength, put enough turns of wire on that particular coil to give you that same signal with your condenser set at 50. You will then have your set adjusted for best results with stations using either a shorter or longer wave length.

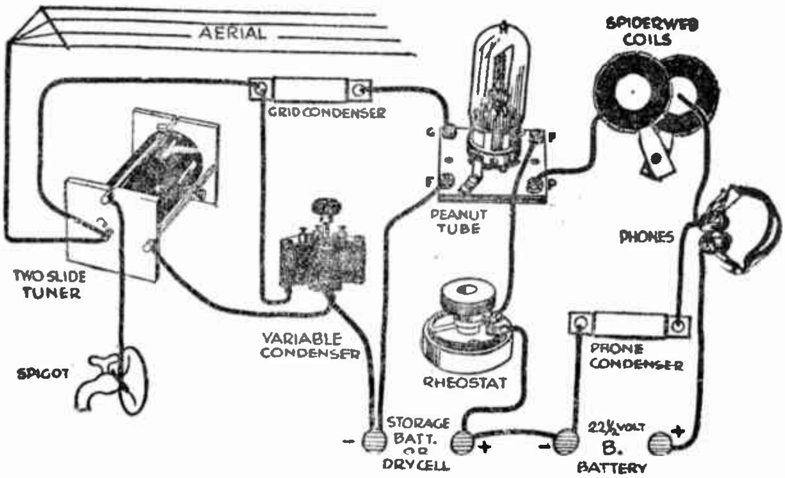
In the panel which I am giving in the picture I am showing the dials of the condensers on the front with the bulb set on a little shelf above the middle condenser. This makes the best-looking panel if you are using only these instruments.

If, however, you are using a variometer also, put the variometer dial to the right of the condensers and then you can mount the bulb in the middle with the rheostat dial on the panel and with the two other dials on each side.

In this arrangement, your two coils are mounted on the base board, one at the extreme left and the other at the extreme right. The two metal strips, each with four connections, as shown in the previous hook-up, can be mounted on the base next to them and all the connections made so that they do not show on the front. In fact, it makes a better-looking job to put the aerial and ground binding posts and the two storage battery binding posts on the base and set your B battery behind the panel and then the only connections that show on the front are the two binding posts for the phones.

These, too, can be eliminated by getting a phone plug and jack, the two together costing $1.80.

IMPROVEMENT FOR YOUR TWO-SLIDE TUNER



This hook-up shows how to add two spider-web coils to a two-slide tuner to get a full regenerative effect

Any one who feels inclined to use two fifty-turn spider web coils hooked up as a variometer as described in the November issue, but who is at present using a two-slide tuner or even a single slider, and does not want to invest in a variocoupler, can still keep his coil and get all of the tuning effects of the spider webs.

In the illustration accompanying this article I am showing a two-slide tuner, but a single slider can be used in exactly the same hook-up with only one change.

This change consists in removing the wire running from one side of the variable condenser to one of the sliders and connecting it directly to the same slider to which the ground connection is wired. The rest of the apparatus then stands as shown.

It is, however, very well worth while to put the extra slider on the tuning coil, especially as it is now possible to buy a brass rod and a slider in the five-and-ten-cent stores and mount it yourself.

The hook-up as given in the illustration has all of the benefits of a variocoupler or a loose coupler, and the two spider web coils connected to the plate of the tube give you full regeneration.

As I explained in the November issue, these two coils are wound on cardboard forms, each of which has a spoke extended so that they can be pivoted together and can be opened and closed like a fan. The windings of the two coils are connected by soldering the last turn of one coil to the first turn of the other.

This hook-up is especially good with the little peanut tube, but it is also very efficient with the full-sized bulb that requires a six-volt storage battery.

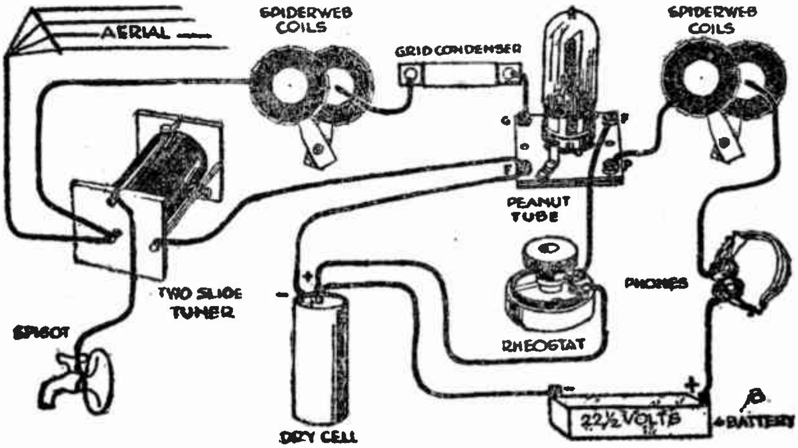
I am showing a fixed condenser of .001 mfd. capacity connected from one side of the spider web coils to the minus side of the B battery, and this will usually result in better signals.

The variable condenser should be .0005 mfd., or twenty-three plates. A forty-three-plate condenser can be used there, but the smaller size gives sharper tuning, and an eleven-plate or a nine-plate will be even better.

The two binding posts that are marked A battery connect to the plus and minus side of the storage battery if you are using a six-volt tube or to the dry cell if you are using a peanut tube.

Do not forget that the center binding post of the dry cell is positive and the side one is negative.

ANOTHER "SHORT-WAVE REGENERATIVE" SET



A hook-up of this kind gives you all of the benefits of the "short-wave regenerative" set without the expense

The amateur whose pocketbook is very limited but whose dreams in radio are of the far-famed "short-wave regenerative" set need not do without the joy of this tantalizing hook-up nor need he spend much money to get it.

Any boy can now buy the makings of a two-slide tuner for less than a dollar and this will take the place of the variocoupler and do everything in the tuning line that a variocoupler will do. Any boy can also hook up two 50-turn home-wound spider webs for use as a variometer by the method that I described in the November issue, and, with two of these in his circuit in addition to the two-slide tuning coil, he has what amounts to the short-wave regenerative set. This hook-up is another one that will work well with the peanut tube or it can be used with the standard-sized tube.

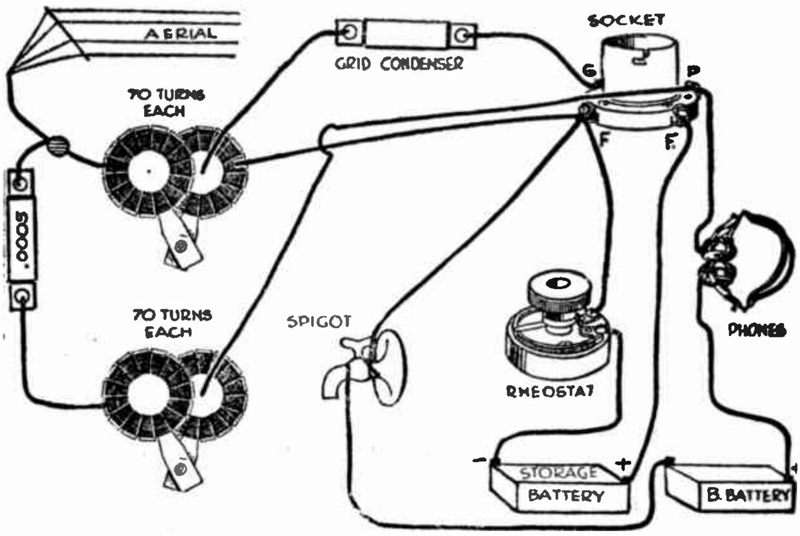
Like the hook-up using the variocoupler and the two variometers, it is extremely sensitive and requires the very finest kind of tuning to get results, being only for the man with sufficient patience to overcome the howling and squealing of the tube while he is tuning the set. It will give signals that are hard to surpass so far as volume of sound is concerned.

The difficulty in tuning comes first in eliminating the howling or whistling, and, second, in clearing up the distortion of signals so that they come in as pure tones.

For the man who has a two-slide tuner and who is willing to buy the two variometers, these variometers can be substituted for the spider web outfit shown in the illustration.

This will enable the amateur to use his tuning coil with all of the benefits of regeneration while he is saving up sufficient money to buy a variocoupler.

ABOUT THE RINARTZ CIRCUIT



Here is an interesting and simple way for the beginner to try the famous Reinartz circuit

Amateurs all over the country have been in a great furore lately about several newly developed hook-ups which are said to be giving remarkable results. One of these is known as the Reinartz cirsuit, and it has proved so interesting to skilled amateurs that they have carried on a great many experiments with the idea of simplifying the arrangement.

I have purposely refrained from dealing with this circuit because in its early forms it was too complicated for the average beginner to handle.

I noticed, however, in a recent

issue of "QST," the very wide-awake organ of the Amateur Radio Relay League, there is a letter from J. E. Stuart, of Montana, giving a very interesting modification of the original circuit and claiming for it results that are quite remarkable.

In the illustration printed here I have simply taken his hook-up as given in diagrammatic form in "Q S T" and have translated it into pictures and have also substituted the more easily made spider-web coils for the variometers which he recommends.

Those who are skillful enough to make variometers, however, will be interested to know that he recommends larger than ordinary instruments having rotors four and one-half inches in diameter. These instruments can be put in place of the two sets of spider-web coils which I show here, and the extra wire that taps the first one, coming from the minus side of the filament, is supposed to tap the middle of the outside coil of the variometer.

For the arrangement that I show here you should make spider-web coils of about seventy turns each on a form with a hub two inches in diameter.

In both cases one spoke of each form is extended and two of them are pivoted through these spokes so that the coils can be opened and closed like a fan.

The two coils are connected to each other, the outside turn of one being connected to the inside turn of the other coil.

In the first pair of coils the wire from the filament connection on the socket is tapped at about the fiftieth or fifty-fifth turn on one coil only.

The fixed condenser between the two pairs of coils is a regular grid condenser of about .0005 mfd. but you must be sure that it does not contain the ordinary grid leak. The grid condenser with the leak goes in the line from the first pair of coils to the grid condenser on the socket.

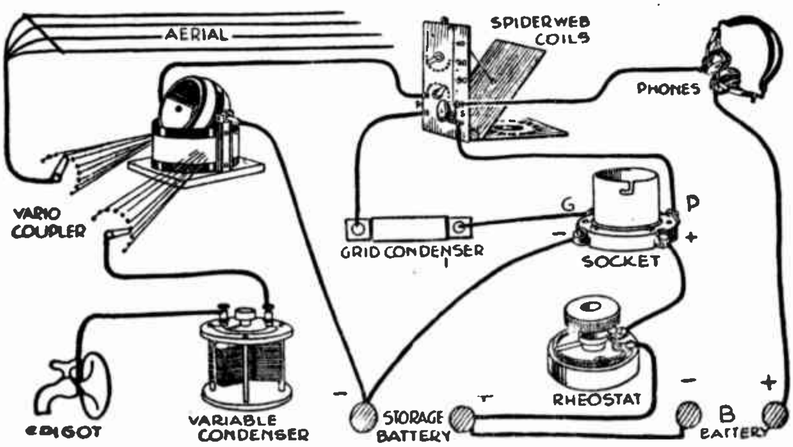
REGENERATION WITH THE SPIDER-WEB COILS

Every time I give a hook-up calling for the use of a variometer I have a sort of guilty feeling because it brings up to my mind a picture of the thousands of radio enthusiasts who really cannot afford one of these instruments, and I know from sad experience of my own that a home-made variometer seldom gives satisfaction very long.

It is a perfectly easy matter to wind this instrument, but the problem of constructing the shaft bearings in such a way that they give perfect electrical contact even when the shaft is spun like a top is too much for the average man or boy unless he is quite skilled in the use of tools.

I can, of course, give directions for building one of these instruments which will be almost as good as the bought article and I will do this in the near future, but it really takes a practiced hand to do it correctly.

Any one who examines the hook-up given in the last article, will, if he understands the principles of radio, see the advantage to be gained by putting the variometer in the plate circuit. I should say that it adds something



By means of two home-made spider-web coils the full benefits of regeneration can be gained with this hook-up

like 75 per cent to the efficiency of the hook-up and it may even double it. Therefore it is decidedly desirable.

But it is possible to get almost the same efficiency with a little different arrangement which does virtuallv the same thing and which anybody can make. This is simply two spider-web coils of about fifty turns each. I am showing in the illustration the form of spider-web coil mount which was described in the June issue of E-Z RADIO, in which I also gave full instructions for winding spider web coils.

Anv method by which the two coils can be moved closer together or farther apart will answer the purpose perfectly well. You can, if you wish, make one spoke of each coil longer than the others and then pivot these two coils so that you can open and close them like a fan or you can mount them both on a rod through the centers so that you can move them closer together or farther apart in any way you desire.

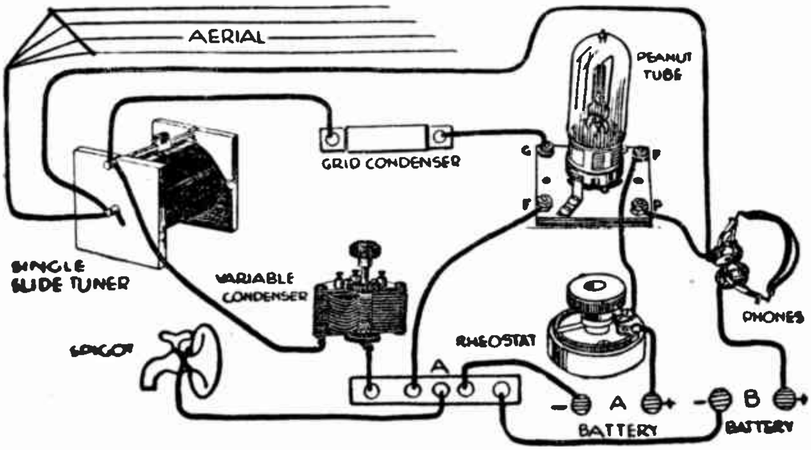
You will notice by the hook-up that one of these coils is connected to the rotor form on the variocoupler and also to the grid condenser. The other coil is connected to the plate of the bulb and also through the phones to the plus connection of the B battery.

This accomplishes the operation known as "feed back" and feed back causes "regeneration."

In other words the strong currents of the B battery go through one of these coils on their way to the plate and the magnetism thrown out by the current going around the turns of this coil cuts through the windings of the other coil and causes in them a similar current which boosts up the signals as they come in from the aerial.

If you fail to get "regeneration" on your first trial, try reversing the connections of the second coil. That is, hook the phone wire to the lower binding post and the plate wire to the upper one.

THE TUNING COIL WITH THE GIBBONS HOOK-UP



Owners of a single or double slide tuning coil can use it in this arrangement to get all of the benefits of the famous Gibbons hook-up

Among the many unusual or freak hook-ups which have been given in this series of articles there is none that has brought a more widespread response from readers than the Gibbons hook-up with its several adaptations to different pieces of apparatus.

I have recently been trying it with a single slide tuning coil and I am giving here the best method of making the connections, confident that amateurs who have this type of coil cannot do better than try this arrangement.

It is good for either the full sized audion bulb or the peanut tube, although I recommend it for the latter. In almost all hock-ups for either the single slide or the double slide tuning coil the aerial lead-in is connected both to the start of the coil and to the grid of the bulb.

In this Gibbons hook-up, however, it connects to the start of the coil and the plate of the bulb and the plate connection also runs to the phones.

The slider runs both to the grid condenser and to a 23-plate or .0005 mfd. variable condenser. If you have a two-slide tuning coil, you can have one of the sliders go to the grid condenser and the other one go to the variable condenser though you will find that these sliders will usually tune best when they are fairly close together.

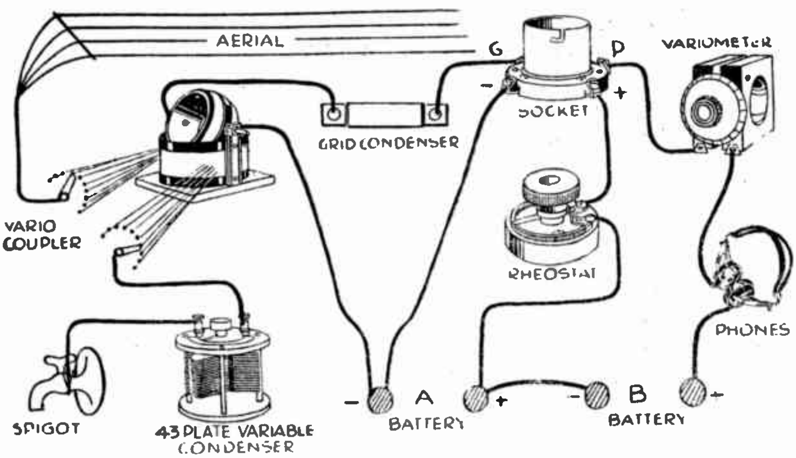
The little oblong marked A represents a small strip of tin or brass which makes it easier to hook up the several connections necessary at this point. Wires should be run from this strip to the variable condenser, to the minus side of the dry cell, if you are using the peanut tube or the minus of the storage battery if you are using the standard sized tube, another wire from the minus side of the B battery, another wire to the ground connection and another to one of the filament connections on the socket.

If you do not care to use this strip of tin you should scrape off the insulation from the ends of these five wires, twist them together, make a good connection with a drop of solder and wrap them with insulating tape.

In using any form of this Gibbons hook-up, you must "check up" on the wiring with the most extreme care because the slightest mistake will mean that you will not get any signals.

You may get even better results by disconnecting the wire from minus B battery to the metal strip and connecting it from minus B to plus A battery. Try it.

THE VARIOMETER IN THE DOUBLE CIRCUIT



This hook-up gives an efficient method of inserting a plate variometer that is different from the one previously given

In our recent series of articles showing the method of building up from the simplest form of bulb set to the full short wave regenerative set we learned of two methods by which we could add a variometer to the hook-up known as the single circuit.

In this series we began with the single circuit and kept the instruments hooked up that way until we arrived at the full short wave regenerative set and then it was necessary to disconnect the whole thing and connect it up again. This was because in the single circuit set there are two connections to the lead-in from the aerial. One of these connections goes to the outside winding of the variocoupler and the other one goes to the grid of the audion bulb. It was necessary to disconnect because, in the full short wave regenerative set, the aerial lead-in has only one connection—and the grid of the audion bulb is connected to the wire on the rotor of the variocoupler.

The first method is called the single circuit because the bulb is thus attached through its grid connection directly to the aerial.

The latter method, however, is a double circuit because the electrical impulses caused in the aerial by the received signals go straight through the aerial and the outer winding of the variocoupler and so to the ground. They do not reach the bulb directly at any point, but their influence is transferred from the outside windings of the variocoupler by means of the magnetism that the electrical impulses cause and this magnetism "induces" or causes a similar current of electricity in the wire that is wound around the rotor form. It is this rotor wire that carries these induced currents to the grid and filament connections of the bulb.

As the impulses travel directly through the outer winding of the variocoupler first, we call that the "primary" winding. These impulses, creating currents in the rotor windings, make the rotor what we call a "secondary," and the circuit containing the rotor windings and the parts of the bulb to which it is attached is known as the secondary circuit. It is thus a double circuit.

Those who wish to add a variometer to their coupler can use the hook-up that is given in the diagram with this article. This places the variometer in what we call the plate circuit because it is in the line going from the plus of the B battery through the phones to the plate.

This is an excellent hook-up as given here and most fans will prefer to use this method as shown after they buy their first variometer.

This is probably the best scheme and then when you buy your second variometer you simply insert it in the line between the grid condenser and the rotor of the variocoupler and you have the full short-wave regenerative set.

I know many successful amateurs, however, who use this hook-up exactly as given here and prefer it to the one using the two variometers.

A RADIO EDUCATION ANY ONE CAN UNDERSTAND

The past nine issues of E-Z RADIO make the most valuable volume on the subject that any beginner can have. There is virtually no question that arises in the mind of the novice that is not answered in some one of our past issues in a way so simple and clear that there is not the slightest difficulty of its easy comprehension.

We are giving below, an index by subjects, showing the contents of our previous issues. The beginner can not do better than look over this list, see which issues answer the questions which are uppermost in his mind and send to us for the copies that he wants.

The price is twenty cents per copy or any six copies for one dollar.

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