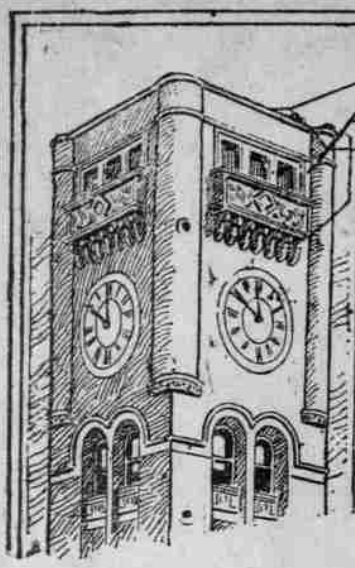




BY SAUL EMANUEL.

IN COMPARISON with the tremendous amount of electrical power as used in the big radio telegraph stations of the world, the rated power of the radio broadcasting station appears rather low. Several of the big government radio stations use an equivalent of nearly 1000 horsepower of electricity to send their traffic several thousand miles, while the most powerful broadcasting station in the United States, that of the General Electric company at Schenectady, N. Y., employs only five kilowatts of radiated energy, which is about 1/100th of a horsepower, to send out its programs. Its broadcasts have been heard over 4000 miles.

However, the power used at a broadcasting station is measured by the energy delivered to the antenna system rather than the energy taken from the power lines. When we say that The Oregonian station is rated at 50 watts, we mean that 50 watts of power are delivered to the antenna, although much more is applied to the apparatus itself from the power lines. A broadcasting station transmitting apparatus is composed of a number of devices which function

with each other for the production of waves in the ether. The most important of these devices are the vacuum tubes, identically alike in their manner of construction with the type used in the receiving set, except that they are much larger and capable of handling much more power.

Other devices, condensers and coils, are part of the transmitter and aid in the creation of an oscillating high-frequency current which is sent into the antenna. The voltage applied to the plate elements of the tubes in a transmitting set is like that of The Oregonian is 1000 or more, this is usually supplied by a specially made generator. The Oregonian station employs three power vacuum tubes, one of which acts as an oscillator, or generator of the waves; the other as a modulator for impressing the music or speech upon the carrier wave, and a third tube, the speech amplifier, which amplifies the voice or music currents before they pass to the antenna.

In order to have music and speech reproduced without distorting effects, it is necessary that the acoustic conditions in the broadcasting room be perfect. To accomplish this, the transmitters used for the different classes of music and speech are placed in various parts of the room and are generally fitted with sound collectors and horns of various sizes.

In connection with these microphone transmitters, a device known as the modulating transformer is used to control the power in the vacuum tubes used in the speech amplifier. This first tube, after amplifying the music or voice currents, passes them into the generating tubes, which in turn send their fluctuating energy into both the antenna and ground, causing waves to vary in intensity to be impressed on the main "carrier" or continuous wave. It is these last waves which are picked up by the receiving set.

A broadcasting station transmitting apparatus is composed of a number of devices which function

side of the "A" battery is connected to the negative of the "B" battery.

3. Yes. Connect the coils as if they were all one coil.

4. Yes. Such coil would act as a loading coil and increase the wave length of the aerial circuit.

Editor Radio Waves and Ripples: 1. A jewel voltmeter was shunted across the terminals of a five-watt tube would the voltage be cut down in the tube? 2. If the voltmeter was taken off would the tube draw more juice? 3. Would one 6-ohm 3-ampere rheostat be sufficient to control two 5-watt tubes? If not, could one rheostat be put in series with the other one to help cut down the current in either tube? 4. Would it better to put the tubes in parallel?

In using more than one ground wire to find the wave length do you add the length of each wire together?

5. ADP, Monticello, Wash.

1. No. The voltage remains the same but there will be slightly less current entering the tube.

2. Yes, a little more than before.

3. Do not advise using one rheostat for two tubes as the tubes are not standard in their characteristics, it is better to use a rheostat for controlling each tube.

4. If both ground leads are the same length, only the length of one is used in figuring the wave length. If the leads vary in size use the longer of the two, one in figuring the wave length.

Editor Radio Waves and Ripples: 1. What is the function of a radio frequency transformer? An audio frequency transformer?

2. In the absence of an ammeter, how can an operator know or tell when his "B" battery is exhausted?

3. Is it possible to recharge an Eveready "B" battery?

A. R. P. Woodburn, Or.

1. The transformer is used to step up the voltage or strength of the incoming radio frequency oscillations to the point where the tube is used in the circuit. The audio frequency transformer performs the same function as the radio frequency transformer, that of stepping up the voltage of a lower frequency or audio frequency current which has come out of the detector.

2. There is no other definite method of knowing when the "B" battery is exhausted, except from the fact that the vacuum tubes will sound dead and the signals will be much weaker than usual.

3. No; recharging a dry battery is impractical.

RADIO QUERIES AND ANSWERS

Editor Radio Waves and Ripples: 1. In a two-stage V. T. amplifier set, in what transformer larger than the other, what is the ratio of turns?

2. What are the variometers used for?

3. What is the size of wire and number of turns for the stator and the rotor?

4. Is the result the same with a two-stage radio frequency amplifier as with a two-stage audio?

5. Please send me a hook-up for a two-stage V. T. outfit to hear your station about 200 miles away. This hook-up is audio or radio frequency?

R. S. NALPHEE, Wash.

1. No. Both transformers are of the same size. The ratio of the audio transformers are usually 5 to 1 or 6 to 1.

2. The variometers are used in the grid and plate circuits of the detector unit for regeneration of the detector.

3. Make variometers with about 40 turns of No. 22 double cotton covered wire on the stator and about the same number of turns on the rotor.

4. The audio frequency amplifier will bring in local signals much louder than the audio amplifier, but on the other hand the radio frequency amplifier will bring in long distance signals clearer.

5. The hook-up has been mailed to you.

measurements. Radio waves travel 186,000 miles a second, or 300,000,000 meters a second. Now, if a wave with a frequency of 1,000,000 is being sent, we say that its wave length is 300 meters. This is obtained by dividing the speed a second by the frequency.

2. A potentiometer is a form of rheostat used to regulate the voltage. In radio work the potentiometer is used to vary the potential applied to the plate circuit and sometimes the grid circuit of audio tubes.

3. A transformer consists of two windings usually on an iron core, or for radio work, on an air core, one of which is called the primary coil and the other the secondary. It is used to change alternating currents from one value to another.

Editor Radio Waves and Ripples: Please answer the following questions in next Sunday's Oregonian. On a small coil sending set, if so, how? 2. How far will such a set send? 3. How should an aerial for such a set be made? 4. When a detector and amplifier tube becomes slightly blackened around the top is it still serviceable? 5. What is the purpose of a "B" battery necessary for a set?

D. D. FAN, Sheridan, Or.

1. Yes; but do not advise doing any transmitting unless you procure a license. Connect one end of the spark gap to the aerial and the other end to the ground. Insert a telegraph key in the battery circuit of the coil.

2. With such coil with a high aerial, it will transmit several miles or more.

3. A four-wire aerial 50 feet long and as high as you can get it will make a good one for transmitting on short waves.

4. Unless the tube filaments have been burned out, you ought to be able to get signals from the tubes.

5. Use 22½ volt for the detector tube and about the same for the amplifier.

Vacuum Tubes Should Be Used With Care.

Inexpert Handling Will Cause Units to Burn Out Easily.

IF you desire to prolong the life of your vacuum tubes, use them with care. Inexpert handling of these expensive units to the radio set will cause them to burn out quite easily. "How long should the vacuum tubes last?" is a frequent question of many an amateur who has had his new vacuum tubes burn out his newly purchased tubes.

The vacuum tubes will last as long as the way you use them. They are the most sensitive of radio instruments, and are comparatively short lived if used carelessly. On the other hand, if they are used in their proper operation, they will last 12 or more months, and will be operating as efficiently at the end of their life as they did when they were purchased.

Improper filament temperature, excessive plate voltage and shocks are the three main causes of tube life. These factors tend to shorten the life of a tube.

The average tube of good make has a normal operating life of 1000 hours. This means that if the correct temperature is maintained on the filament the tube will give 1000 hours of service before it burns out. This tube life varies with conditions that are imposed upon it.

Many fans burn their filaments at a temperature higher than normal, thinking that in this way they increase the strength of the signals. This is not true, for a properly designed tube will give maximum signal strength at the correct filament temperature, and any increase of temperature beyond this point will not increase the strength of the signals, but it will greatly shorten the life of the tube. Remember this and do not increase the current flowing through your tube after maximum strength has been reached.

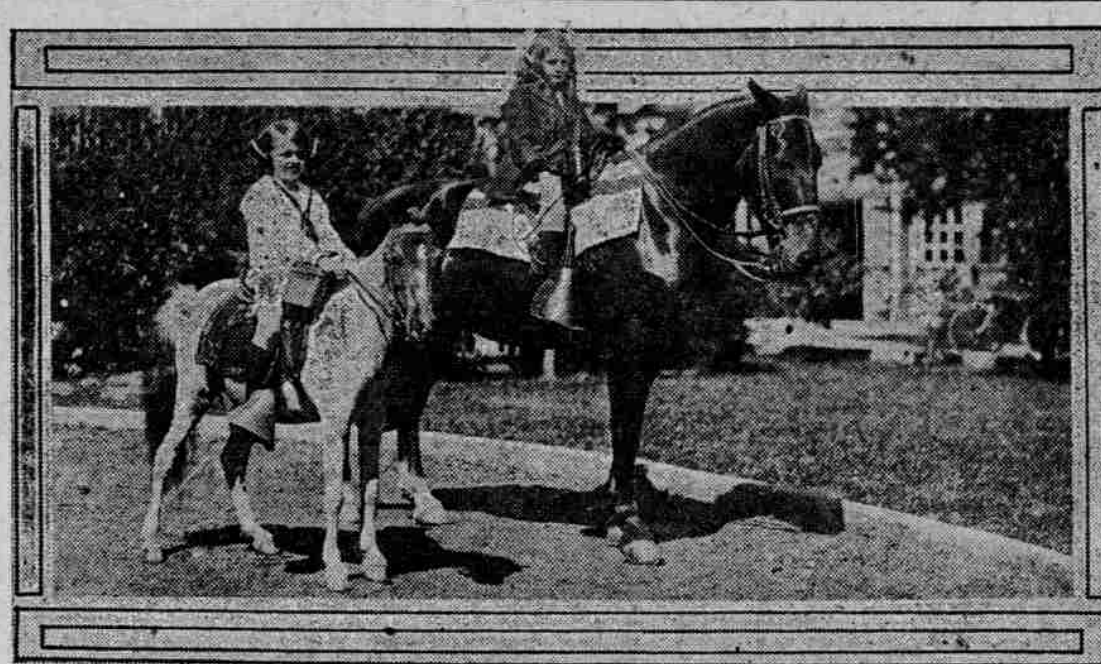
Even reducing the current a little below this point will be beneficial, for if the tube is operated at 95 per cent of its rated brightness it will last longer. If you double the filament emission, the operating life will be reduced to one-fourth.

Do not use too high a plate voltage, as this puts an extra strain on the tube that is not helpful. You can readily ascertain the correct voltage for the plate of a defective tube, as it will not operate at voltages above this. If a blue glow is observed in a tube, the plate voltage should be lowered because it is excessive.

If your set is mounted and is kept in one spot in your home, it is not liable to be subjected to shocks and jars, but if you have a portable set, or wish to transport the tubes, they should be carefully protected. In

HOME-BUILDER INSTRUCTS HIS CHILDREN IN HORSEBACK RIDING BY RADIO SERVICE

President of Nationally Known Company Equips Mounts of Daughter and Son With Portable Wireless Telephone Sets and Follows Movements in Country at His Office in City.



Sally and William Sovereign, children of W. J. Sovereign, president of the Aladdin Homes company, receiving parental instructions by radio while riding.

RADIO is used by W. J. Sovereign, president of the Aladdin Homes company, to keep track of his two children, Sally and William J. Jr., according to A. A. Patterson, manager of the Portland branch of the concern.

Both children ride spirited horses which caused the threats to little anxiety, until Mr. Sovereign, a radio

enthusiast, conceived the idea of watching them by radio. The mother and children are in their summer home at Bay City, Mich., which is 25 miles from the main plant of Mr. Sovereign's company. A radio transmitting station at the plant allows Mr. Sovereign to issue his parental instructions to his children each morning.

Small portable radio receiving

sets, placed on horseback, bring their father's voice to the children whenever they are out riding over the country roads.

Mr. Patterson believes that it will be but a short time before the same instant that it would seem foolish to attempt to jam the air with person-to-person messages when these can just as well be handled by the radio method. Only where wire cannot be strung does it seem likely that the wireless will ever be called on for this sort of work—and even then the telegraph will probably be the selected method because it is cheaper and lends itself to wave lengths so high that interference is greatly diminished.

doing such notable work in carrying its message to so many people at the same instant that it would seem foolish to attempt to jam the air with person-to-person messages when these can just as well be handled by the radio method. Only where wire cannot be strung does it seem likely that the wireless will ever be called on for this sort of work—and even then the telegraph will probably be the selected method because it is cheaper and lends itself to wave lengths so high that interference is greatly diminished.

It would be helpful to the whole art if the experienced amateurs were to instruct the novices of their craft in the use of the radio. The radio for the radio-telephone is the work that it alone can do—broadcasting the announcement of a league interest to the thousands within that area.

During next winter radio amateurs expect to lengthen their radio relay traffic lines to all parts of the world. For several years messages have been sent from station to station in all parts of this country and Canada. With the increased use of the radio, the interest in wave telegraphy and the interest and energy that radio amateurs in China, Japan, Hawaii and European countries are showing, officials of the American Radio League believe that when the summer's static storms and interfering vacuum tube storms are over, duplications of the current wave length spanning of the Atlantic, which was accomplished in February, will be nearly a nightly occurrence.

The numerous wave length spanning of the Atlantic, which was accomplished in February, will be nearly a nightly occurrence.

So many readers are puzzled by their rights to construct their own sets without coming into contact with the radio amateurs, owing to their limited manufacturing resources. However, the safest course in respect to these parts is to purchase them for inclusion in the set to be sold, as in the case of design patents on coil, etc., or to sell the set without, as in the case of tubes.

The crystal set is covered by no patent, to our knowledge, save certain design patents on a few parts, which may be made in a different style by the amateur without infringing on the patent or bought if he so desires. Quite a number of experienced radio amateurs are making their pin money by constructing crystal sets for beginners, and there can be no objection to this practice—so long as the set is honestly made and sold on a conservative representation.

A new law for wireless telephone in connection with mine-safety, is proposed by the United States bureau of mines. This suggestion has been made that the rescue cars and trains stationed at various points throughout mining regions be equipped with apparatus and that high power apparatus at the bureau's safety stations and experimental laboratories in the regions be installed to broadcast emergency messages in case of mine disaster.

Aerials have been successfully installed on trains in Germany and the bureau's rescue and training cars could easily be so equipped. In this way, it is said, not only could warnings and calls for aid be sent, but the delay to those points best equipped to offer aid, but mine safety programmes and other instructions could also be broadcast.

Field engineers of the bureau have reported that the radio is already in wide use in the different mining centers.

It is altogether unlikely that radio-telephony will ever reduce in the slightest degree the use of the wire phone. One small cable can carry more messages by means of the latter than the air channels of an entire city area can efficiently handle at the same time. In congested districts it is safe to say that the radio-telephony will never be able to replace the wire phone for ordinary personal conversation.

Even in long-distance work it is extremely unlikely that the wire lines will be supplanted. Radio is

Marconi's strange wireless signals, at first believed to emanate from Mars, may be explained soon if experiments being conducted near airbases in France are successful. Following the American thesis that certain insects, by wind friction, send out wireless vibrations into the ether, it is now believed that the more rapid revolution of airplane propellers is sufficient to stir up

Radio Notes.

BEFORE his recent departure for Germany to investigate radio conditions in that country, Dr. Lee DeForest, one of America's real pioneers in radiotelephony, made the startling prediction that there would be 20,000,000 receiving sets in operation in 1937.

Dr. DeForest, a conservative scientist and business man, must undoubtedly have realized the implications of his predictions. He was probably aware that there are only about 1,000,000 wire telephones in operation, according to the latest available American Telephone & Telegraph company's statistics, and that the radio sets in 1927 would exceed the telephones in use.

Assuming, therefore, that there is a good deal of sound reason behind the startling prediction, as we fairly may, it is interesting to speculate on the situation five years hence.

Dr. DeForest believes that every family in the United States will by that time own and constantly use a receiving set. Consequently we may believe that by that time broadcasting will have taken over so many every-day functions and perform them so efficiently that it will be considered as indispensable in its way as the wire telephone. All the experiments now being made will apparently be adopted permanently, such as the weather forecasts, market reports, health and beauty talks, public speeches and the countless others.

Discouraging Dr. DeForest's prediction a great many times, it is still safe to assume that radio will not alone remain when the novelty has gone, but that it will continually find new uses and converts.

One result which ardent radio-telephony has been the greater utilization of the shorter wave lengths between 50 and 100 meters. This has been done by the radio amateurs, but his followers have tended to stress the longer wave lengths, chiefly because of the fact that they are easier to send great distances. Further, since telegraphy was used almost exclusively against the limitation of their wavelength bracket, largely because of this question of distance. But if

Grid Leak Is Essential in Vacuum Circuits.

Constants Used in Connection Should Be of Correct Size.

IN VACUUM tube circuits, especially in detector circuits, a certain negative potential must be kept on the grid. This may be done in a number of ways, the most common of which is to connect a small capacity condenser that is shunted by a very high resistance, in series with the grid. This resistance is called a grid leak. The grid of a tube is the controlling element and it is important that the constants used in connection with it should be of the correct value. The grid condenser should have a value of from .0002 to .0005 mfd. It is not absolutely necessary that the condenser be variable, but sometimes this quality will help greatly. Fixed variable condensers, or condensers variable in steps, are several types of grid leak are on the market. The value of the one may be changed by changing the little tubular units, which may be brought into use by means of a screwdriver. The value of a grid leak should be correctly between one-half megohm and three megohms, and for a particular set this must be determined by experiment. Once found, the value will be correct throughout the length of the vacuum tube with which it is used.

A simple and effective grid leak may be easily made of a small piece of bakelite and two screws, with their corresponding units. Mount the screws in the position shown in the lower left hand sketch. Sandpaper the space in between the screws with fine sandpaper so that the glass is removed. Now draw some pencil lines in between the two screws. When connected in the circuit the correct resistance may be obtained by adding lines or erasing them until the best results are obtained. A permanent resistance may be obtained by drawing a line with India ink instead of with a pencil.

Increasing Amplification Sometimes Bad.

Anything Above Three Stages Will Distort Reception.

INCREASING the number of amplification stages does not always give a strong volume of sound in radio concert reception. If that is desired, for use in a large room or auditorium, anything above three stages of amplification of audio frequency will distort the reception so that it will be far from being a good reproduction.

Although radio frequency amplification is rapidly coming to the front as an improvement on the usual amplification devices, there is another method of increasing the volume strength which will give a minimum of distortion and allow perfect reproduction of speech and music.

Instead of the ordinary amplifier tubes, the transmitting type, commonly known as the 5-watt power tubes, are used in their place. In conjunction with these tubes, a plate voltage of 100 to 250 is necessary. Using the ordinary 2-watt amplifier with 5-watt power tubes in place of the usual amplifier tubes, the numerous advantages of "sp" battery, the music that will come out of the magnavox will be tremendous in volume and strength. As tones will be considerably better.

One thing must be watched, however. You must be sure that the amplifying transformers are built so that they will not be extra heavy voltage. Otherwise they will burn out.

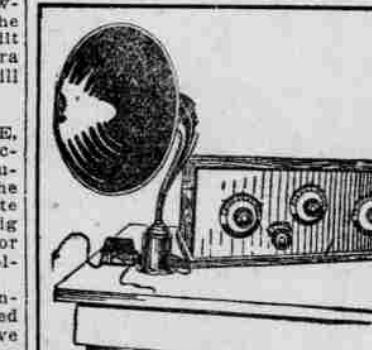
WASHINGTON STATE COLLEGE, Pullman, July 19.—Broadcasting lectures for correspondence study pupils and extension classes is the latest "stunt" planned by the College of Washington for the big broadcaster which is to be ready for service at the opening of the college year in September.

Dean H. V. Carpenter of the engineering college has announced that they expect to arrange to have professors who are well known in their own rooms at home, attack on their receiving headpiece at the appointed hour, open the switch, and they were in a class room at the college.

During the recent journalism convention at Pullman Dean Carpenter sent a radio crew to the campus with a portable broadcaster on a hand cart, while he remained in his office and sent his voice across the lawns and through the buildings without other aerial than the small arrangement on the cart, no taller than the boy who was to show the flexibility of the simple equipment now used.

Submarine Deutschland Sold.

LIVERPOOL.—The former German super-submarine Deutschland has been sold at Kellock's salesroom, Liverpool, for £200 to Messrs. Robert Watson & Co., Glasgow. She will be dismantled and sold as scrap. The Deutschland ran the blockade during the war and made two commercial voyages to the United States.



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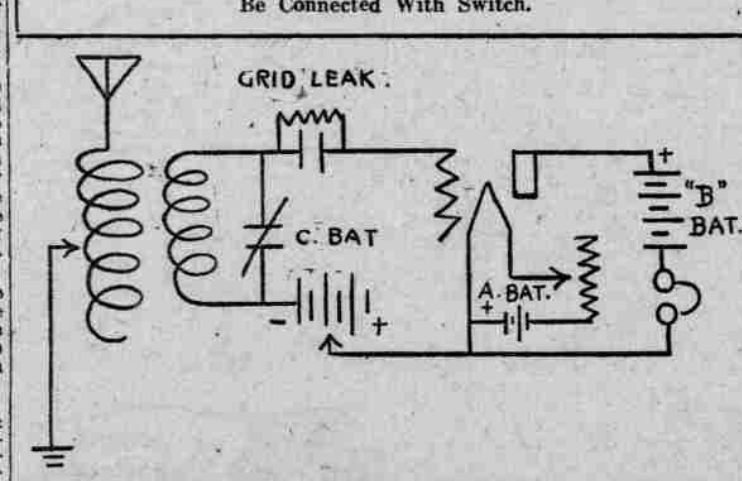
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"C" BATTERY IS IMPORTANT TO TRANSMITTING STATION

Signal Strength Increased Considerably—Ordinary Dry Cells Should Be Connected With Switch.



Straight audio hook-up with addition of a "C" battery for increasing strength of signals.

THE radio experimenter is familiar with the "C" battery, or "bias" battery, as it is sometimes called. This device is an important unit in every transmitting station, but outside of one or two types of receiving sets, it is rarely used in the standard regenerative receiver. With some types of apparatus the addition of the "C" battery will increase the signal strength considerably, especially if

Editor Radio Waves and Ripples: 1. I have a two-wire tube, coil, a fixed condenser and a crystal detector and I cannot hear anything on it. I have a good detector and condenser and I think there is something the matter with the tuning coil. I use No. 20 enameled wire, 4½ inches long. There are about 150 turns, 3½ inch gold sliders and brass rods and the springs are made of phosphor bronze. Could you tell me what is the matter with the tuning coil? I might have the wrong hook-up for this coil with my condenser and detector. I would like to send me a hook-up for this set?

2. Could I use my double slide tuning coil for the primary in a loose coupler?

3. What size wire should I use for the secondary of the loose coupler? The primary has No. 20 enameled wire wound upon it.

4. Will you please send me a hook-up for a double slide primary with the secondary having one turn of No. 20 enameled wire fixed condenser and a crystal detector?

C. T. Portland, Or.

1. Unless there is some broken wire in the primary, the coil and springs do not make good contact with the wire turns, your troubles must be due to wrong connections. As you did not enclose the hook-up, I cannot tell you whether your apparatus is connected up correctly. A hook-up has been mailed to you.

2. Yes, if you can place the secondary so that it will move in and out of the primary coil.

3. No. 22 silk-covered magnet wire can be used for the secondary of the loose coupler.

4. The hook-up has been mailed to you.

Editor Radio Waves and Ripples: 1. What set will give the best results in the use of a loose coupler? 2. What is the best type of loose coupler? 3. What is the best type of loose coupler? 4. What is the best type of loose coupler? 5. What is the best type of loose coupler?

R. D. Canby, Or.

1. The vario-coupler and variometer regenerative type of receiver is considered the best today for short-wave radio reception.

2. Yes. Twist about four or five wires together.

Editor Radio Waves and Ripples: 1. Does the number of wires in an aerial have anything to do with the wave length? 2. How do you find the wave length? 3. How much water should be used for 8 pounds of fine vitrol in making a wet battery and how many volts and amperes will it produce? 4. Does the amount of copper and silver used make any difference? 5. What is required for a small C. W. transmitter? G. M. Nyssa, Or.

1. The addition of more wires to the aerial adds to the capacity and therefore increases the wave length to some extent.

2. Add the length of the aerial to the length of the ground-in and multiply by 1.5. This will give you the approximate wave length in meters.

3. Add enough water to make a fairly good saturated solution. The voltage of the cell will be about one and a fraction volts. The amperage will depend upon what resistance you put across the cell.

4. Yes. The plates should be as large as can easily be got into the jar.

5. A small powered continuous wave set consists of a 5-watt power tube, socket, filament battery, 40-volt B battery, filament switch, telegraph key and tuning inductance.

Editor Radio Waves and Ripples: 1. What is meant by a meter? 2. What is the potentiometer used for in radio work? 3. What is a transformer? L. B. Hogue, Wash.

1. The meter is the basis of the metric system. It is the equivalent of 39.37 inches in our system of

measurements. Radio waves travel 186,000 miles a second, or 300,000,000 meters a second. Now, if a wave with a frequency of 1,000,000 is being sent, we say that its wave length is 300 meters. This is obtained by dividing the speed a second by the frequency.