May 1, 1925
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RADIO PROGRESS

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"Always Abreast of the Times"

IN THIS ISSUE

YOU WILL UNDERSTAND THIS MAGAZINE --- AND WILL LIKE IT

PUBLISHED TWICE A MONTH

RADIO PROGRESS

HORACE V. S. TAYLOR, EDITOR

Volume 2 Number 4

Contents for

MAY 1, 1925

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Some of the Good Things for May 15

A loud speaker is always a problem. They have been far from perfect in the past. A new style has just been invented which bids fair to take a leading place. It is not built like the old ones. The construction is quite different and it is described by Vance in **"A Brand New Type of Speaker.**

What are the popular sets these days? Three or five tube? What proportion of people use their sets in the summertime? Are storage batteries more popular than dry cells, and if so how do they compare in numbers? All the questions and a lot more like them are detailed at length in **"Six Best Sellers of Radio."**

You hear a great deal these days about short waves, or high frequency vibrations. Most sets can not get below 200 or 250 meters. Those that can usually are of no use for broadcasting. **"A Combined Long and Short Wave Set,"** by West, describes how the two may be united into a single radio.

Doubtless you know that the government inspectors are checking up on the air all the time to get rid of undesirable sending stations and to reduce interference. Many people do not understand how this is brought about. An article by Koch, **"How Radio Inspectors Catch Trouble,"** give the details of the method.

When you cross the ocean on a big liner, in spite of all its compasses and logs, do you realize that the time signals are depended on to a considerable extent to find out whereabouts in the ocean the vessel is? Arnold explains how radio waves help the captain keep his bearings, in **"Sailors Depend on Time Signals."**

Explorer MacMillan is going up into the Arctic regions again. When he wants to hear from home he will use special short wave radio equipment. Do you know why that is required around the North Pole? See **"High Speed Waves for Frozen North."**

In wiring a set there are apt to be losses in the conductors connecting the different units. There is a lot of mis-information on this point. Many so-called tests are absolutely unreliable. Taylor explains the reason for this in **"Low Loss Wiring in a Set."**

RADIO PROGRESS

"ALWAYS ABREAST OF THE TIMES"

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A Selective Honeycomb Hook-Up

Here is a Sharp Tuned Set Which is Easily Built

By HORACE V. S. TAYLOR

WHAT is the password in radio these days? A year ago it was, "Distance". Everyone was fishing for away across the continent and the electric companies reported that they were earning extra dividends on the lights which were burned from eleven o'clock on up to one, two or three in the morning. Two years ago, "Loudness" was the cry. Each chap tried to outdo his neighbor with the amount of deafening din which he could throw from the mouth of his loud speaker.

At the present time there is no doubt about it—"Selectivity" is what everyone is after. This follows from the fact that there are now so many loud stations going that a set which lacks the sharp tuning necessary to cut through the local station and pick up a distant program is losing a lot of the enjoyment which might otherwise be had. This question of selectivity is being emphasized more than anything else by the salesmen of high priced factory built radios.

Has Two Advantages

The radio fan who builds his own set is naturally interested in how he can get results which compare with those of the manufactured instruments. The basis of most sharp tuning depends on two things—first small distributed capacity and second loose coupling. The set which we shall describe, which is based on the use of honeycomb coils, has both of these advantages.

When honeycombs are first mentioned some of you may throw up your hands and exclaim, "Why, they passed out two years ago." To be sure, they were quite popular and then later they fell out of style and were not used so much. This is an illustration of how radio fashions run. It oftentimes happens that a new piece of apparatus or a new style hook-up will be very popular for a while and every magazine will carry one or two articles about it. Then as such publications feel the need of getting new stuff they drop that particular idea and rush off full tilt on some other one. The latter may not be as good as the old one was, but the need for something original will discard the old standby and bring in the novel, but inferior device.

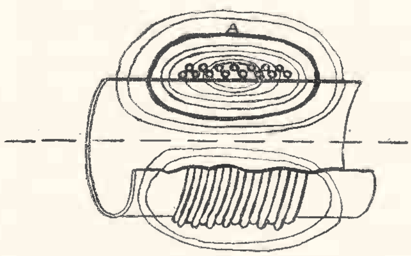


Fig. 1. A Honeycomb Coil is Like a Banked Winding Developed

Following Bank Coil Idea

As a matter of fact a honeycomb coil is a very efficient piece of apparatus. As no doubt every broadcast listener is aware, it consists of a winding in which the turns do not lie snugly side by side, but are spaced about one-eighth of an inch apart and across each other at a slight angle. The idea was developed from the improvement noticed in a bank coil.

Fig. 1 shows a sketch of a two layer coil, in which a special method of winding is used. It is called, "bank" and consists in winding on a turn of the first layer and on top of that a turn of the second. This is repeated over and over again so that the end turn of the entire coil does not lie over the beginning. Such a method of winding reduces the distributed capacity to a small fraction of what it otherwise would be.

Waves Think it a Condenser

This question of distributed capacity may be understood better if we realize that a condenser consists of two separate conductors with insulation between. In the ordinary two-layer coil the starting turns of the first layer serve the purpose of one plate and the finishing for the other. The insulation between consists of the cotton or silk covering of the wire. Since the radio waves think it is a condenser when they strike such a coil they naturally behave as if condenser capacity had been connected into the circuit at that point.

You can readily see that this capacity action from the first to the last turn will not be quite the same as from the second to the next to the last ones. All the way down the line the action still continues but loses force more and more as the middle turns are connected together (it being the same wire) and so no condenser effect results. Since this action is varying as just described, and is stretched out along the whole length of the coil it is called "distributed" capacity.

Makes the Tuning Broad

The effect of such action on the sharpness of tuning is bad. Instead of tuning to single sharp frequency, as is done by the regular condenser, which is in your grid circuit, it has the bad effect of bringing in *various* frequencies and in this way makes it hard to cut out unwanted stations. Besides this such capacity is not under control as is the regular condenser and so by turning the dial no chance is had of adjusting for the value desired.

A banked coil is rather hard to wind if it consists of more than two layers. It also requires a considerable amount of collodiom or other dope to hold it in shape after it has been wound. To get around these two difficulties the honey comb coil was invented. While it is not easy to wind by hand, automatic machines called "universal winders" spin them off so fast that the motion is hard to follow with the eye. They are also self-supporting, and so do not need very much to hold them together.

Why Sets Are Selective

Owing to the fact that the turns are spaced some distance apart, the condenser action between turns is small. This combined with the fact that the coupling between two adjacent coils is small helps make the set, which uses honeycombs, a selective one. Even a rather simple hook-up will give good results for these reasons.

The hook-up which appears in Fig. 2, is a modification of a standard circuit, which gives very good results. It uses a primary, which is tuned by a series condenser, a secondary adjusted by a parallel condenser, Cs, and a tickler which is advanced back and forth to vary the amount of feedback and so control the regeneration.

How to Make a 40-Turn Honeycomb

Referring once more to Fig. 2, the primary usually is a fifty turn coil. This varies, however, with the length of the aerial. If your antenna runs about 100 feet or so in length, fifty turns will be right. A longer one up to 150 feet will work better with a forty turn honey comb. This cannot be bought but may be easily made by unwrapping ten turns from a standard fifty turn coil.

On the other hand, if your antenna is rather a short one, say fifty or sixty feet long, then the best results will be had by buying a 75 turn coil and unwinding ten or fifteen turns. You see the series condenser, Cp, is able to increase frequency (decrease the wave length) but can not work the other way. When it is turned so that the plates are fully in mesh this gives you the lowest frequency or highest wave length which can be had. To go beyond this point it is necessary to use more wire in the primary.

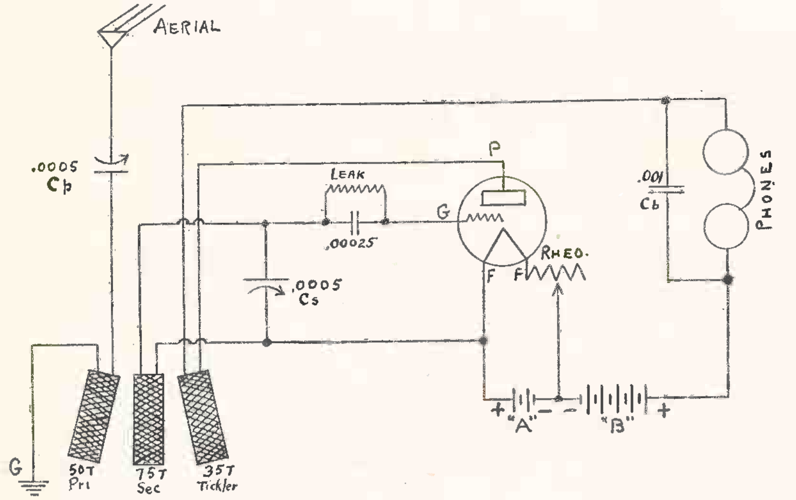


Fig. 2. Connections for Honeycomb Set. Selective Because of Loose Coupling

Tuned Primary is Better

Of course, it is not absolutely necessary to tune this first coil to the wave frequency coming in from the aerial. The set will work well with a so-called "untuned" primary of 35 turns without using the series condenser, Cp. However, considerable increase both in sharpness of tuning and volume will result by using the connections as shown.

The way you can tell whether the turns are correct in this coil is by observing in what position of the condenser the majority of stations come in. Perhaps you will find that the dial hugs the zero for most stations. This means that the plates are turned way out of mesh, giving as low a capacity and as high a frequency as possible. In that case take off five turns from the coil and try again. You will notice an improvement, but if it is not enough then take off five more turns.

When to Use Larger Coil

On the other hand you may discover that with the condenser turned fully into mesh most of the stations are loudest. This signifies that the combination of aerial and coil is not big enough. If you can increase the length or height of your antenna this is a good way to remedy the trouble. But if you have already put up the best aerial that your locality permits, then the way out is to get the next larger size of coil and use it instead. Since it is impossible to add turns to the honey comb, but easy to take them off, it is well to start with a coil which you think is probably too large and then reduce the size a little at a time. When the right amount of wire has been found you will get the low kilocycle waves at one end of the dial and the high frequency vibrations at the other, and they will be spaced fairly well apart, so that it is easy to turn them in.

The secondary coil should be 75 turns, if you are using a condenser at Cs, which has a capacity of .0005. The same reasoning applies to this unit, however, as has just been explained in connection with the primary. In other words, if the coil is too big you will have to use the condenser at the small end and conversely. The spacing of the stations over the dial of condenser Cs should be fairly well apart, so that it is easy to turn them in.

Even Spacing of Stations

The secondary coil should be 75 turns, if you are using a condenser, at Cs which has a capacity of .0005. The same reading applies to this unit, however, as has just been explained in connection with the primary. In other words, if the coil is too big you will have to use the condenser at the small end and conversely. The spacing of the stations over the dial of condenser Cs should be fairly uniform.

The tickler will be a 35 turn honey comb. This should be ample to get enough feedback to pull in any station within range. The number of turns on this coil has very little to do with the wave length. The more wire there is in this unit the farther apart it will have to be spaced from the secondary in order to prevent oscillations and squealing. On the other hand, if this coil is too small you will not be able to make the set oscillate, even when it is pushed right up tight against the secondary. The remedy of course in such a case is to use more turns. However, if you find that a 35 coil does not get the results, it is better to look over the rest of the set before using a bigger unit.

Trouble in the Tube

At this point it might be stated that the tube itself naturally plays a very important part in the amount of tickler needed for regeneration. If the tube is a poor one, or has not a good vacuum, or if it has the coating burned off the filament, either from excessive voltage or from old age, then it will not oscillate readily and a particularly big tickler coil will be required. Instead of such a large unit it would naturally be better to scrap the defective tube and put a good one in its place.

Another point to be looked after in case the set does not oscillate as it should is the bypass condenser, Cb. This is oftentimes omitted in many sets and as a matter of fact is not strictly necessary, provided that the telephone cords themselves furnish enough capacity so that the high frequency which operates the tickler is able to get to the "B" battery and filament without being forced to thread through the big inductance or electrical weight of the phone windings. It is well, however, to use a .001 mfd. capacity here even if not absolutely necessary, as it adds to the smoothness of operation and oftentimes reduces the tinny noise which some phones are known to give.

As regards the connections of the coils the polarity or difference between the two ends cuts no figure for primary and secondary. It is customary to connect the outside of the secondary to the grid and the inside to the filament, but this as explained will work either way. However, when this has once been determined then the polarity of the tickler must be made right. As looked at from either end the wires leaving the grid and plate must turn in opposite directions in these coils. That is, if the wire from the grid spins around clockwise, as you look at it from the right, then the wire from the plate must turn round its coil in the counter clockwise direction. However, the important point is not whether the grid wire goes to the left or the right, but that the two coils must be in opposite directions.

Many people prefer to get the proper polarity by trial, rather than by tracing out the wiring. To do this it is only necessary to bring tickler and secondary coils up close together while varying the secondary condenser. If various stations are on the air you will get a series of squeals or whistles in the phones as you rotate dial Ss. If you do not get any such whistles, then turn the tickler coil the other way round or else reverse the two leads. The latter is usually the easier method. If you still get no whistles, it means that there is something wrong with the set or tube and you must receive, as explained above.

Making the Connections

As will be seen from the diagram, this is an unusually easy set to hook-up. Make the connections in this order:

1 Rotor of condenser Cp to aerial.
2 Stator of Cp to inside of primary honeycomb.
3 Outside of primary to ground. (This completes the primary circuit.)
4 Grid condenser and leak to grid.
5 Grid condenser and outside of secondary to stator of condenser Cs.
6 Inside of secondary to rotor of Cs and over to either filament terminal of the tube

This finishes the secondary circuit.

7 Plate to inside of tickler.
8 Outside of tickler to phone condenser and phones.
9 Other phone lead to plus of "B" battery and condenser Cb.
10 Minus of "B" battery to "A" battery.
11 Negative of "A" battery to rheostat
12 Rheostat to filament.
13 Filament to positive of "A" battery. (This completes the filament circuit.)

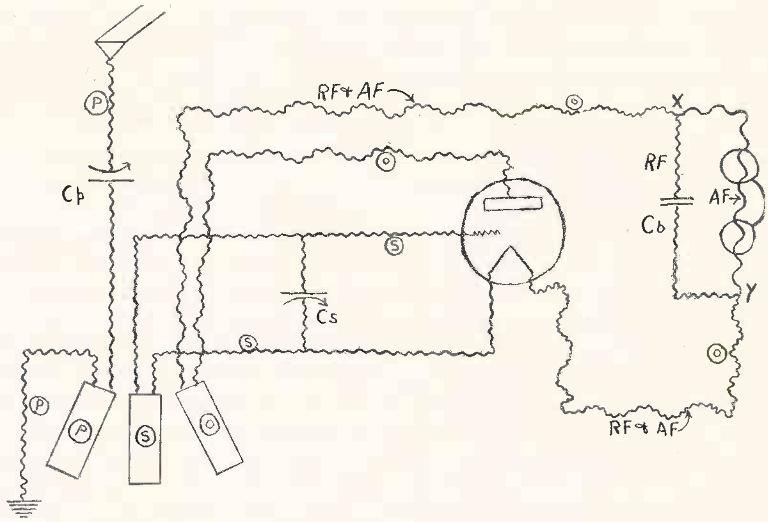


Fig. 3. This Shows the Path of Waves Through Wiring of Fig. 2

Wave Paths Through the Set

It is interesting to see how the radio waves run in such a circuit. As it is simple it is easy to grasp the path. Referring to Fig. 3, the primary waves come in at radio frequency labelled "P" and are tuned by Cp through the coil to ground. The secondary waves also at radio frequency are tuned by condenser Cs and fed to the grid. The output which the detector tube has reduced to audio frequency leaves the tube by the way of the plate. However, it also contains some of the radio frequency, which is shown by the slight ripple on

Continued on Page 8

American Radio Relay League

2,000 FREE RADIOS FOR BLIND

Co-operation of a most practical sort is to be furnished to the American Foundation for the Blind, of New York, in its plans to place radio receiving sets in the homes of blind people throughout the United States. The American Radio Relay League, with headquarters in Hartford has agreed to supervise the installation of sets by its members in the communities where the idea is to receive its first tryout.

The American Foundation for the Blind hopes to complete the installation of 2,000 radio receiving sets throughout the country if the results attained in the tryout seem to warrant it. Thus it is that members of the league were called in to contribute their knowledge of radio to give the sets every chance to prove their efficiency.

By the agreement between these two societies, the technical knowledge of good radio men in each community will assure the blind broadcast listeners that they are getting the most possible out of their sets. Of great importance in a movement of this sort is the fact that this service will be furnished free of charge by the League members. This will permit the American Foundation for the Blind to apply all of the funds available for radio work to the purchase of parts, sets and material.

The plan of the foundation calls for test installations at several strategic points in each state to demonstrate the value of it. The first work will be undertaken in twenty-four cities with a total installation of thirty-six radio receiving sets.

F. E. Handy, acting traffic manager of the Radio League, is providing the services of members in the following cities for this work:

Hartford, Conn.; Augusta, Ga.; Rome, Ga.; Gardiner, Me.; Herman, Mo.; Omaha, Neb.; Nebraska City, Neb.; Portsmouth, N. H.; Charlestown, W. Va.; Pittsford, Vt.; Salt Lake City, Utah; Richmond, Va.; Gould, Okla.; Greensboro, N. C.; Lena, Miss.; Providence, R. I.; Birmingham, Ala.; Davenport, Ia.; Kansas City, Kas.; Grand Rapids, Mich.; New Orleans, La.; Columbia, S. C.; Fairview, Wyo.; and New Haven, Conn.

RADIOS CAN TALK CHINESE

There is a great deal of doubt as to the legality of importing radio receiving sets into China. But in spite of it, that country has twenty privately owned broadcast stations and 5,000 listeners, as reported by the American Radio Relay League. "The Chinese Press," after making a thorough investigation on behalf of its readers admits frankly that it does not know whether importing completely assembled receivers is legal or not.

It is said that the Chinese government issued an edict against the importation of "military" equipment, and in some quarters this term has been applied to radio sets. The customs authorities have refused to admit assembled sets, and it is rumored that a considerable stock has been seized and held by them. However, several companies in Shanghai are selling receivers openly upon instructions of consular and diplomatic officials that the government cannot classify radio sets as military equipment. The number of persons interested in radio is increasing constantly according to the "Press," which states that it receives inquiries upon the subject almost daily. It does not attempt to explain how the several thousand receiving sets now in use got into China, or how they were obtained by local companies. The assumption is that the parts have been imported as "electrical materials" and assembled by the dealers themselves.

In order to keep up with the public demand, which is insistent, magazines and newspapers following the example of those in the United States and many other countries are printing no end of hook-ups and instructions for building home-made sets.

A SELECTIVE HONEYCOMB HOOK-UP

Continued from Page 7

top of the slow audio wave. This output runs through the tickler coil, where the radio ripple reacts with the secondary coil to cause the feedback. The audio frequency has no effect in this coil owing to the small number of turns.

From there both radio and audio travel along to the point X. Bypass condenser Cb allows the radio vibration to be short circuited around the phones but the slow audio oscillation can not pass such a small capacity. Instead it is forced through the phones where it makes the diaphragm vibrate to give us music. The two frequencies unite again at Y and after passing the 'B" battery return to the filament.

To operate this set adjust the tickler coil until it is close to the secondary. This will cause the set to oscillate, as shown by a slight roughness or squealing. Move the secondary immediately away again until the oscillations just stop as otherwise you will be disturbing your neighbors. Then turn Cs until a station is heard. The primary condenser Cp may now be adjusted to give loudest volume. A slight shift of condenser Cs will then bring the station out clearly.

Loudness vs. Selectivity

The primary coil is to be placed up close to the secondary to give the loudest volume. However, this position is not best for selectivity. The sharpest tuning may be had by separating the coils P and S by an inch or two. However, what you gain in selectivity is bound to be lost to some extent in loudness. After making changes in the setting of the coil it is well to readjust condensers Cs and Cp to the best position.

In conclusion, it may be said that for an easily built set, which possesses good selectivity and an adjustable volume, it is hard to beat this hook-up. The most serious disadvantage is that adjusting the amount of feedback and tickler action by changing the position of the tickler coil is not as neat or as easily made as the more customary way of changing the rotor of the variocoupler.

HELPING HONEY HARVEST

One hundred and twenty-five broadcasting stations are assisting the United States weather bureau in the transmission of weather forecasts, storm and flood warnings and special forecasts for orchardists and bee-keepers.

Weather Controls Radio Alarm

Setting Up Exercises When Warm—Stay in Bed When Cold

By OLIVER D. ARNOLD

HAVE you seen pictures of the Swiss girl clad in a bathing suit as she stands on a cake of ice about to plunge into the freezing waters of the river? She may enjoy such cold weather but most of us do not like to get up out of a warm bed into the shivering air of a zero temperature.

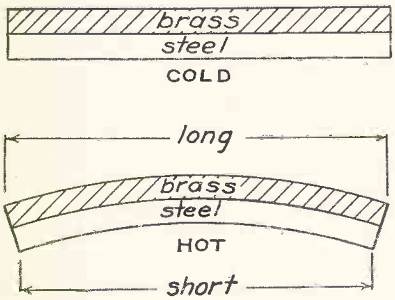


Fig. 1. Brass Expands with Heat and Bends Steel

On the other hand, there is nothing like setting up exercises to put pep into you for a day's work or a day's fun. And several of the big broadcasting stations are now sending out music for such exercises together with snappy descriptions by a physical director telling you when to bend your arms and flex your legs and how to stand on your head. Such setting up exercises over the radio are quite popular as is proven by the flood of letters of praise sent to the broadcasting station.

But how can you combine these two ideas—that of doing fifteen minutes exercise on a warm day, but sleeping that extra time if the temperature is frigid? In the past one has had to set his alarm clock and then throw a shoe at it in the hopes of stopping the ringing, if the room seemed cold. Furthermore, this "cold" stuff furnished a good alibi for not getting up and doing the exercises but instead for rolling over and taking another snooze. Some way was sought which would get you up in time, if the temperature were right, yet which otherwise would let you sleep.

The Same Old Alibi

Of course, there was invented long ago the device known as a thermostat. It has been used for some time in the household as an oven temperature indicator. It is often used to regulate the drafts of the furnace in the cellar, so that it is not necessary to keep running down every hour or two to open and close the dampers. The operation of such a device is rather simple.

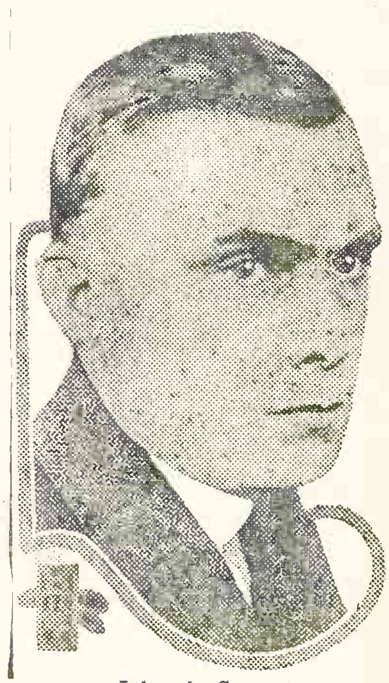
Why is Brass Like Little Girl?

It depends on the fact that metals expand a small fraction of their length when they are heated and different metals have different rates of such expansion. You have all seen a little girl in hot weather stretch her arms and stand on her tiptoes and yawn, while in cold weather she huddles up into as small a space as she can. Brass does the same thing—gets longer when it is hot and shorter when cold. Steel also has the same characterictics, but in a considerably less degree.

It is a peculiar thing that if you alloy steel with about 30% of nickel, then the resulting metal has a temperature coefficient (or rate of expansion) of practically zero. It has an invariable length and so is called Invar. Steel tapes made of Invar are used by surveyors in measuring plots of land, since with its use it is not necessary to correct for errors due to changes in temperature. Of course it is not at all clear why this proportion of steel and nickel is not affected by the weather, but such is found to be the case and in the thermostat this property is made use of.

Two Metals in Strip

Suppose we weld a strip of brass to a strip of Invar, in the way shown in Fig. 1. Since it consists of two parts, it is called a bi-metallic strip. When it is cold both metals will have the same length, as shown in the upper drawing.



John A. Spencer

Fig. 2. The Inventor of the Snap Thermostat

When it is warmed up the brass expands while the Invar does not, as just explained. Since the two pieces (brass and Invar) are welded together along their whole length, it is impossible for the former to have its ends slip by the latter. However, it is now longer than its neighbor, so what can it do?

If you have ever seen horses or automobiles run around a race track, you will realize that the outside of the track is longer around than the inside. That is why the racers all want to hug the one side, and the phrase, "the inside track" means that one has an advantage over his rivals. Perhaps the Invar strip has seen a race—at any rate it seems to realize that the inside is the shorter and so the bi-metallic strip, when heated, bends into the shape shown in the bottom of Fig. 1. You see that the brass is now quite a bit longer than the Invar although the ends are still opposite each other.

Curves Up or Down

This bending takes place more and more as the temperature is raised. This is reasonable because the hotter the brass gets the more it increases its length over

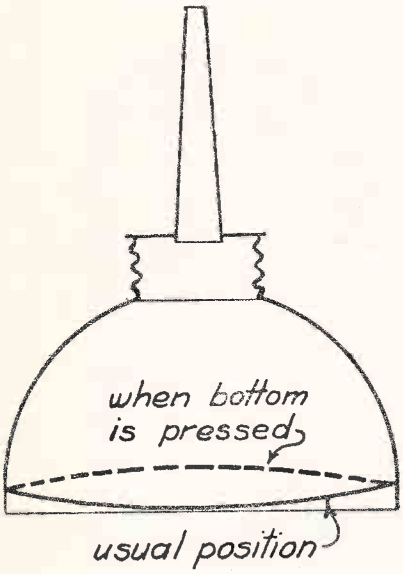


Fig. 3. Snap Action is Like Bottom of Oil Can

that of its companion. By the same token as the strip is cooled down below the temperature at which it was flat, the brass shrinks to a shorter length than the Invar and as a result it curves with the latter on the outside.

Such a bi-metallic strip may be used as a thermometer by fastening one end and attaching a pointer to the other. If the motion of the free end is not great enough it may be magnified by a system of levers. Another use for such a strip is to open and close an electric contact. By fastening one contact to the free end of the strip and another one fixed right beside it the two may be made to open and close depending on the temperature. If the contact is carried on the brass side, then since the end moves toward the brass when cold, the contact will be made as the temperature falls. On the other hand, if the contact is soldered on the Invar side, then rising temperatures will close the electric circuit.

Keeping the Room at 70°

In the ordinary thermostat which works your furnace there is a contact soldered to each side of the strip and two corresponding mates, one just above and the other below. When the temperature of the room rises the strip bends upwards and closes the contact which makes an electric circuit down in your cellar. This operates a device which *closes* the dampers. As the room cools down again and gets below 70 degrees, the lower contacts are closed and another contact is made which *opens* the dampers again. This action is repeated indefinitely and so your house keeps within a degree of 70 all the time.

It is easy to see that such a thermostat will have a very slow motion. As the room gets warmer the strip will bend upwards, but its rate of movement is so slow that you almost need a microscope in order to see its motion. That means that the contacts when they first touch have such a very light pressure that the amount of current they can carry is quite small. Fortunately, only a small fraction of an ampere is necessary to work the damper in the cellar which controls the draught. Such action would not do, however, to carry the currents from the "A" battery to operate a radio set. For such use it is necessary that a switch be provided, which turns the current on and off with certainty and speed.

Making It Snappy

Up until recently no thermostat had ever been devised which would be snappy in its action. However, Mr. John A. Spencer, of Revere, Mass., Fig. 2, has recently invented one of these devices which is so quick in its action that it may be used as a snap switch to control a radio set or indeed any other electrical device.

The principle on which the Spencer thermostat acts is so novel that it has received the first basic patent on quick acting thermostatic bimetal devices that has ever been issued by the United States Patent Office.

The story of this invention well illustrates the old adage, "Opportunities lies everywhere if you have but the eyes to see them." In Mr. Spencer's case, it was being able to apply his observations of the action of a steam boiler which he tended years ago in a Maine lumber camp that resulted in his recent invention.

Took a Fireman's Job

The boiler was located in a lumber mill in the northern part of Maine. Spencer, a boy about fifteen years old, was employed on the night shift in the mill, and in addition to making periodical tours of inspection, he had to maintain the fire in the boiler. The task of firing kept him particularly busy as, the weather being cold, the wood refuse used as fuel burned quickly. Therefore, he constantly had to run to the boiler room to see if the fire needed replenishing.

The peculiarity of this boiler lay in the fact that it had a rounded cleanout

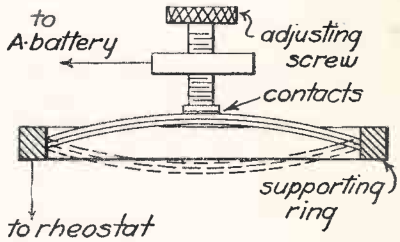


Fig. 4. How Contact is Made by New Thermostat

door which was constantly changing its shape with a loud snap or click. At times this door would be convex; then it would snap into a concave shape; and once again it would bulge out and become convex.

Try This on Your Oil Can

This same thing happens every time you use an oil can—Fig. 3. The bottom is made so that it bulges out somewhat, normally, but when you wish to squirt some oil on that squeaking hinge you push the bottom and it suddenly yields with a snap, so that it takes up the position of the dotted line in the sketch.

This action was well known to every one in the mill, but no one, except Spencer, gave it the slightest serious thought. The young watchman, however, was interested by the action and by careful observation he soon discovered the cause: When the door was hot, it rounded inwards; and as it became cool, it reversed its shape and curved outwards. Being of a mechanical turn of mind, Spencer rigged up a device by means of which a heavy log was leaned against the door when it was bulged in; thus he was able to engage in other duties until the noise of the falling log warned him that the fire was low.

Several years ago, after Mr. Spencer had acquired a knowledge of mechanical principles, he recalled the action of the boiler door and was impressed with the fact that no one had utilized the peculiar action. He therefore decided to investigate it in order to learn if it had practical value, and after a series of experiments, worked out a formula for a combination of metals that best suited his purpose.

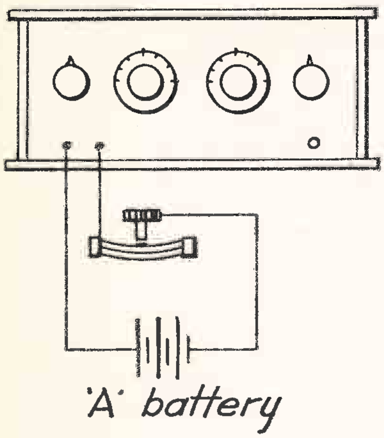


Fig. 5. Hook-up in Set for Radio Alarm

They Jumped Into the Air

His first practical application of the new principle was a toy. He stamped out little convex discs which, when heated in the hand and then placed upon a cool surface, would suddenly change their shape with a click and spring several feet into the air.

The idea here is not to use a narrow strip, but a round disk. After forming to shape, it is bent out like the bottom of an oil can as shown in Fig. 3. The brass being on the top wants to expand with heat as already explained. As this disk is heated up the center part cannot creep up gradually as it did in the strip, Fig. 1, as it is held as an arch in the curved down position. As the temperature keeps rising the pressure which it exerts increases more and more until finally, at a certain degree of heat, the whole disk yields with a snap just as the oil can bottom does and it assumes a curve up in the opposite direction.

Why the Contacts Act

If the upper edge of this disk, as shown in Fig. 4, carries a contact, which mates with another one on the bottom of the regulating screw, then a sharp positive contact will be made at the temperature for which the disk is set.

The way this device is used for the radio alarm is shown in Fig. 5. Notice that it is inserted in series with the "A" battery. When the contacts are closed it puts the current through the tubes' filaments in the regular way. By installing the disk outside your bedroom window it will respond with music on a warm day, but will let you sleep on a cold one. An electrical contact made by your alarm clock times the operation.

Other uses of this device have seemed so important that the Westinghouse Company has paid a large sum of money to the inventor to acquire the patent.

Fast as a Rifle Shot

Electrical engineers have long sought for some effective means to regulate the temperature of an electrically heated appliance, such as a flat-iron, by turning the current on and off automatically. Certain devices for this purpose have long been available, but they are not entirely satisfactory, because they operate so slowly that an arc forms between the points and in time will corrode the contacts, eventually making them useless. When the Spencer disc is used as a thermal switch, it clicks on or off in less than .00018 second (a speed comparable to that of a rifle bullet) which is so rapid that no arc forms. Hence it can be used for heat control with entire success.

Westinghouse engineers state that electrical heating apparatus will be revolutionized by the use of the Spencer thermostat. An iron in which it is used, for example, will heat up to the most efficient temperature and then with a sharp click the current will be automatically cut off. The iron will then start to cool, but before it gets too cool for satisfactory use, the current again will be clicked on. This process is repeated indefinitely, so that the iron is always kept at the proper working temperature and cannot get dangerously hot. Similarly coffee percolators, water heaters, etc., using this device, can be boiled dry without damage, for as soon as the temperature begins to rise, the current is cut off. It is also planned to use this new thermostat on motors, generators, and other electrical machines to prevent overheating.

COMPARING WGY AND KGO

By Martin P. Rice, Manager of Broadcasting, General Electric Co.

Radio programs are slowly but surely improving. The listening public is becoming more discriminating and exacting.

The advertising program is being weighed in the balance of public favor and it is doubtful if it will be accepted. More skill, art, and talent are needed to make advertising by radio successful.

Un-noising the Jazz

Good music is appreciated everywhere and the stations broadcasting it are always popular. Jazz still has a place on programs, especially for dancing, but it is not so noisy as it used to be and is more melodious.

Western programs include much high grade material, but in general they lack unity. Educational programs of real value seem to be further advanced in the West, particularly at KGO, than in the East.

The radio dramas developed by WGY and carried on by KGO and KOA always bring large and appreciative responses. No example of drama written expressly for radio and utilizing all its possibilities has yet appeared.

Talks Short and Snappy

Talks seem to be in favor at many stations and the studio managers are fairly successful in convincing speakers that radio talks must be short and, above all, interesting. It is usually easier to tune out than to tune in a speaker.

The linking of several stations to make the broadcasting of an important public event available to the largest audience is making progress and is a real public service. The expense of thus connecting stations is so high that it is not warranted except for events of national importance.

Western audiences are more responsive to the request of stations for reports on reception. More letters and telegrams are received by western than eastern stations in proportion to the population reached.

Exit---Microphone Fright

A Combination Mike, Loud Speaker and Movie Screen

By VANCE

DID you ever have an attack of stage fright? Perhaps back in your school days you stood up on the platform to recite, "The Curfew Shall Not Ring To-night." Sure enough, it did not do any ringing for your tongue stuck to the roof of your mouth, and you were unable to say a word.

Stage fright like this is bad enough, and many speakers are affected by it even though they may have addressed audiences many times before. But it is a strange fact that even veteran speakers, who can go out on the stage and face an audience of a thousand people without a tremor, will oftentimes be thrown into confusion when they stand before a microphone to broadcast. Here it is not the audience, but the *lack* of an audience that embarrasses them.

Wanted,—A Live Microphone

Studio directors sometimes arrange to have a few of their friends in the room at the time in the hope that it will make the speaker feel more at home. It doesn't seem to have that effect, however. The trouble is that when a person stands up before a steel drum, he can not visualize any audience and his mind seems to rebel instinctively at talking to such an object. If some way could be found to make the microphone seem alive, or to represent a real audience, it would go a long way towards removing the tightness in the throat which the broadcaster is apt to feel.

With this idea in mind there has recently been invented a new style which conceals the microphone behind a screen. It is called the Micro-speaker-phone. Behind the grill work is a thin screen which allows the voice to penetrate it easily, but which permits a movie camera to project on it. By using one of the small home-movie outfits, with a film of an audience, any lecturer may be given the impression that he is speaking to a crowd of living human beings, instead of a mechanical contraption.

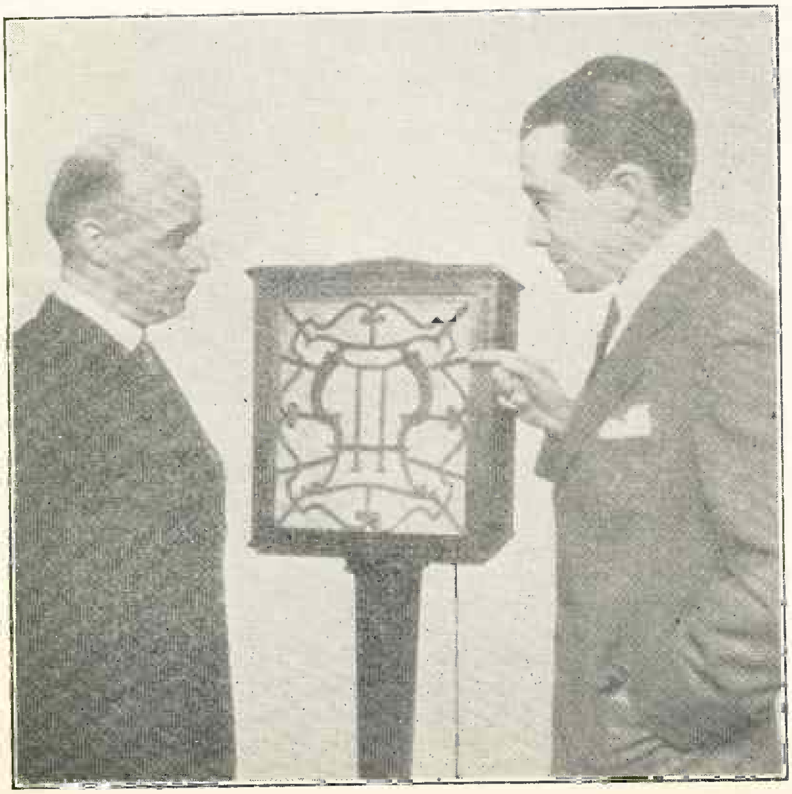


Fig. 1. Explaining the Merits of the Scoreless Mike to Commander MacMillan

Audience Must Move

Of course, an ordinary stereoptican picture of a theatre could be used. It is found by experience that a moving picture conveys the atmosphere considerably better, however, as this gives the impression of a live audience. Some people find it easier to address a vast throng, while others prefer to talk to a small group. Whichever it is, the speaker can take his choice and insert a film showing the character of audience he prefers. This is found to go a long way in removing the microphone fright which has affected so many seasoned lecturers.

Our photograph shows Commander Donald D. MacMillan at the left, as he inspects this new device. On the right is seen E. F. McDonald, Jr., who is the president of a National Association of Broadcasters. He is instructing the Arctic explorer as to the way the new microphone works. This unit is now being installed at Station WJAZ, the New Zenith studio in Chicago.

It Talks as Well as Listens

Another thing of interest in this device is the standard on which the mechanism is supported. Notice that this consists of a square tapering wooden

Continued on Page 19.

Keep Your Tubes in Good Health

Why Your Neighbor's Bulbs Last Twice as Long as Yours

By W. S. STANDIFORD

YOUR friend, Bill, has been running his vacuum tubes now for over a year, and they are still going strong. Yours are beginning to get a little bit frayed around the edges, although they have been in the set for a little less than six months. What is the reason?

Various articles have appeared in the magazines concerning radio receiving outfits using vacuum tubes for detecting and amplifying signals, but little has been published in regard to the care of these devices. Yet they are of vital importance in transmission work, as well as for picking up radio concerts.

An ever increasing army of amateur wireless enthusiasts in Canada and the United States are constantly joining the ranks of those more experienced fans in the radio field, and are to a more or less extent, ignorant as regards the care of radio appliances. A few practical pointers on the care of this most expensive and important part of their receivers will enable any radio fan to enjoy the utmost satisfaction and pleasure from his outfit.

Sometihng Like Light Bulbs

As detector and amplifying tubes resemble ordinary electric light bulbs in some ways, many amateur radio operators who are new to the game, think that they can handle this apparatus with roughness of ordinary bulbs. Due to their construction, the latter are made so as to work with their filaments near a white-heat, so as to obtain the utmost light possible.

This in itself makes it easier on the filament. When the wire is at nearly white heat it becomes soft something like the way hard rubber will soften when it is put into hot water. You can easily see that if a hard rubber comb were dropped on a concrete floor it would be pretty apt to knock a few teeth out. On the other hand if you had just pulled this comb out of a boiling water bath, it might bend the place which strikes first but owing to the fact that the material would be quite plastic it would not break.

How to Stop Its Breaking

Since an ordinary electric light bulb runs at a temperature, which makes the filament plastic, there is small danger of its breaking when hot. Many years ago when Tungsten bulbs were first made, the wire was very fragile and breakage was high, even from the small jars which were received when cleaning the glass. For that reason the manufacturers always used to specify that the current should be turned on and the bulbs lighted when any cleaning of the glass ware was to be done. This would prevent the filament from snapping.

The UV-200 tube has a pure Tungsten filament, which runs at so high a temperature that it has something like the action described above. But the other tubes each have some kind of coating on the wire which gives the same electron emission or plate current at a much lower temperature and for this reason such tubes have not the protection against jars when hot that the UV-200 has.

Vacuum Tubes Don't Give Light

Electric lamps are also made very rugged in construction as compared with detector and amplifying tubes. The latter are not intended as light giving apparatus, but they are much more sensitive for an entirely different purpose. On this account, and also because of their high price and fragility as contrasted with ordinary light bulbs, it is best to take the utmost care of them so that they will have a long life.

In order to make your tubes last as long as possible, you must keep the filament inside at as low a temperature as is practicable. Detector and amplifier tubes require that the voltage impressed across their filaments be kept at an exact value for best results.

When a piece of metal is heated it evaporates just the same way as water does, but of course at a very much slower rate. Perhaps you did not realize that a solid could evaporate. However, a piece of ice even in cold weather will slowly disappear. The temperature may be way below the freezing point, but in spite of that, water vapor is continually being given off from the surface of the ice so that in time it will be all gone. Naturally this action is very much slower with the cold weather, but it exists just the same.

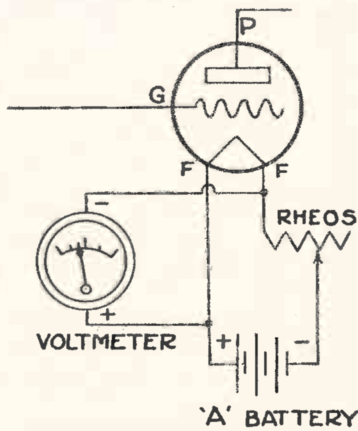


Fig. 1. Proper Way to Use Meter in Adjusting Filament

UV-200 Much Hotter than Others

In the same way the filament of your tube is gradually giving off part of its substance, especially when it gets near the red hot temperature. The UV-200, as just explained, has to have such a high heat that it gives off electrons (which form the plate current) from the temperature effect alone. The other styles of tubes, however, do not need to be hotter than the glowing end of a match stick to give excellent results. Detecting and amplifying tubes require that the voltage impressed across their filaments should be right, so that they may work at their utmost efficiency and last as long as possible.

Most people probably do not measure with a meter the electricity supplied to their tubes. Of those that do take a reading, some use an ammeter in series with the filament to measure its current and others a voltmeter to determine the volts impressed on the tube. To measure this pressure the voltmeter is connected as shown in Fig. 1. The plus terminal runs to the positive and the minus to the negative of the tube. If the rheostat is connected in the negative side of the battery, as is standard practice, then the voltmeter will be attached between the rheostat and the filament. In this position it measures not the pressure of the "A" battery but that directly across the tube itself.

Volts to be Kept Constant

The scheme of measuring the voltage is better than that of current. The reason is that if you keep the pressure on the filament constant throughout its life it will work as well and last considerably longer than if you keep the current constant. That is because the diameter of the wire is gradually reduced as the tube is operated owing to the evaporation of the surface as has been explained. Because of the reduced diameter the resistance goes up just as the resistance of a pipe carrying water increases if it gets partially stopped up with sediment.

If the current is kept constant through the wire in spite of the fact that its resistance is higher as the tube gets old, then the voltage needed to force this same current through the higher resistance will naturally be greater than what it was at the start. This increased pressure on the filament makes it run at a higher temperature than it was designed for and so the life is shortened.

If the voltage is kept constant on the other hand, then as the resistance goes up through old age the current will fall off slightly. However, there is now not so much filament to heat as there was before and so the smaller current will keep it at the same temperature as in the beginning. Because of this the tube will work just as well, and yet will last quite a bit longer.

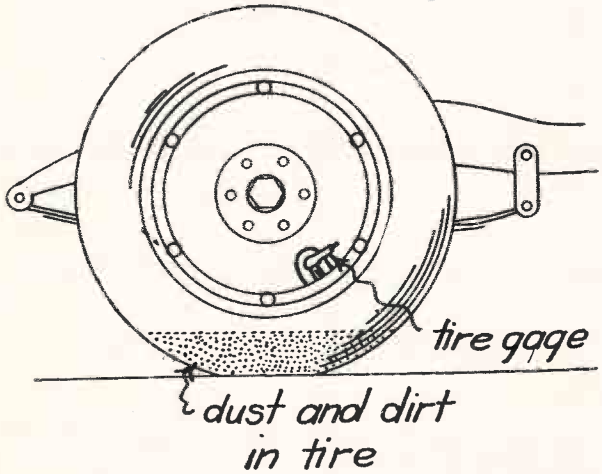


Fig. 2. Why Constant Pressure Beats Constant Current in Preventing Damage

Filament Like Auto Tire

To see how this action goes on, look at Fig. 2. Suppose we have an automobile tire which we wish to keep well inflated. We could use one of two ways. The usual idea is to put a tire gauge on the valve and keep the pressure up to say 50 lbs. Another way would be to measure the quantity of air in the tire and keep this constant. Naturally this would be a hard thing to measure, but it could be done. Either way would give the same result as long as the tire was new.

After it has run six months let us assume that it is partly filled with road dust as shown in the illustration. If we keep it inflated by the pressure method, then we shall put in the right amount of air to maintain 50 lbs. per square inch. But if instead we measure the *quantitiy*, then by crowding the same amount of air into the space which is now considerably smaller you will easily see that the pressure will necessarily run up to 60 or 70 lbs. and may cause a blow out. Quite obviously the constant pressure method will be much superior. The same reasoning applies to the vacuum tube.

A Voltmeter is Worth While

For this reason fans will find that a small voltmeter (which is an instrument for ascertaining the amount of pressure, or voltage) will save them its cost many times over in prolonging the life of the tubes. Indeed, it is one of the best investments that any person interested in radio work can make. It also comes in handy for finding out the strength of new dry batteries when purchased, as some of those that have stood on dealers shelves for sometime, may be weak in pressure.

For testing dry cells an ammeter is slightly better than a voltmeter, as the reading changes more with increasing age than is the case when a voltmeter is used. The latter instrument, however, while not quite so accurate will pick out old or used cells very easily. When new, a dry cell has a pressure of 1½ volts. This gradually drops off as it is used until when it has fallen to one-volt it should be thrown away.

When Detector is Not Amplifier

Many broadcast listeners think that a detector and an amplifier tube are the same thing. This is true about all the styles except the UV-200, which can be used as a detector only. It is probably the most sensitive device made for this purpose. It will not work well, however, as an amplifier. All the other tubes may be employed equally well as detector or amplifier.

The chief difference between the UV-200 detector and the other tubes is the amount of vacuum. The former has a small quantity of gas run in after a high vacuum has been formed while the other tubes are sealed off at the highest exhaustion which the vacuum pump will give. It is termed a "soft" tube as contrasted with an amplifying one, called "hard." As a matter of fact, either type of tube may be used for detector. But an amplifier is best suited for amplification use as it is specially designed for that purpose. Such a tube has a higher vacuum and on this account, it can use a higher voltage "B" battery.

A Poor Way to Tune In

Some amateurs try to get distant stations by tuning more current into their tubes, thus heating the filament hotter than it is intended to be. This is a dangerous practice and it shortens a tube's life. It will readily be seem from the above, that a person having a three or four tube radio set has a neat sum of money invested in tubes alone, so as it is advisable from a financial standpoint to make them last as long as possible, and not try any experiments in extra-hot filament heating so as to cause distant stations to come in louder.

It is hardly necessary to add, that only inexperienced amateurs overheat their tubes. But large numbers of them are making and purchasing outfits, who naturally know very little about the ins and outs of radio, so this information is timely and will save them money. Another pointer; a vacuum tube after it has been in use a certain length of time, say about three months, may become either softer or harder than before, the matter depending upon constructional factors that vary. This causes a radio novice to blame the manufacturer for marketing an inferior article, which is not the case. All makers are doing their utmost to get their product as uniform in quality as possible.

Sometimes a tube that has changed its hardness after several month's usage, will become noisy, and while local stations can be heard, out-of-town broadcasts will not be received very well. If both the "A" and "B" batteries test high and are in good condition, it is most likely that a tube has changed. You will want to find out whether such is the case, or the fault is with some other part of your set. It is a good plan for a radio enthusiast to try out any tube which refuses to work well in a friend's set—one that is operating satisfactorily. By doing so, you will then be able to tell the condition of your tube.

If it is a hard tube, more "B" battery voltage may be used in order to make it operate best. Should it prove to be "soft," use lower potentials so as to enable it to work well. A few experiments along the above lines will save many a tube supposed to be defective from being discarded when it apparently refuses to give good service. The writer ran across an interesting case sometime ago. An amateur had a new WD-11 tube, which failed to operate after using it three hours per day, for a period of three weeks. As it would not work even with the rheostat arm turned away round to "on", he concluded that it was burned out and was about to discard it and buy a new one.

Where the Trouble Lays

I suggested that he test the tube by removing it from its socket and conmeeting the two filament prongs across the terminals of a single dry cell. When this was done it lighted up brilliantly. The fault was found to be in the rheostat contact arm, as it had been bent up slightly and was not in contact with its resistance wire (See Fig. 3.) When the switch arm was bent down again so as to press against these wires firmly, all trouble vanished.

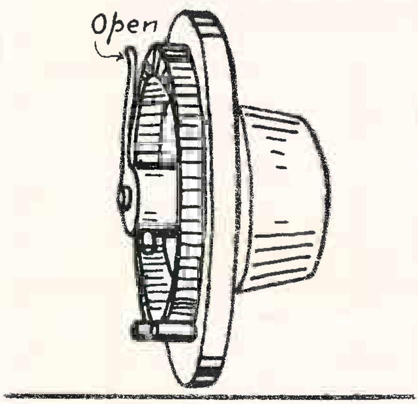


Fig. 3. This Explains a Frequent Cause of "Static"

Some radio fans do not like a wire-wound type of rheostat, but prefer the carbon disc style, as they think that it gives less trouble. As a matter of fact, both give excellent service in radio work if they are well made. As rheostats play such an important part in tube current regulation, it will be of interest to the ever increasing army of novices to know what to look for when they purchase rheostats so as to obtain the very best—it being an axiom that a high-grade article gives the least trouble; this applies with double force to radio parts owing to the rapid way the art is advancing at the present time.

Picking a Good Rheostat

A first-class wire-wound rheostat should have the following characteristics: Its wire ought to be tightly wound in place so as to prevent any loosening of its coils during expansion and con traction. The wire should be of sufficient thickness so as not to get too hot while carrying the current. A rheostat to work with a UV-200 will be required to carry one ampere, while the unit controlling a single UV-199 takes but 1/16th of an ampere. That explains why the wire for the two different capacities of rheostat must be of such different diameters.

The contact arm should be made in such a manner that its pressure on the wire coils can be adjusted. In order to reduce wear to the lowest possible extent, hard phosphor-bronze for contact arms is better than brass. All wires ought to be spaced as closely as practicable. Close wires coupled with a wide contact arm give a more sensitive adjustment and prevent a tube from flickering. The switch arm knob should be firmly fastened so as not to work loose. The resistance wire must fit tightly in its groove, and lastly, the insulating base of the rheostat should be able to withstand the heat given off by the wires without softening.

Buying Cheap Junk

Sometime ago, I thought that I would try out a rheostat bought in a cut price store; the cost was ten cents per part or thirty cents in all. It didn't give good satisfaction, being too badly and loosely constructed and got out of order quickly. It was soon discarded, a waste of money resulting; but as my object was to find out what kind of radio material is sold in those stores. I was satisfied with my experiment.

Another pointer; do not leave your rheostat (which controls the tube's heat range) set at the same position when it was last used and expect it to heat the filament to the same degree of redness when you listen-in on the following night. It will be found that you may have to alter its resistance in order to keep a tube's brilliancy at the proper point. There are two reasons for this. In the first place a battery which is partly run down will have its voltage lower than normal owing to this use. After standing for some hours it partially regains the pressure that was lost. If you keep a volt meter connected up to a battery after snapping off the filament switch, you will find that it may rise as much as ten percent. by the next day. For this reason the pressure on the filament will be too high and so the rheostat should be turned farther toward the "off" position when starting up the tube.

The second reason for this shift is that all metals when hot have a higher resistance than when cold. This applies not only to the rheostat wire, but also the rest of the circuit. The rheostat was adjusted the night before, after the entire circuit had been warmed up by a couple of hours current flow, and owing to the higher resistance of all the parts the rheostat was set at a lower value than will be needed the next day when everything starts cold again. This again means that the rheostat should be turned around slightly when starting to pick up a program. Of course, neither of these causes is very serious but if the longest life of the tubes is desired, these points should be looked after.

The usual type of crystal devices in use on reflex radio outfits has some drawbacks, which prove to be very annoying when a person is listening-in to a broadcast concert. The cat-whisker wire on these detectors has the disadvantage that the slightest vibration is apt to throw its point off the sensitive galena spot and so stop reception in the midst of an interesting program. In most cases, it takes a lot of time and patience to find another sensitive place, and thus a good part of an entertainment is wasted.

A type of crystal detector which does not have this disadvantage, but can be adjusted if so desired, is shown in Fig. 4. Due to its construction, this detector cannot be thrown out of contact with the galena or other mineral *nor will its action stop if the point of the wire is burnt off*, as sometimes is the case with the ordinary pattern. Instead of touching the crystal at one place the wire bears against it at numerous spots; there are plenty of sensitive grains pressing against it. Any vibration occurring simply shifts this wire to different grains. So much for its advantages; now for constructional details.

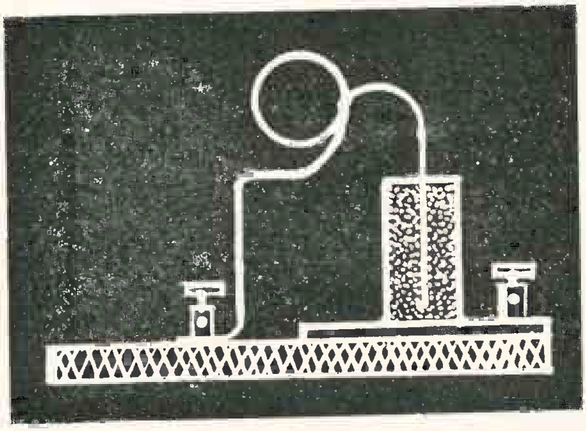


Fig. 4. A Crystal Detector That is Especially Suited to a Reflex

Building the Detector

Procure a piece of Bakelite or other high-grade insulating panel 3/16 inch thick, 2½ inches long by 1½ inches wide; one piece of copper tube one inch long by 3/8 inch inside diameter; a small piece of sheet copper about 1/16 inch thick and 1¼ inches square; two binding posts and some round-head wood screws of suitable size.

Solder the tube to the sheet of copper (Fig. 4), making holes for the binding posts, also for the screws to hold it upright. Two other screw holes should be made in the insulating base so that it can be fastened down. Get a number 20 or 22 guage piece of phosphor-bronze spring wire and make a loop in its center as shown; the object of this loop is to keep the "cat-whisker" thrust down into the galena grains. Cut your wire so that when it is placed under the binding post, it will occupy the center of the tube, extending within ¼ inch of its bottom. Both the inside of the tube and also part of wire projecting into it, ought to be brightened with fine sandpaper, taking care not to touch either surfaces with your fingers, or get any oil in the inside of tube or on the outside part of the wire.

Untouched by Human Hands

Pulverize enough galena crystals to fill the pipe within 1/16 inch of its top. Don't make it too fine or touch it with your fingers either before or after pounding. Handle it with a clean piece of paper. Fill it by creasing a stiff piece of writing paper, pushing the grains on it with a clean stick, after which the tube can be filled by gradually slanting the paper and pushing the material into it with the stick.

Under no circumstances whatever should these crystals be touched by the fingers as there is sufficient natural oil on the skin to stop the reception of music or code signals. Place your binding posts in position as illustrated, and connect this appliance to your set in place of the regular one and it is ready for use. You will be surprised to note how this type of detector retains sufficient contact between many sensitive galena spots, thus enabling a steady reception to be maintained during vibrations caused by a heavy motor car shaking the house, or by a person walking across the floor.

How to Clean Your Old Crystal

If a radio enthusiast has a number of dirty galena crystals, he can clean them by immersion in alcohol. Use medicated, not the denatured article. An old tooth brush gives good service taking care not to touch the crystals with the fingers. Handle with tweezers after cleaning. Then pound them up and fill the detector tube. This will save the expense of buying new ones, and they will be found to give as good service as new crystals. Let the galena dry before putting it in the tube, if it has been cleaned with alcohol, as verdigris may form and stop reception.

CONNECTICUT ON ITS EAR

A bill has been introduced in the legislature of Connecticut to prohibit "emitting any noise or other disturbance which deliberately interferes with broadcasting of concerts and other programs between the hours of 6 p. m. and 12 p. m."

Latour's Patents Control Radio

Why Many Big Companies are Taking Out His Licenses

An Interview from DR. O. C. MAILLOUX, Honorary President of International Electrotechnical Commission

THE smoke has not yet cleared from the battle between the Westinghouse Company and the DeForest Company over the regeneration patents. You will remember that Major Armstrong assigned his invention to the Westinghouse Company, while DeForest turned his over to the Company bearing his own name.

Now more patent trouble apparently is coming, as it appears that many of the basic ideas which practically every radio set contains were developed and patented by a French professor. It is only recently that Prof. Marius C. A. Latour has started the active pushing of his inventions.

Latour himself is quite modest and not given to self advertisement; that is probably why he is not so well known on this side of the Atlantic. But it is to the genius of this man that is due the delight of millions of our citizens in radio broadcasting, which is to-day so tremendous a factor in the entertainment and instruction of people all over the world.

Well Known Abroad

Long before the war, Prof Latour had already attained the summit of distinction in electrical engineering and invention, not only in France, but in all Europe. This gives an idea of the qualifications of the man for the task of development in inventions which was intrusted to him as a result of the war.

The radio inventions of Prof Latour are now attracting world-wide attention, particularly here in America, where radio broadcasting has become a factor in the everyday lives of all of us. They are the results of research work begun by him long before the war and brought to complete development and utilization during and as a result of the war. It was, indeed, because of his early researches with reference to methods of securing amplification of weak currents that, at the outbreak of the World War, the governments of France and of the Allies looked to Prof. Latour to continue his intensive studies. Additional research in the development of his earlier ideas enabled the Allies to take leadership in the field of radio reception.

The First Meeting in France

His intensive work enabled him to obtain results that seemed extraordinary in the early part of the war. In 1916, when I had occasion to meet him in France, I learned for the first time of his interesting results in receiving signals from very distant stations without any antenna and with the extremely compact apparatus developed by him.

This apparatus was the basis of that which was put at the disposal of the Allies for radio reception. Models were sent to this country to be copied for the use of our own army and navy.

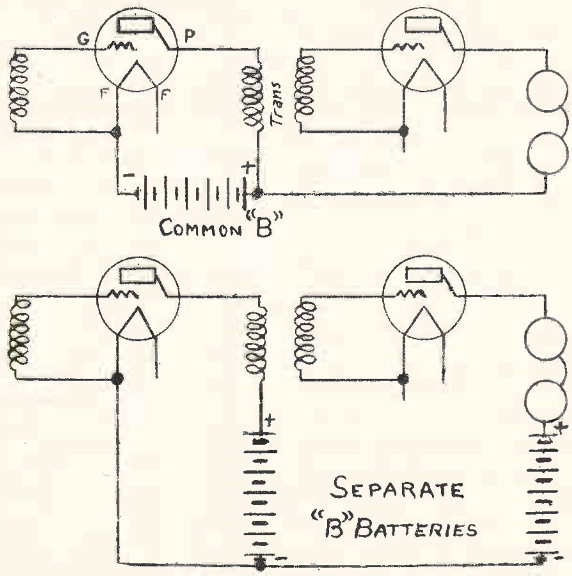


Fig. 2. This Invention Saves a Lot of "B" Batteries

Mr. Latour's inventions undoubtedly preceded all other methods of radio reception with amplification. They are the basis of all present systems for the reception of code signals. They are in fact, the underlying foundation of the present system of radio broadcasting.

Out of the vast mine of ideas and discoveries which he opened up, came the inventions made by him and others, which are now being used in broadcast reception.

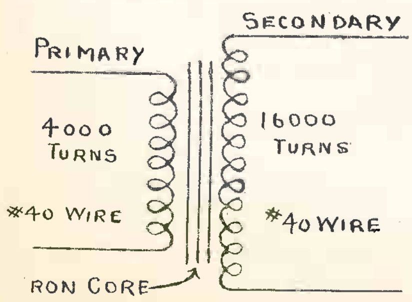


Fig. 1. Shows Principle of Iron-Cored Transformer

Is Yours an Infringement?

Professor Latour himself states that every receiving set used in America, by amateur radio operators and by broadcast listeners, is a violation of his patents, granted and pending. Such sets have been and are being manufactured by scores of companies taking advantage of the tremendous demand for receivers.

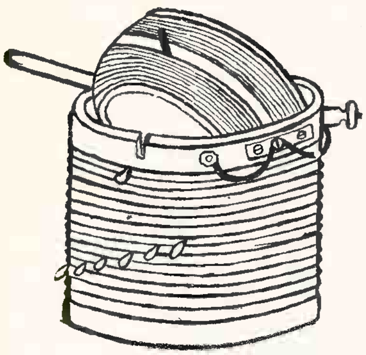


Fig. 3. It is the Taps on This Variocoupler That Count

It is contended by the Professor that his inventions, dating back many years and coming before broadcasting became so popular, are so broad and cover radio art so well that it is practically impossible to build a receiver in the present state of the art without infringing on one or more of his inventions.

It is not going too far to say that the successful research work of Professor Latour, in the field of radio, before and during the war, was the starting point of the development which made American broadcasting what it is to-day, for his inventions have contributed as much to broadcast sending as to reception. The finest broadcasting stations in the world are in fact equipped with Mr. Latour's sending apparatus, invented and perfected by him.

For 11 Years with G. E.

Professor Latour was for eleven years a consulting engineer to the General Electric Company. He has been consulting engineer to several of the large electrical companies of Europe. All broadcasting stations in France were built under his patents for transmitting apparatus, which is also used in other great stations of the continent. He is the inventor of big frequency alternators, frequency multiplies, as used in the Sainte Assise, Lafayette Belgrade and, Coltano radio stations of France, and magnetic modulators for any wave-length, as used in the Paris station. He has many inventions in dynamo-electric machinery and the like.

He is now professor at the Ecole Supericure d' Electricite in Paris and is continuing research work, his hobby, along with writing books on poetry and philosophy. One of his books is "The Philosophy of the Emotion."

Within the radio industry there has been naturally considerable fear as to the effect of this situation. Manufacturers, distributors and dealers have realized that any apparatus handled by them which infringes valid patents makes them liable, under law, for all the profits accrued through the sale of such infringing devices or for triple damages suffered by the parties controlling the patents. If such claims were pressed for adjudication by the courts, the amount involved would probably run up into many millions of dollars.

Professor Latour explained that the following features of construction and design in radio receivers involve infringements of his inventions.

The Iron-cored Transformer

Audio frequency transformers which use an iron core. This is represented in Fig. 1 which shows that the iron acts as a spool on which the primary and secondary turns are both wound. Such a core gives maximum amplification without the bad effect of distortion. All radio sets which have one or two steps of audio use this idea.

Radio frequency transformers with an iron core. Such units are manufactured by some concerns but the majority use air cores and so do not come under this patent.

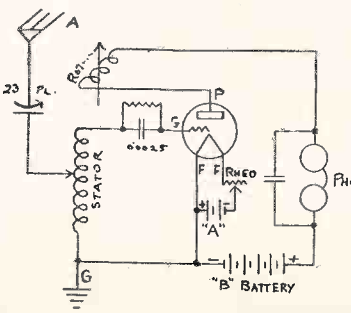


Fig. 4. A Simple Way of Using This Invention in a Set

Using a single "B" battery for several tubes. This is illustrated in Fig. 2. At the top is shown the ordinary method of connection with a single "B" battery which is common to every bulb in the set. At the bottom of Fig. 2 is shown the scheme of connections with a separate "B" for each of the various tubes. This used to be the way sets were hooked up until Latour patented this improvement.

Variocoupler Comes Next

The tapped coil. This is a very popular way of changing the wave frequency in the ordinary set. It usually takes the form of a variocoupler. Such a unit is shown in Fig. 3. Notice the taps which are connected to a tap switch in such a way that one or another may be picked out depending on the wave frequency. A simple way of connecting such a tapped coil appears in Fig. 4, where the taps are used to get coarse tuning while fine adjustments are made with the 23-plate condenser.

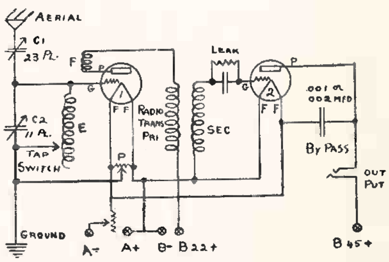


Fig. 5. The Polentiometer Prevents Radio Frequency Tubes from Oscilating

The method of preventing radio frequency tubes from breaking into oscillations by use of a potentiometer. Fig. 5 shows a simple hook up of one tube of radio frequency amplification feeding the detector. The potentiometer is shown at "P." Notice that by adjusting this unit a variable voltage is impressed through the tap switch and coil "E" on the grid "G". By giving this the proper voltage bias, any self oscillation of the amplifier tube can be prevented.

Destroying Hand Capacity

Grounding the filaments or "A" battery. In Fig. 6, which shows a Neutrodyne hook up, notice the connection in the lower left hand corner between the ground wire and the "A"— lead. This connection is not necessary for the operation of the set. However, it has a distinct advantage for two reasons. In the first place it tends to prevent unwanted oscillations in the first two tubes and besides that it reduces body capacity to a very large extent. Every radio set should make use of this connection.

In view of these basic patents it isn't suprising that Prof. Latour is now getting after the radio industry to pay him a royalty for their use. As he is a wealthy man, he is not making any attempt to collect back damages or profits. This is fortunate for the manufacturers who have been using his inventions. However, he has sold licenses to at least four of the largest manufacturers to make use of his eighty patents.

The purchase of these licenses by the American Telephone & Telegraph Company, the Radio Corporation of America, the Postal Telegraph Company and the Freed-Eisemann Radio Corporation, according to a statement made on authority of the last named organization, is a concession of the validity of the patents, in the first place and, in the second place, gives these companies absolute manufacturing and selling rights.

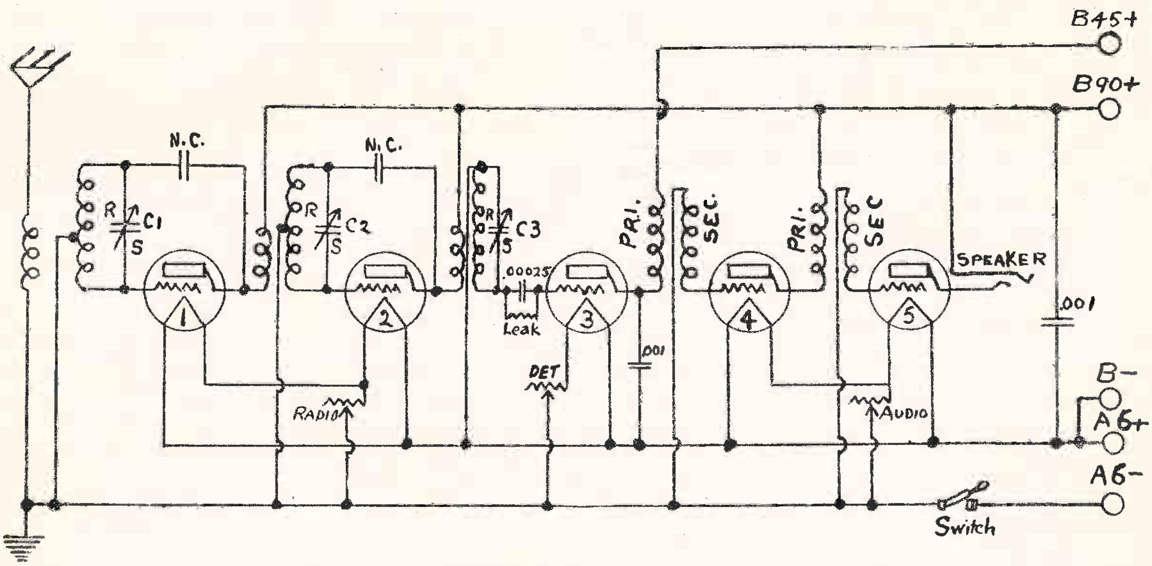


Fig. 6. Notice in the Left-hand Lower Corner the Connection from Ground to Filament Line. This Reduces Body Capacity

EXIT—MICROPHONE FRIGHT

Continued from Page 12.

pedestal. It is in fact, a large organ pipe. At the bottom of the column is installed a loud speaker telephone unit. In this way the apparatus may be used as a loud speaker to receive broadcasting from some other station or as a transmitter to do its own broadcasting.

By combining the two functions, it is possible to change a solo into a duet. If some sister station is broadcasting the air of a popular song by a well known soprano, this can be tuned in on the loud speaker. If a tenor stands befor the combined unit, he can hear the tones as brought in, and at the same time sing an accompaniment to it. Of course, the microphone, which is included in the upper part, will pick up the harmony from both loud speaker and singer, and so the music broadcast from the studio will be a duet.

JAZZING THE TOBACCO

Radio music speeds up work and hurries on the workers. This idea is in line with the thought that music is helpful to digestion at meal-time. Yet confirmation of the first-mentioned theory comes from a Kentucky township, where the chief industry is tobacco growing. One of the "gang" bosses of the progressive type thought of furnishing music while his workers were tying tobacco, and he tuned in for one of the dance orchestras, whose concerts are regularly broadcast by Westinghouse Station WBZ at Springfield, Mass., from its Boston studio. The tobacco was tied in record time, nobody seemed tired, and many of the group went rabbit hunting the next morning at sunrise.

Six hundred pounds of tobacco of the Pittsylvania bright leaf were tied up quicker than ever before. When the workers started, the thoughts of the next day's rabbit hunt was disturbing them. The piles of leaf tobacco appeared unusually large and it did not look as if many rabbits would be chased the next morning. The radio was turned on, and the jazz band started its tuneful selections. More tobacco was tied in Danville that night than ever before.

The nimble fingers of the tobacco workers never had tied so rapidly and securely before. The jazz music was the inspiration. One of the older tenants affirmed that years ago he had worked to the music of fiddle and banjo with some degree of success, but that as a stimulating and energizing factor, the radio had them all beaten.

MAINE TO CALIFORNIA

One hour a day of a national radio program, interconnected over the whole country under some independent direction, has been suggested by Herbert Hoover.

Distortion a Good Thing--Sometimes

What Ruins An Amplifier Must Be Had by a Detector

By DR. PETER I. WOLD, Professor of Physics, Union College

NEXT to "low loss" the most talked of word nowadays is probably "distortion." We all know that when the music comes in rather poorly and the broadcasting singer's voice seems to have an attack of gout, then our friends put on a learned look and murmur "distortion." But what does this term mean and is it always a disadvantage?

In these days all of us have become so well acquainted with vacuum tubes through actual use, or through the countless articles on radio sets making use of them that anything further might almost seem superfluous. On the other hand, there may be some who have only recently become radio fans; or it may be that the exceedingly versatile device, very commonly called a vacuum tube, (Fig. 1) offers some points of view which may be new to many.

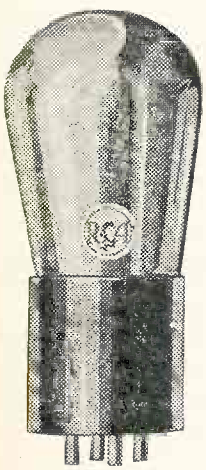


Fig. 1. Two-Stand Vacuum Tubes—Detectors or Amplifiers

Tubes Do Six Things

If you have followed the radio art very long, you will have heard of these tubes being used in a number of different ways,—as for audio frequency amplification, radio frequency amplification, detection, regeneration, and oscillation, any or all of these occurring in your receiving sets; and if your interest carries over to the broadcasting station as well, you have heard in addition, of oscillation generators and of modulation.

One of the simplest circuits showing a tube detector appears in Fig. 2. The aerial excites the coil, which is tuned to the incoming wave frequency. The grid condenser conveys the oscillations to the grid and the output of the plate flows through the phones to the "B" battery. Fig. 3 shows an amplifier reduced to its lowest terms. The input applied to the transformer primary, is carried by the secondary terminals to the grid and the output from the plate works the loud speaker. Notice particularly that whereas the detector uses a grid condenser, the amplifier *never* does.

Repeating or Distorting

All of these various terms may suggest a confusing variety of uses for the vacuum tube, but it may simplify matters in your mind if it is pointed out that this tube has really *only two* functions, which are separate and distinct, and all the various uses just mentioned come under the one or the other. These two functions may be spoken of as the *repeating* action and the *distorting* function. The two are present in every tube in an amount depending on its design, i. e., the relative sizes and spacing of the elements (grid, plate, and filament) in the tube, amount of vacuum, etc. By the way in which the bulb is operated, and by the circuit with which it is associated, the one or the other of these two characteristics may be emphasized.

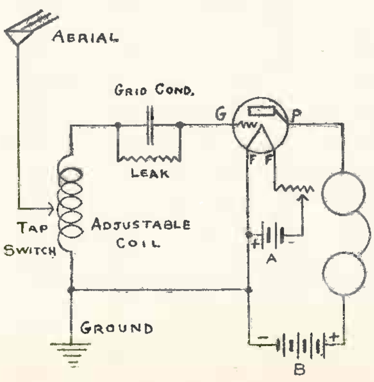


Fig. 2. This is a Very Simple Detector Circuit

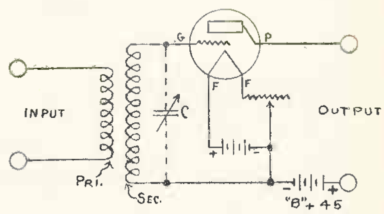


Fig. 3. No Amplifier Hook-up Could be Simpler

By the first of these functions, I mean that of *repeating* the electrical variations or waves in the output, which have been impressed on the grid. Of course, the amplitude (loudness) of the repeated waves, must be considerably greater than that of the input, or else the amplifier is not doing much good. An increase in volume of 5 to 20 times is not unusual. The output wave should be a faithful reproduction of the input. See Fig. 4.

The second function I refer to is that property of the tube by which input variations on the grid result in output variations, generally amplified, which are substantially different, Fig. 5. As an example of the first we may take the relaying of telephone messages across a transcontinental line in which the greatest precautions are taken to make the repeating action as faithful as possible, i. e., to reduce distortion to a minimum.

When Your Friend Hangs Up

When you talk from New York to California you naturally want your friend to say, "Why, yes, old scout, I recognized your voice right away." But if the amplifier has a tone of its own (distortion) he may think your voice sounds like that of a creditor and hang up the receiver.

Fig. 4 makes this action plainer. The upper line shows a complicated wave which is impressed on the grid of the amplifier. It consists of a high radio frequency or carrier wave, which has been modulated into groups at a low frequency, or audio tone. There are four such audio vibrations illustrated. The lower curve of Fig. 4 shows the same wave as it comes from the output of the grid. Notice that the number of vibrations is exactly the same and the general shape has not been changed. The volume, or amplitude, which is represented by the distance up and down is considerably greater than before, and this represents the amplification or gain in loudness, which the tube has given. If the shape of the lower curve did not look like that of the upper, you would know that distortion had occurred.

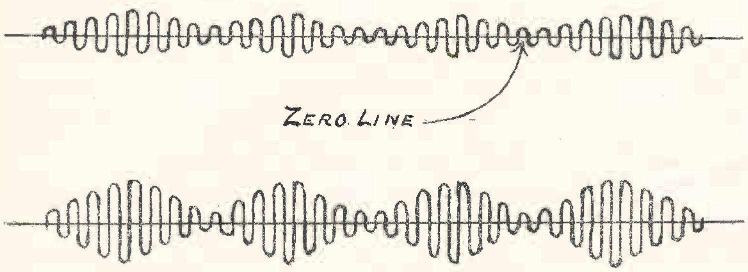


Fig. 4. What an Amplifier Does to Incoming Radio Waves. Shape is the Same

As an example of the second, we may take the detection of a radio message in which electrical oscillations or variations of perhaps a million cycles—and therefore quite inaudible—are so distorted or converted as to give oscillations of an audible frequency at say 1000 cycles (1 kc), which corresponds closely to the note high "C", as played on a piano.

Cutting 1,000,000 to 1,000

Fig. 5 brings out this point. The upper curve here shows the input to the detector tube. Let us assume that it is just the same as the output of Fig. 4. In other words, the radio amplifier step of Fig. 4 feeds directly to the detector of Fig 5. Now notice the lower curve. Of course, the number of vibrations must be the same, since the tube can not leave any out. The shape, however, is quite different. Owing to the intentional distorting action of the tube, the high frequency vibrations run above the zero line considerably more than they drop below it. The dotted line which is drawn through the center of the high frequency vibrations, represents the *average* current, and it is this average which operates the diaphragm of the phones. Notice that the vibration speed of this dotted line is reduced from one million down to one thousand oscillations per second, which already explained, corresponds to high "C." In this way the note which the soprano sang into the microphone at the sending studio, has come out just the same in the phones at your home.

Detection is Most Interesting

The *repeating* action of the tube and its circuit, with amplification, would probably be held to be the more important property, for it includes such applications as long distance telephony and all the actions in radio work mentioned above except that of detection and modulation. On the other hand, its quality as a distortion device is the more interesting, though not so generally understood.

Let me remind you for a moment of the essential elements of the standard vacuum tube, Fig. 6. There is a filament which is raised to a high temperature by the current of the "A" battery, whereupon it gives off electrons—those smallest particles of matter or electricity which we have come to recognize as playing so important a part in all our affairs. Then there is a *plate* kept at a positive potential by the "B" battery, and which therefore attracts the negative electrons from the filament, thus giving rise to an electric current to the plate. Finally, there is the *grid* placed between the two. When the grid is made more positive, a larger current flows from the filament to the plate and through its circuit, and when it becomes more negative a smaller current flows. It is possible thus to control the plate current by changing the potential of the grid. The important point is that the input energy (Fig. 3) for exercising this control is very much less than the output energy of the controlled current. It is for this reason that the device acts as an amplifier.

Drawing the Characteristic Curve

This will be plainer if we draw a diagram of the way the tube acts. In the curve Fig. 7, let the distance back and forth represent the voltage as measured between the grid and the filament. Distances to the left mean that the grid is negative, while going to the right it is positive. Up and down represents the output from the plate, as measured by a millameter in the "B" battery circuit.

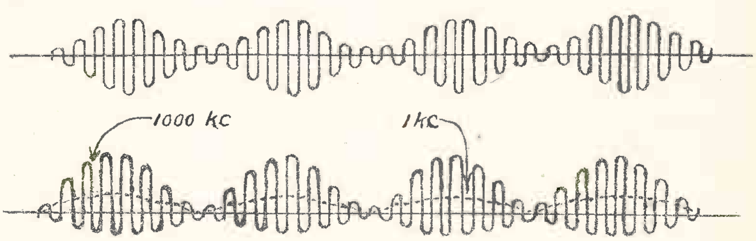


Fig. 5. How the Detector Treats the Amplified Waves of Fig. 4. Notice the Shape is Changed

The higher up we go from the bottom line, the stronger it shows is the output.

When the grid is made quite negative, the plate current is practically zero. This is shown by the start of the curve at the left hand end. Notice that this is practically down to the zero line. As the pressure on the grid is increased more and more, the output from the plate picks up at the same time. At first the output increases at a good deal greater rate than the input. This change in its rate of growth is indicated by the fact that the line is *curved.*

When it is Saturated

We next come to a section where the line is straight. That means that as we keep making the potential on the grid stronger and stronger, the output

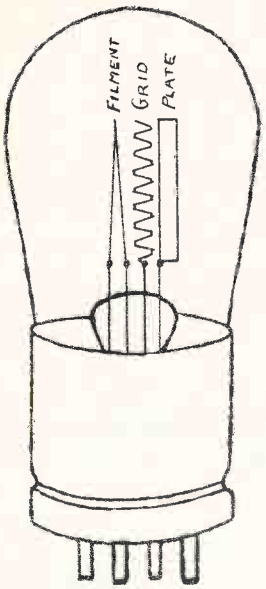


Fig. 6. The Necessary Parts Inside a Tube—Three Elements

goes up in the same proportion. Near the top of the line it becomes curved again, which shows that beyond a certain positive value of the grid, the plate current can not increase very much. That is the so-called "saturation current" of the tube.

An amplifier circuit is designed so that the tube works along the straight part of this characteristic line. Since, as just explained, the variation in output is proportional to that of input, you can readily see that a radio wave like the top of Fig. 4, will cause the same shape of output as shown at the bottom of Fig. 4. On the other hand, it does not require any mathematics for you to grasp the idea that if the tube is so adjusted that it works on the curved part of the characteristics at either the top or the bottom of the line, the output will not follow the input very exactly.

The curvature of the "characteristic" depends on the design of the tube and, in any given tube, may be emphasized by the circuit with which it is associated.

What the Grid Condenser Does

The big aim in life of a grid condenser is to increase this distortion or curvature of the line as shown near the bottom of Fig. 7. When the proper value of grid capacity—usually about .00025 mfd.—and the proper grid leak are hooked up to the grid of a detector tube, then the operation will be right in the middle of this curved portion and the distortion which is wanted will be greatest.

Suppose we have a tube circuit which has a curvature (detector) and we impress on the grid two electric currents of different frequencies at the same time. It can be proved in theory and is found by experiment that there are present in the plate circuit four different vibration speeds combined together—(1) the high frequency; (2) the low frequency; (3) high minus low; (4) high plus low. In other words, the resultant current is not a faithful reproduction of the original impulses, but shows some distortion.

Modulating a Million Cycles

This is a very useful thing, as may be seen if we apply the principle to a broadcasting station. Suppose, for example, that we combine in a tube circuit the radio frequency of one million cycles (300 meters) with a musical vibration speed of one thousand cycles. Then, in accordance with what was said above, we would have set up in the plate circuit the original, and also the sum and difference frequencies, i. e. we would have in the plate circuit speeds of 1000; 1,000,000; 1,000,000 plus 1,000, or 1,001,000; and 1,000,000 minus 1,000, or 999,000. The first of these, 1,000, is of too low frequency to affect the radiating antenna of the station, but the other three, being of suitable high frequency, would be radiated.

It is these three waves of slightly different vibration speeds which would travel out to your receiving set. The middle one of these, one million, is called the "carrier wave," and the others are named the upper and the lower side waves, or "side bands." The three together constitute the modulated wave, i. e., the wave on which has been impressed the message which is to be transmitted. The side waves or frequencies are the important ones and it should be noted that they were not originally present, but were brought in only by the distorting effect of the tube. The mixture of the original frequencies is a very intimate one.

Working the Modulation Backward

Let us now go to the receiving set where these waves are picked up. They finally reach your vacuum tube. If this tube is a RF. amplifier, and so shows no curvature or distortion, it will merely repeat and amplify the high frequency waves which arrived, but these, in that form, are of no use, for they vibrate so fast that they are inaudible. What is desired is a musical tone of the same as the original frequency, i. e., *one thousand,* or high "C." Obviously it is going to take something radical to get this from three frequencies, each at or in the neighborhood of *one million.* Suppose, however, the tube and its circuit has its distortion, then by the same principle as given before, there will appear in the plate circuit currents which are the same as the

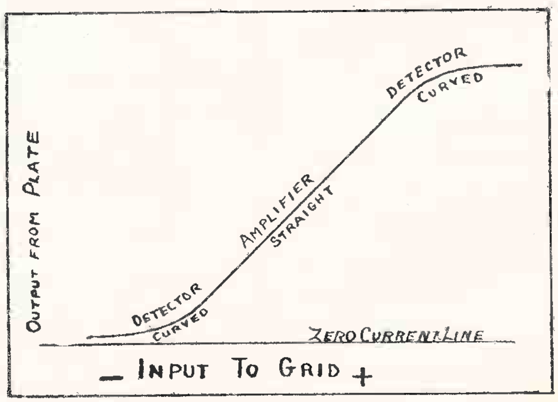


Fig. 7. This is the Curve Which Showas How a Tube Acts

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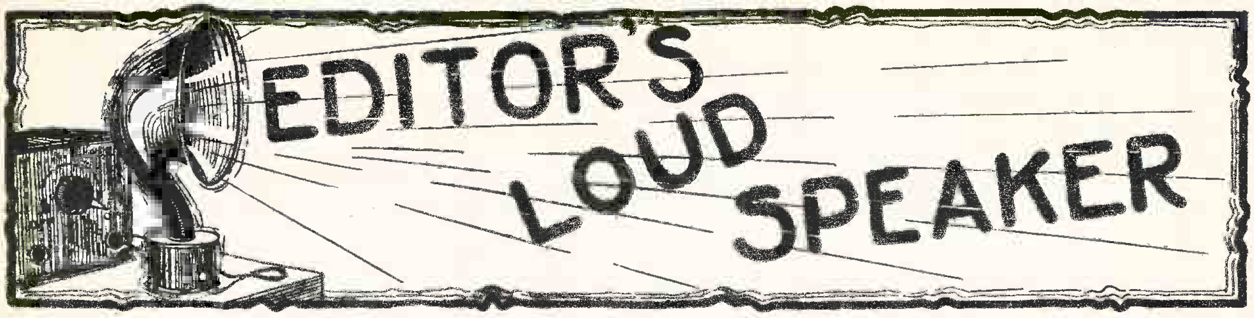

FOOLING OLD MAN STATIC

If some one asked you for a six-letter word meaning a lot of weird noises from your loud speaker, you would probably be able to tell him the answer in pretty short order. Ever since radio was first sprung upon an astonished world, the great problem, especially of the summer time, has been to cut down the trouble from static.

There have been various devices on the market from time to time which are claimed to get rid of this interference. So far, none of them have been very practical. Of course, as a general proposition, a good set is not bothered as much as a poor one. This can be seen if you consider that one kind of a noise is like another, as far as your set knows. We have never yet run across a radio which might be said to have a musical ear. In fact, they are just as willing to bring in a series of discords as they are the finest melodies.

Two Ways of Control

Remember that there are only two ways of separating sounds which are known to science. The first of these is that of tuning to the particular frequency (wave length) of the vibration which is wanted. Such tuning allows this wave to come in with full strength, while it reduces all other vibrations in proportion as they are more or less separated from the frequency you want. The other way is that of directional reception. When using a loop it is possible to turn it so that waves arriving along some one line are suppressed. Those coming from other directions are brought in more or less loudly, depending on how far they diverge from the line of the coil.

Of course the great majority of sets do not use such a loop, and so this second method of picking out what waves you want can not be used. That is the big advantage of the loop set—it can select its program; first of all, by tuning, and second, by aiming the loop.

Static is Invited, Too

However, after you have tuned your set to the vibration speed you want, and then aimed it in the direction you wish, you have done all you can in the way of cutting out undesired vibrations. If your favorite station is putting a wonderful program on the air, of course it will come in with splendid effect. But if at the same time the forces of nature are letting loose a lot of static at the same frequency and in any direction except the one line from which waves are suppressed, then the static will come in equally well.

Another thing which makes it hard to get rid of this unwelcomed visitor, is that while a broadcasting station builds up its energy by a large number of tiny vibrations which mav be tuned pretty exactly, on the other hand, static has only a small number of waves each of which is quite large. Owing to the small number of vibrations, it is impossible to tune very sharply against them.

Tuning Two Clocks

It is like two clocks ticking on the mantelpiece. If you listen to them both at once for a few ticks it is hard to say whether they are going to keep in step or not. But if you listen over a period of several minutes, you will usually find that although they may start both ticking at the same time, they will gradually pull out of step and then in again, and keep this action up indefinitely. In other words, it is possible to tune them together over a large number of ticks (vibrations), but if only a few are taken, the tuning will be very broad.

It is owing to the fact that the energy of static is all gathered into a few big waves, rather than spread out over a large number of tiny ones, that makes it so hard to get rid of it even in a good set. But selectivity helps somewhat even at that. Just as a good set will pick up the frequency you tune for, and reject another station which is ten or twenty kilocycles away, so the selective set will be able to suppress a good deal more of the outside noise by tuning than it will if it can not separate such stations. Right away that points to the fact that you should never use a single-circuit set in the *summer time.* In that respect it resembles the spring, fall and winter. Every single-circuit squealer should be made over so as to use a separate aerial and grid coil, in this way sharpening your selectivity, decreasing static, and stopping the squeals which otherwise annoy your neighbors.

Increasing the Power

When all this is said and done, the fact still remains that one is apt to be bothered by static to some extent. What is the next step to reduce this interference? To tell the truth, there is nothing more that the broadcast listener can do to his own set to improve results. The sending station is the next place of attack. If the broadcaster increases his power, then static appears to fade in the same proportion.

As an example of this, remember the time you were getting 1500 miles on a single tube. With the ear phones clamped on tight, it was a strain to catch the mystic words which would tell where the sending station was located. Just at that moment someone rattled the newspaper and the call letters were lost. That newspaper rattle was just the same idea as static. Ten minutes later, after you had triumphantly located the DX station, you switched back to your local station and heard them come pounding in. Now the newspaper could be rattled at a great rate without causing any disturbance. Why? Merely because the amount of power coming in was now a great deal more than it had been at the time static caused the trouble.

Loudness Not Whole Thing

It is a well-known fact among those who have experimented that *loudness* alone does not count so much in hearing clearly, as does *ratio* of sounds. Thus in a quiet room we can easily hear a word spoken in the lowest tones, whereas the same person shouting in a boiler factory can scarcely be understood above a deafening din.

When considerable noise is going on in the room you positively can not hear a clock tick at all, and yet the same clock keeps you awake at night in your quiet bedroom. That is, it is the relative amount of loudness between two sounds which decides whether they are going to interfere. If one is but a small fraction of the other, it will cause no trouble.

Applying this principle to radio we see that static *will* come in using the very best set possible. If the broadcast is received in about the same volume, then the former will be very annoying. To get a bigger ratio we must either decrease the static or increase the music. Since, as already shown, the static has already been reduced to the limit, the evident answer is to make the program louder. If this is done, then the disturbance will apparently fade in the same proportion.

Godfrey Ludlow, Violinist. Mr. Ludlow, who has toured practically all over the world, gave five successful concerts in New York and was acclaimed by the critics. He is now on the staff of WJZ and WJY and is scheduled for special Sunday Concerts from ten to ten-thirty. Mr. Ludlow had the signal honor of no less than six royal commands, receiving many beautiful gifts. He is the proud possessor of the famous de Rougemont Strad, dated 1703.

Real He-Power

That is the big end and aim in the idea of raising the output of broadcasting stations up to 2000 watts and more. At the present time in the United States there are thirty stations which have an output of more than 500 watts. Four of them are now putting out 2000 watts, and one (KDKA) has at times used as much as 5000 watts. If you are within a few hundred miles of one of these big stations, you will realize that when listening to it you are not troubled by static, except on nights of severe weather disturbances. Of course, a thunder storm may put even your Bell telephone out of order, and it is hardly to be expected that under such conditions your music will be undisturbed. But it certainly is true that these large amounts of power are a big help in overcoming outside noises.

Many people ask why local reception is not troubled by static. It is for this very same reason. Your receiving set picks up so much energy from the nearby sending station that in comparison static fades to nearly nothing. It is going just the same as before, but you do not notice it.

The Blanketed Station

Of course, the big objection to such increase is this: When you wish to pick up a good program 1000 miles away, you find that the local sender has blanketed the air over a broad enough band so that you can not get through him. Naturally, if he should increase his power, it would blanket a still wider frequency band on your dials. This objection is a good one and must be considered. But it is not the whole story.

If *every* station were to double its power, then the relative strength of each would remain just the same. A DX station, which you could just pick up through the local interference before the change, would come in exactly the same after *both* powers had been increased. This, then, would be neither a help nor a hinderance as regards selectivity between one station and another. But notice the effect on static. If the latter had been doubled at the same time then everything would stand as before. But static has not been increased. As a result its proportion is now only half what it used to be, and so it is no longer a serious bother.

Continued on Page 30

New Radio College for Women

Greatest Interest is Being Aroused in These New Courses

THE new bride, who complained to the grocer that his flour must be tough because the bread she made was poor, certainly had never taken a course like that given by the new radio college, which has just been opened for women.

So far radio has been directed mostly to the attention of the male sex. It is largely the boys who build the new hook-ups and the men who write the checks for the factory built sets. As the art has advanced, however, it has begun to appeal more to women. They are now undoubtedly responsible for the choice of a large portion of the radios bought, and that explains why the manufacturers are now devoting so much attention to giving them a good appearance and making them harmonize with the furniture of the home.

So it is not surprising that broadcasting programs are coming more and more to include numbers of interest to the feminine mind. This air college idea seems to be appealing very strongly to the women. Indeed, it ought to, because it is very well worked out and the topics which are taken up are very interesting. It is even whispered that the husbands of some of these new "college girls" are as much interested in the course as their wives, as they notice a distinct improvement in the cooking and the household management.

New York State College of Home Economics at Cornell University, has adopted a new method of giving extension courses to the home-makers of the state. Station WGY, Schenectady, has been given a place on the faculty, and henceforth, twice a week, the voice of the General Electric Company broadcasting station will be heard in the great class room which extends far beyond the boundaries of the state.

Two Authorities at Head

On Monday and Thursday afternoons at 2 o'clock, the wife and mother in city and country home, may attend this "air college" and hear the latest in styles, clothing, house furnishing, nutrition, household management, and equipment. All these talks will be prepared under the supervision of the directors of New York State College of Home Economics,—Professor Martha Van Rensselaer, and Professor Flora

Miss Martha Van Rensselaer

Rose, who are international authorities on the subject of home economics.

Problems suggested by the talks may be taken up by letter with the college by women who are residents of New York State, and all will be answered without charge. Residents of other states may receive the same service from home economics schools in their own states. The experience and knowledge of the college faculty as well as the benefits of a research department supported by Uncle Sam, will be offered those who listen to the semi-weekly radio talks.

The following titles give an idea of what may be expected in the radio extension course:

Outline of Courses

Clothing series -How to Select Stockings; How to Pick Out Gloves; The Selection of Hats; Storing Winter Clothing; Choosing Spring Fabrics; Clothing Budgets; Becoming Clothes for Thin People; Suitable Styles for Stout People; How to Press Garments; Help for Home Sewers; Becoming Colors in Clothing.

Home Furnishing Series—Selection and Hanging of Draperies; Picking Out Rugs; Choosing and Hanging of Pictures; Color in the Home; The Artistry of the Table; The Use of Dyes in the Home; Decorative Use of Flowers.

Nutrition Series—Selecting Meals; Cost of Food; Vitamins in the Diet; Sunshine and Nutrition; Diet for Expectant and Nursing Mothers; How Cornell Babies are Fed; Feeding the Pre-School Child; Diets for the Overweight; Menus for the Underweight; Suggestions for Overcoming Constipation; Fixing the Child's Habits in Preschool Years; Development of Personality in Children; Fears of Childhood; Discipline of Children.

Household Management Series—The Family Resources; Division of Income; The Family's Savings.

Equipment Series—Refrigerators; Washing Machines; Vacuum Cleaners; Springs and Mattresses.

A List of Good Speakers

In addition to the directors, the speakers will include Ruth Scott, Charlotte Weiss, Frances Scudder, Beulah Blackmore, Beatrice Hunter, Dr. Nellie Perkins, Ruth Kellogg, Annette J. Warner, Dora Wetherbee, Helen Monsch and Nancy McNeal Roman.

The bill changing the School of Home Economics into the New York State College of Home Economics was signed by Governor Alfred E. Smith, and became a law February 24. The governor's signature made this the first college of its kind in the world. The success of the bill was due in large part to the enthusiasm and support of the women of the state through the Home Bureau Federation and Federation of

Women's Clubs, as well as other organizations which have labored to get recognition of the work in which they are so much interested.

There is probably no greater authority on the subject of home economics than Professor Martha Van Rensselaer (Fig. 1) who, because of her achievements, was selected as one of the twelve greatest living American women by the National League of Women Voters. Miss Van Rensselaer is director not only of the New York State College of Home Economics, but also of all home economics extension work in New York State. She is state leader of the home demonstration agents who work with the thirty-five organized home bureaus of the state with a membership of 30,000 women.

Miss Flora Rose

Long before Cornell University had a department of home economics, Miss Van Rensselaer organized a well developed extension program for the farm women of the state as part of the extension service of the college of agriculture. This service was continued and developed into the present program in home economics, which includes bulletins, correspondence courses, specialists' service, and home bureau work. This makes it possible for any woman in the state to receive information on any home-making subject by writing directly to the college of Home Economics or to the home bureau agent representing the college in the county.

Has Over 500 Pupils

In 1907 the department of home economics was organized and Miss Van Rensselaer and Miss Flora Rose were named as heads and together developed its work, until in 1920, it was made a School of Home Economics with the rank of a professional school in the State College of Agriculture. The school now has six departments with over 500 students taking courses and 450 of them specializing in home economics.

During the period of the war, Miss Van Rensselaer was in Washington as director of the home conservation division of the National Food Administration. She has served on many state and national educational committees, and was president of the American Home Economics Association during the early years of its existence. She is now editor of the home-making department of Delineator, and is well known as a writer of magazine articles and as a public speaker. She has written many bulletins issued in the Cornell Reading Course for the home and, with Miss Rose and Miss Helen Canon, is the author of the Manual of Homemaking.

5-Year Health Program

Professor Flora Rose. (Fig. 2) the other director of the College of Home Economics, was appointed director of home economics in New York State for the United States Food Administration during the war. She has served on many important home economics committees in various organizations, and is now a member of the nutrition committee of the Milbank Memorial Fund, which is conducting a five-year health demonstration in Cattaraugus County. In 1923 she made a survey of the nutrition of the school children of Belgium at the request of the Educational Foundation of the Committee for Relief in Belgium, of which Herbert Hoover is the president. Five thousand school children were studied in this survey and detailed data of the nutrition and health of each child was compiled.

DISTORTION A GOOD THING

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three high frequencies and in addition there will be all the possible combinations of sum and difference frequencies. If you will set these down yourself, as can be easily done, you will find quite an array.

To make it easy let's call the highest frequency A, the middle one B, and the lowest one C. Then in our output we shall have these three vibrations, A, B, and C, and in addition A—B, A+B, A—C, A+C, B—C, B+C. The additions of any two of these frequencies will be around two million vibrations per second and will be even farther above the notes that we can hear than the separate ones were. For that reason they have no effect on the operation. But you will find two of these, A—B and B—C both of which give the answer 1,000. This is the same as the speed of vibration of the note which was originally sung, and so we hear that same tone in our loud speaker.

Mix and Unmix the Message

Thus we see that it is as a result of its distorting characteristic that a tube can first modulate a carrier frequency with a message frequency, i. e., "scramble" the two together so that one carries the other, and then at the receiving station "unscramble" them and give us the original message.

While we have applied this to the case of a simple message of constant frequency, it holds equally well if the message is varying in its vibration speed all the time, as is true in the case of the complex telephone currents which we use for broadcasting of music and speech.

Now this feature of distortion is not characteristic of vacuum tubes alone, but must be present in every form of detector which can be used in the radio art. If it doesn't distort, it will not detect. It is also present to some extent in many other things where it is not wanted, such as telephones, microphone diaphragms, etc. This has been recognized for a long time and every attempt is made to reduce it. In radio, however, as just explained, there are cases where we wish to use a property which was formerly considered undesirable. We have here an illustration of the fact that however varied may be the behavior of things in nature and however undesirable some of these may appear to be, there may come a time and a place where we want the very action that we formerly wished to avoid.

Radio—The Doctor of the Deep

Sickness at Sea is Now Cured Through Wireless Waves

YOU rush the sick child to the doctor's office, knowing that quick action is needed. There you are told that the doctor is out. But imagine your feelings if the doctor were out and would not be back for weeks.

That is about the situation that a good many sailors have been in since the days of Columbus. Of course, the big ocean liners each carry a doctor and perhaps an assistant. But the smaller boats, the freighters and the sailing vessels, with their crews of eight or ten men, naturally cannot afford to carry a physician. But now radio has stepped into the breach.

Coffee Crew Falls Sick

This is the way it works. A ship has sailed from Brazil on its way to New York with a cargo of coffee, for our breakfast beverage. When still three or four days out from land, one of the men is taken ill. This ship, like numerous others, carries no doctor. Yet here is a case for a physician. It may be a question of life or death. Medical advice is urgently needed. What is to be done?

Fortunately, this freighter is equipped with radio apparatus. The Radio Operator is soon pounding his key, and shortly after, his call is picked up by another vessel miles away, in reply to the unwritten code of the sea. This is the message received:

S. S. West Adrian
To Captain S. S. Glenworm Castle,
Man has intense swelling right side face. Does not abate. Patient delirious. Have you a doctor on board to wireless treatment?
Captain.

A few moments later the Radio Operator with his phones glued to his ears, picked up his pencil and jotted down the reply on his radiogram blank:

S. S. Glenworm Castle
To Captain West Adrian,
Keep patient in bed and treat face with hot applications of water. If not successful paint inside of jaw with white iodine. Advise results. Captain.

A few hours later the captain advised the distant doctor via radio that the patient had been relieved and was resting as well as might be expected. This exchange of radiograms probably resulted in a life being saved.

THE LONG AND SHORT OF IT

There's quite a difference in size between the little organ pipes held by the girl and the large ones beside her. The pipes are part of the Wurlitzer organ in the Crosley WLW broadcasting studio in Cincinnati.

S. S. West Adrian
To Captain Glenworm Castle,
Patient resting easily after treatments and pain greatly relieved. Please accept my compliments and thanks.
Captain.

It was not always possible to get medical aid like this. The way it began makes an interesting story. Over four years ago Radio Medical Service had its modest beginning in an idea developed by Captain Huntington, Chief of the Medical and First Aid Course for seamen at the Seamen's Church Institute, 25 South Street, New York City. He described his plan to Dr. Mansfield, in charge of the institute, who immediately saw in it a practical and humane service.

Right of Way Except S. O. S.

On November 3rd, 1920, a special commercial wireless telegraph station license with the call letters KDKF was issued to the institute. Soon KDKF began to desseminate medical service to ships in its vicinity, from 9:00 A. M. to 5:00 P. M., during the period the institute's doctor was on duty. The idea, now given the acid test of actual service, proved highly practicable. KDKF soon received the right-of-way over all calls except the SOS of ships in distress. And soon it became manifest to all in touch with the development that the radio medical service must be running twenty-four hours per day. So on April 20th, 1921, KDKF was licensed to operate continuously.

The day and night service was made possible when the Public Health Service took an active interest in the institute's work and offered the services of its staff at the Marine Hospital located on Hudson Street, so as to furnish medical advice by night as well as by day. A direct telephone connection was made between the institute and the hospital, and in this manner speedy medical information was now on tap for the lonely steamer within ready reach of New York.

The Range Too Small

One more obstacle still confronted the service, and that was the question of radio range. The radio transmitter at the institute was not powerful enough to reach ships at any considerable distance from New York, so that in many cases it became necessary to relay the messages. The medical service had grown all the while and increased its scope of usefulness, but the Seamen's Church Institute did not possess the funds nor the equipment to carry on the work which had reached such vast proportions.

At this stage in the development of the radio medical service, the matter was brought to the attention of the Radio Corporation of America. The organization, fully aware of the far-reaching importance of the radio medical service and the necessity for extending this humane and worthy cause, immediately donated the use of its stations free of charge, and instructed its operators to be constantly on the watch for calls for medical aid. Thus the radio medical service passed out of the narrow confines of the little transmitter of the Seamen's Church Institute, and became available through a large network of coastal radio telegraph stations. Since that time the R. C. A., in co-operation with the U. S. Public Health Hospital at New York and other ports, has been handling this radio medical service.

Norway the Next Nation

The service, in the course of its rapid expansion, has taken on an international aspect. On June 7th, 1923, it was learned that the Norsk Marconi Kompani of Christiania, Norway, would give free medical service to ships of any nationality through its stations in Norway and Sweden. So, the germ of an idea by Captain Huntington, developed and perpetuated by the personnel and equipment of the R. C. A., has spread to all parts of the globe and now any ship seeking medical aid is promptly served, merely in the interest of humanity.

The Chatham Coastal Station, the most powerful of its kind in the world, with the call letters WIM, listens for calls for medical service in the Boston vicinity. WIM is so powerful that it often handles medical service messages from all parts of the Atlantic, from close to Europe down to the Gulf of Mexico.

United Fruit Co. Also Serves

Radio medical service for the North Atlantic and North Pacific is handled by the high powered stations, but in the Carribean Sea and adjacent waters, the United Fruit Company has inaugurated a free service through its splendid hospitals established in tropical America.

As you gaze at the sky it seems incredible that through the apparently empty air this merciful work is quietly functioning all the while. Indeed, side by side with the radio waves that bring programs into your home, there are the waves bearing the code dot-dash messages of ship-to-shore traffic, some of which is devoted to the radio medical service. Countless radiograms bear witness to cures by stating at the close of the case, "Patient O. K., normal yesterday, and to-day no symptons of any kind; many thanks."

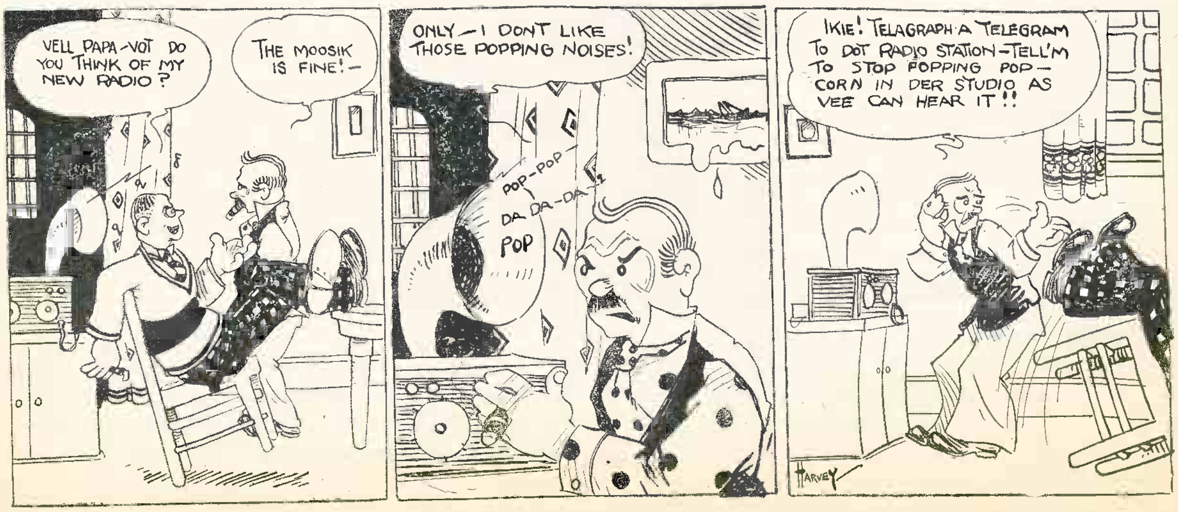
More than one operation has been performed by the ship's crew, working under the direction of a surgeon many miles away. In such instances the surgical instruments have been of an improvised nature—kitchen knives, ordinary scissors, pieces of wood, and so on —but always quite in keeping with the lay hands that wielded them.. Still, such long-range surgery has accomplished wonders. Surgical cases, as acute appendicitis, must be caught in the nick of time lest they prove fatal. In their first start, lay methods will work greater wonders than the efforts of the foremost surgeons when the case has advanced to the fatal stage. Hence radio operations have been the means of saving many a life which would otherwise have had to be forfeited for lack of early surgical care. Radio operations have often provided temporary relief until the ship could make port.

Crew Has Been Poisoned

Once the U. S. Liner "America" picked up a stray message from a lone freighter stating that nineteen members of its crew were suffering from a painful malady. Only the vaguest details were forthcoming as would be expected from laymen. The vessels at the time were some three hundred miles apart—obviously a case of long range diagnosis. Putting their heads together and working on the meagre details, Drs. C. F. Leidy and Hislop diagnosed the ailment as ptomaine poisoning. For two days

Continued on Page 30

IZZY A. MUTT.—HE SHOULD USE A CORN CURE



Rx DR RADIO PRESCRIBES.

NOTE: In this section the Technical Editor will answer questions of general interest on any radio matter. Any of our readers may ask not more than two questions, and if the subjects are of importance to most radio fans they will be answered free of charge in the magazine. If they are of special interest to the questioner alone, or if a personal answer is desired, a charge of fifty cents will be made for each answer. This will entitle the questioner to a personal answer by letter. However, if the question requires considerable experimental work, higher rates will be charged.

Question. When is it desirable to operate with two different kinds of tubes in the same set?

Ansewr. Of course, the most usual case is where a UV-200 is used for a detector and UV-201A tubes for amplifiers. They both require the same pressure—5 volts. Probably what you have in mind, however, is sets which employ UV-201 A tubes for audio amplifiers and UV-199 for radio frequency amplifiers. The advantage of such a scheme is that each of these two styles is the best for its particular class. The 199 tubes do not have as great a volume for audio waves as the 201A and so do not put out as great a volume through the loud speaker. They have plenty for radio waves, however.

On the other hand, the 201A tubes have a great deal more internal capacity between grid and plate and so waste a good deal of the high frequency energy. Such a trouble is not found with the low frequency audio vibrations. Of course, such a scheme requires higher resistance rheostats in series with the the 199 tubes than with the others; 60 ohms is not too much.

Question. Why do the manufacturers of "B" battery eliminators tell you not to measure the voltage with an ordinary tester?

Answer. The ordinary eliminators on the market have an output of 15 to 25 milliamperes. This is enough current to operate up to five or six tubes. However, the ordinary "B" battery tester takes considerably more than this to read even as high as fifty, and so when it is used to test the voltage it is like trying to measure the water pressure at a faucet with the water turned on and running out in a stream. Of course, in such a case the water pressure drops so low that the gauge reading is not worth much and in the same way the voltage will fall off owing to the heavy drain through the meter so that the reading does not mean anything. Only a special high resistance volt meter can be used for such tests.

Question. What is the advantage of radio coils shaped like a doughnut?

Answer. The real name for such a shape is the toroid. For the benefit of some of our readers who mean by "doughnut" the kind of goody which has the ends twisted together, we might say that the toroid is the shape of a life preserver, which has a round section when cut across. If you take such a shape of winding form and wind the wire around it threading it in and out through the center hole, then you get a coil which is unusually efficient in that it is not affected by outside magnetism.

You see that any magnetic lines which struck it on any side would go around counter clockwise say at the top and clockwise at the bottom, and the two effects would neutralize each other. In the same way the magnetic effect that such a coil has is confined almost entirely within the winding. Since the latter loops back on itself, there is no chance for stray magnetism to get out and interfere with other coils in the same set. This, in a large measure, prevents the magnetic feedback in a set like a neutrodyne from causing the RF amplifier tubes to oscillate.

Fone Fun For Fans

It Specializes That Way

A lemon can afford to be sour. It has to be sour to be successful as a lemon. As we are not trying to be lemons: let us smile.

Able to Walk

Man—"Is New York the next stop?"

Porter—"Yas, sah; brush you off, sah?"

Man—"No, I'll get off myself."

—Western Christian Advocate.

The Teeth of the Storm

Ding—What did your wife say when you got home last night"

Dong—She never said a word. And I was going to have those two front teeth pulled, anyway.—Crosley Radio.

Mellerdrammer

Hero—Cur! Where are those papehs?

Villain—They are at the blacksmith's.

Hero—Ha! You are having them forged?

Villain—No, I am having them filed. —Awgwan.

Careful George

"I say, George," said the young business man to his friend, "where do you buy your typewriter ribbons?"

"I don't," replied the other, "I usually buy her flowers."—Tit-Bits.

New Name for it

She (anxious to impress)—"I've just put my furs into cold storage."

The Fool—"Cold storage! Ha!—jolly good—never heard it called that before; my cuff links and watch are there too."

—London Opinion

All Quiet in the Building Trade

Country Cousin (after prolonged inspection of building operations)—"I don't see the sense of putting statues on the top of your buildings."

Friend—"Statues? Those aren't statues. They're bricklayers."—Punch

Affectionately

He thought he'd surely made a hit,
When for his photograph she prayed.
"Out, when this calls," she wrote on it,
And gave it to the maid.

—Amherst Journal.

In the Kitchen

"What was that—er—scuffling in the kitchen a short while ago, Jane?"

"Why, sir, that was the cop tryin' to kiss me."

"Aha! And you forcibly objected?"

"I didn't, sir, but the letter carrier did."—Judge.

EDITOR'S LOUD SPEAKER

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Sky the Limit

Of course, this idea could be carried still further until the power of the larger broadcasters reached five, ten, or perhaps even fifty kilowatts (50,000 watts). It is hard to say just where the limit (if any) would be. That is why the Department of Commerce keeps increasing the upper limit which is permitted for the power of sending stations. It does this in small steps of not more than 500 watts for each change. If enough opposition to these increases was heard from broadcast listeners, then power would not be permitted. So far, however, the number of complaints against the increase already granted have been very small indeed.

It certainly looks as if this summer would see less bother from static than ever before, and that increased power was the answer to this perplexing problem.

DOCTOR OF THE DEEP

Continued from Page 28

the men of the freighter were treated by radio instruction. Then this message came back to the "America": "Your directions followed. All but six now on duty. They are recovering fast. Thanks and God bless you. Bon voyage."

At another time another freighter called to the "America" stating that a member of its crew was in dreadful agony. The doctor then aboard the "America" studied the case by means of the meagre data supplied, and then prescribed by radio. The following day a message was received from an Italian steamer some 300 miles away in an entirely different direction stating, "Many thanks to S. S. America. We had sick member of crew suffering from similar ailment. Prescribed same as directed for other steamer. Our patient recovering. God bless you." So, what was intended for a specific case also came in handy for another. In this particular instance the radio medical service of the "America" had been truly broadcast.

And sea babies! The stork does not always select his visits in keeping with carefully laid plans. Sometimes he insists on paying a visit aboard a ship—even a ship without medical aid at hand. Here again the radio medical service supplies the necessary expert direction, while lay hands do the work.

This Prevented a Mistake

Serious mistakes have been prevented in many instances as evidenced by such radiograms as these:

Marine Hospital,
New York.

We have seaman with crushed hand in great pain. Only available relief spirits of chloroform. Please advise how to use and means of dressing hand.

Master, S. S. Comber.

The unfortunate seaman had much cause for gratitude, as the response from land read:

Master S. S. Comber,

Do not use chloroform. Clean hand thoroughly and apply iodine if you have it. If no iodine use water and apply heat in form of hot water bag or towel.

Medical Service, N. Y. C.

Often the hospital's advice will be "Take patient to nearest port as soon as possible. Arrange by radio to have ambulance meet your ship on arrival." Indeed, by the time the patient arrives at the hospital, the doctor is already familiar with his case, so that no time is lost in bringing him back to health.

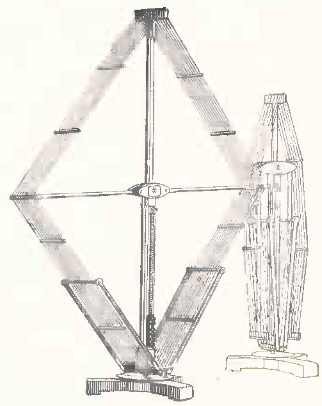
Medical Service Beats Broadcasting

In the radio medical service we have but another instance of the versatility of radio and its vast capacity for service. The public at large is too apt to consider radio only in terms of radio broadcasting which, after all, is mostly entertainment. But in the radio world, the broadcasting phase is of minor importance only, when considered side by side with commercial radio traffic.

TOBE C.
DEUTSCHMANN
Fine Radio Apparatus

STATIC ELIMINATION

WITH the approach of summer, every radio fan looks with a certain amount of dread to the Enigma of Radio—Static. For more than a quarter of a century, scientists in many parts of the world have applied their knowledge and skill to the problem of eliminating Static. Most of their attempts have resulted in failure.



Science recognizes but one device capable of curbing the annoying electrical disturbances, and that is the loop antenna. Electrical storms, like other weather disturbances, find their origin in various points of the compass. It is obvious, then, that by the use of a directional loop turned to a direction away from the disturbance, the disagreeable static noises may be tuned out.

The superior construction of the DTW IMPORTED COLLAPSIBLE LOOP enables it to perform this function to much better advantage than other loop antenna devices. Forty-two inches high by forty inches wide, its inductance consists of fourteen turns of genuine Litzendraht cable, made up of sixty individual strands, insulated, twisted and covered with double green silk.

The woodwork is mahogany and all metal parts are highly nickeled. A graduated metal table at the base accurately gives the station direction. The turns are sectionized and by unique design all "dead end" effect is absolutely eliminated. The center tap permits its use without modification for all types of Super Heterodynes. The loop is collapsible and by means of the adjustable slide it may be actually used as the tuning unit of the set. No other loop incorporates such perfection of design, and no other loop can give such marvelous results.

Price, $25.00

CUT OUT

I am interested in the DTW loop advertised in RADIO PROGRESS.

Please send me literature descriptive of the loop.

(Name). . . ..

(Street). . ...

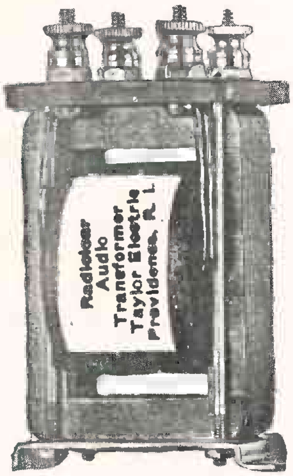
(City). . . ..(State)...............

TOBE C. DEUTSCHMANN
Sole American Distributor
46 CORNHILL, BOSTON, MASS.

How To Clean A Crystal

There is only one good way to clean a crystal from your receiving set. If you follow directions carefully, you will not only get reception as good as formerly, but ten to one it will be better than you ever brought in the music before.

Here is the way to do it. Take a 25c piece or 25c in stamps and send it to us with the request that we ship you an Audion Crystal. When you get it through the mail throw your old one on the dump. The result will be that you do not have to hunt for a sensitive spot on the crystal any longer, but by dropping the cat whisker anywhere you will get the music in as loud as you did on the best spot of your old crystal.



Perhaps you do not know that by combining a crystal with a single tube and using one of our RADICLEAR audio frequency transformers you can get loud speaker volume from the crystal detector. Of course, you will not be able to get more than fifteen or twenty miles range with the normal set but a local station is loud enough for dancing.

The particular advantage of the crystal is its clear tone. There is no distortion at all. If you combine this with an ordinary transformer which distorts, it is like getting a wonderful singer and then listening with cotton stuffed in your ears.

One reason for the clearness of the RADICLEAR transformer outfit is in the grade of Silicon steel used in the core. This is expensive, but we find that it pays dividends in the smoothness of the tone produced. The price of the transformer is $3.95. If you wish the rest of the kit consisting of socket, rheostat, "B" battery terminal, jack and wiring, then $6.00 covers the entire equipment. Use the coupon in the corner.

The Taylor Electric Company,
1206 Broad Street,
Providence, R. I.

Please send me the following by parcel post. (Mark which one you want.)
Radiclear Audio Transformer @ $3.95
Amplifier set complete @.......$6.00
(Socket to fit........tube)
Audion Crystal @ 25c.
Gold Plated Cat Whisker @ 15c.

☐ I enclose $.... to pay for these.
(These above prices include the postage.)

☐ Send them to me C. O. D. I will pay the above price plus postage.
(Indicate which way you wish to pay.)

Name.................................

Address..............................

TAYLOR ELECTRIC CO.

1206 Broad Street

Providence, R. I.