RADIO PROGRESS

"ALWAYS ABREAST OF THE TIMES"

Vol. 1, No. 10 AUGUST 1, 1924 15c PER COPY, $3 PER YEAR

Some Sets Squeal, Some Don't

Perhaps Something's Wrong with a Radio Which Won't Squeal

By HORACE V. S. TAYLOR

WHEN you tune your radio to your favorite station, one of these hot nights, perhaps you get a fine piece of music. Then, bang! In the middle of it comes a horrible howl from a nearby "blooper" or re-radiating set. At such a time one cannot see any good at all in a squeal.

As a matter of fact, there are two broad classes of radios. The first in point of invention, if not in goodness, is the regenerative set. The second is the set using radio frequency amplification. But regeneration is a wonderful thing when properly operated. It increases the range of a vacuum tube sometimes as much as 50 or 100 times. The general theory has been explained a good many times and is quite simple. It consists only of hooking the output or plate of the tube to the input or grid, so that some of the energy from the "B" battery is fed back to strengthen the weak signal coming in from the aerial.

The First Steam Engine

This calls to mind the first models of the steam engine invented by Watt. He designed an engine consisting of a piston, which traveled back and forth in the cylinder, and by its connected rod turned a heavy fly wheel. There was a valve in each end of the cylinder. When the piston got to the top of its stroke, a boy, who operated the engine, would open the valve and admit steam to push it down again. When it reached the bottom he turned off the top valve and opened the bottom, so allowing the steam to push the piston up again. Of course, it had to run at rather slow speed as it was limited to the quickness of the boy. This engine was made in several models until the idea was thought of to make the engine work its own valves. So the cocks controlling the steam were hitched up to the fly wheel in such a way that when the piston reached either end of its motion some of the energy of the fly wheel was fed back by a lever to the controls or valves, and so the motion was made self sustained.

There is the same difference between a regenerative and non-regenerative set. The latter, as illustrated in the hook-up in Figure 1, is very simple in operation, but it has a drawback. No very great distances can be covered. In fact, it is scarcely better than a crystal in this respect. Twenty-five to fifty miles is all that can be counted on in a real non-generative tube set. Sometimes we heard of longer distances being pulled in, but generally in such cases we find that as a matter of fact the set, while designed without a tickler coil, nevertheless, has the wires spaced in such a way that some feed-back action between the plate and the grid causes real regeneration.

Why Only Two Amplifiers?

It is this same idea of the proper spacing of the wires, which is often discussed in connection with audio amplifiers. Even on the most expensive sets, it is rare to see more than two audio frequency amplifiers. The reason is that when three of these units are hooked up one after the other, it is very difficult indeed to distribute the leads and connections in such a way that they do not react one on the other and cause a howl. Such a howl is evidence of this feed-back action, so the next time you hear a friend talk about getting several hundred miles on his radio, which he thinks has no feed-back, you can tell him that he is fooling himself.

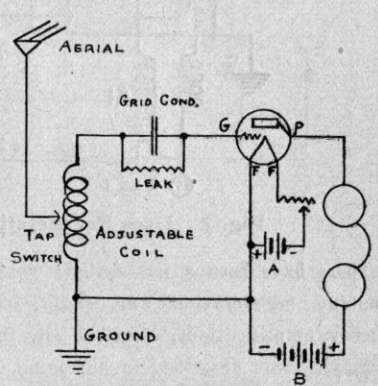

Fig. 1. Non-Regenerative Set

When Armstrong, or DeForest (they are still fighting to see which it was) first invented regeneration, it was hailed as being the most wonderful thing in radio next to the vacuum tube itself, but it has recently come into a rather bad name, owing to the terrible trouble caused by so many sets of this kind being improperly operated. As a remedy for this condition there have been several hook-ups invented which do away with it. These all depend on the basic principle of radio amplification. This latter differs from the audio in

this way. The audio waits until the detector makes music out of the incoming wave and then steps it up to make it a lot louder. It does not increase the range of the set very much, but does enable a loud speaker to be connected up instead of the phone.

Different with Radio Steps

Radio amplification, on the other hand, takes the waves just as they come from the aerial and increases their volume before feeding them to the detector. In this way the range of the set can be extended several hundred miles. If several steps are used, a loop aerial can be used in place of the ordinary outdoor wires. Such sets when properly constructed have no chance to squeal, as they do not oscillate.

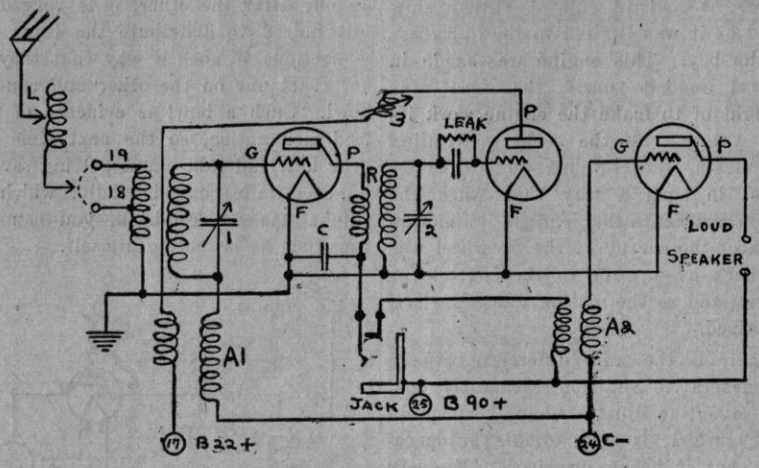

Fig. 2. Uses Regeneration and Radio Amplification

There have been a few designs which combine regeneration and radio frequency amplifications. Such a set, the Trirdyne, was described in our issue of July 1. The hook-up is shown in Figure 2. It will be seen that the incoming radio waves, after going through the tuner, reach the radio amplifier tube. From there they go through radio transformer "R" to the detector, but the plate of the detector is connected through Coil 3, which is an adjustable tickler, before they reach the audio amplifier. The second tube will oscillate and cause a squeal if the tickler is turned up too high. However, this squeal will be only in the ears of the user. It will not get on the line since the first tube acts in such a way as to block the squeals from running out backwards into the line.

Radio Amplifiers Don't Squeal

Most sets which use radio amplification do not offend in the way of squealing into the air. While the radio tube may not be entirely a one-way street to prevent oscillations going backwards, still it reduces them so much that they cease to bother other listeners-in in the vicinity. The only objection to these sets is that they are usually somewhat more difficult to build than those which have the detector for the first tube.

When a neighbor adjusts his set so that it squeals there is no way you can tune him out short of changing your adjustments to listen to some other broadcasting station. This is unfortunate but true. The reason is, if you want to hear, say, KDKA at 326 meters, then any one who works his set on 325 meters will interfere, and since the two waves are so close together, any one geting the one will get them both. No matter how good your radio may be, don't try to tune out your neighbor's squeals, as it is a waste of time since it *cannot* be done. The best cure for this condition is a sharp axe wielded by a Boy Scout. A few deft strokes on your neighbor's set will tune out the squeals completely.

Owing to the fact that regenerative sets have been put out in such large quantities in the past, and are so reasonable in price, it is conservative to say that fully 90 per cent. of the radios now in use operate on this principle. That being the case, it is necessary to take them into account.

For the benefit of those who use this type, but who have sets which are not working properly, the following description may be of interest:

How it Should Squeal

A regenerative set, if working properly, *can* always be made to squeal. It is very much like the brakes on an automobile. If they are properly adjusted, by pushing hard on the brake pedal, both rear wheels can be locked so they will slip over an asphalt pavement. Naturally this is rather rough on the tires, and furthermore, the car does not come to rest quite as fast as it would if the brakes were put on with just the amount of pressure so that the wheels almost slip, but don't. Once they begin to slide, the tires don't grip the ground nearly so hard, and so the braking action is considerably less. But here is the point: if your brakes are not powerful enough, or not adjusted so that you *can* slide the wheels when you want to, then there is no chance that you can bring them to the point of *almost* slipping.

Applying this to our radio problem, we shall find that the tuner is most sensitive when the tube is just at the point of oscillating. That is, the plate is coupled back to the grid so as to give just the right amount of tickler action, so that when the aerial starts a signal the feedback will just keep it up. If the tickler coil is turned on any stronger, then the tube won't wait for the aerial to give it the signal, but will start something itself with the result that our neighbors hear the squeal.

Is Your Tickler Strong Enough?

But we shall not be able to get the tube up to the point of oscillating unless the tickler is strong enough to go a shade farther and make it actually oscillate. Here again it is not that we want it to break into vibrations of itself, but we want it to be *able* to do so. But some sets through one trouble or another will not work this way and so do not make good receivers.

One thing which often causes this trouble of not being able to oscillate is shown in Figure 3. This is an ordinary single circuit hook-up with a variocoupler and tap switch for coarse adjustments and a series condenser for fine tuning. Regeneration is controlled by turning the rotor of the coupler. The output goes from the plate to the tickler plate or rotor and then to the jack and "B" battery. Let us assume for an in-

stant that this is all there is to the set; that is, the audio amplifier shown on the right has not yet been added. In that case, the telephones will be connected into the circuit where the jack is.

By-Pass or Stopping Condenser

Now notice the condenser "C." It is called the by-pass or stopping condenser. It has a very distinct use in the circuit. The output of the plate "P" contains two parts—the high frequency, going about one million times a second, and the low or audio with a speed of a few hundred cycles. Both these go through the tickler, but owing to the low speed, the audio does not have any effect on it. It is the radio frequency which reacts on the grid to cause oscillation. But when these two vibrations reach the point "X" they divide. The higher is able to go through condenser "C" which usually has a value of .001 mfd. (microfarads). As a matter of fact, it can't go the other way through the phones because their impedance or electrical weight is so great that they can't be made to vibrate at such tremendous speed. But the audio frequency can shake up the diaphragm at its vibration without any trouble. Of course, the low pulsations are not able to go through condenser "C" as they are too slow to affect it.

It oftentimes happens that in one tube sets, especially those made at home, that condenser "C" is omitted. This causes no trouble for the reason that the telephone cord acts like a condenser itself. You see it is built of two conductors or wires which are separated by an insulator, that is, the silk of the cord. Now any two pieces of metal separated by an insulator will form a condenser. Such a cord has a capacity not quite as big as that mentioned for "C," but still large enough to enable the radio frequency to pass and so work the tickler to cause oscillations.

Adding One Step

However, we have decided to make our single tube set over to use a second one. After connecting up the one step amplifier, as shown in Figure 3, we find that the detector will no longer oscillate, and as a result we cannot get the distant stations the way we used to. What is the trouble? The answer is this: When the phone plug is inserted in the detector jack, it puts the cord in circuit and it acts as condenser "C" as just described, but when we pull out the plug, and so connect the primary of the audio transformer in its place, then we have suppressed the condenser. How then will the radio frequency get through? It can't go through the transformer, since the inductance of this instrument is about the same as that of the phones it replaces, and instead of having six foot leads to act as a condenser, its connections are made by wires only an inch long and separated some distance apart, so you can't blame the radio waves for dying in their vain attempt to get back to the filament.

This explains why a good many sets will not work as well with one step of amplification as they did on the detector alone. Of course, the remedy is very simple. A .001 or .002 mfd. condenser, costing fifteen cents, can be connected,

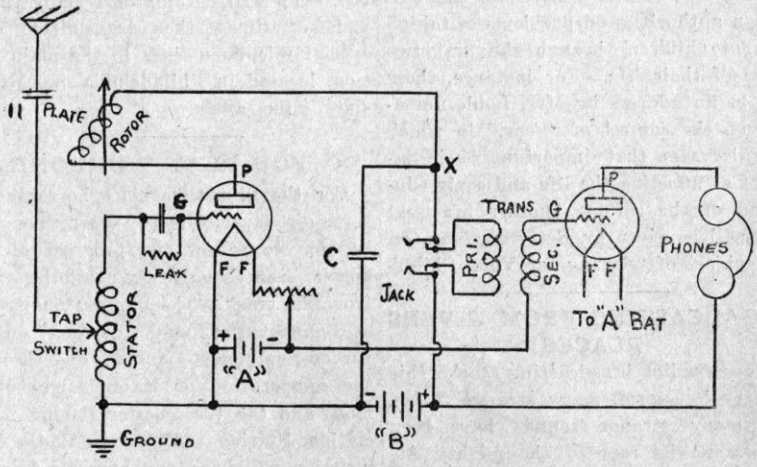

Fig. 3. How to Add One Audio Step

as shown in the diagram, and it will immediately restore the radio to its former efficiency. When the phones are plugged into the jack it merely puts the two capacities ("C" and the phone cord) in parallel, which raises the total value somewhat. But this does no harm since the value of capacity is not critical at all. Any reasonable figure is quite satisfactory.

Some Tubes Won't Squeal

In case your regenerative set will not oscillate when you want it to, and contains the condenser we have been discussing, then the next most likely place to look for trouble is the tube itself. Some tubes make much better detectors than others even of the same style. This can easily be proved by trying out several tubes in your set and noticing how far the tickler dial has to be turned to make the set start to squeal. With some tubes this action will occur at half the reading that others require. If you have only one tube to try then it is difficult to test to see whether it is at fault or not. In such a case it is well to borrow a neighbor's tube just long enough to see if it makes any difference.

If neither of the above causes are responsible, and a new set will not oscillate, it usually means either that there is a wrong connection or that the tickler leads are reversed. Try interchanging the two connections to the rotor of the variocoupler and if that is the trouble it will be easy to get the tube to squealing.

Just a word of caution here. In consideration to your friends the testing which has just been described should be tried late at night so as not to disturb other broadcast listeners who may want to enjoy the regular programs.

KEEPING IN THE SWIM

Westinghouse Station WBZ is playing an important part in the "Learn to Swim" campaign which was conducted recently in the city of Springfield (Mass.). The campaign was not only a timely one with the swimming season setting in, but much valuable information was imparted. WBZ radiocast several of the talks given by authorities on swimming and helped wonderfully in putting over the promotion. The broadcasts included talks on various swimming strokes, reasons why every person should learn to swim, and methods of resuscitation.