RADIO PROGRESS

"ALWAYS ABREAST OF THE TIMES"

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How to Make Your Ground Better

What Reason Have You for Thinking Yours is a Good Ground?

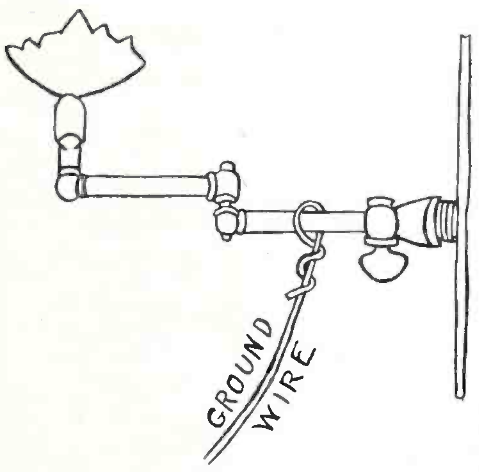
By HORACE V. S. TAYLOR

ALMOST every radio set must have a ground. Perhaps you think you are operating your set without one when listening to a local station if you have taken the ground wire off, but you are not. You are really using a capacity ground. A capacity ground uses the condenser action of the set itself to get the electric waves to earth. This is the way it works; the whole set is one plate of a condenser, the earth the other, and the waves go through the air between them in the same manner as they go through the variable condenser you use when you tune in your set. The same action occurs when you use a counterpoise—the counterpoise is connected to the ground post of the set, and the condenser action (as described above) carries the waves across the intervening air space, and so the set really is grounded.

The only style of set which really does not require a ground is the one using a loop aerial; we mean a real loop aerial, one that has two terminals, both brought to the set. Many amateurs use a wire wound on a square or diamond shape form, and connect the outside end only to the aerial post of their set. However, such coil does not constitute a real coil aerial. The essential difference is that a real coil aerial always has both ends connected to the set and no ground connection at all.

Some Common Mistakes

One of the common faults with the ground system of a radio set is illustrated as Fault No. 1. This shows a ground wire attached to a gas pipe. There are two objections to this practice. As you know, gas is under a very small pressure in the pipes. As a



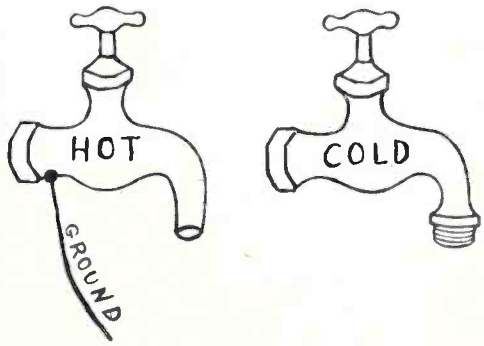
Fault No. 1

matter of fact, the pressure is so low that you can easily blow backward through a gas pipe and by filling it with air can blow out the lights in adjoining rooms. This delicate attention to one's neighbor often occurs in a college dormitory where one fellow will put out the light of his roommate at a critical point in the evening's work. On the other hand, water pipe has to stand very heavy pressure. For this reason the joints of the water pipes are usually screwed up a great deal tighter than the joints in a gas pipe. Of course a lot of the electrical resistance in a pipe may easily occur at a joint not properly tightened, and this is one very good reason why a water pipe is better for a ground than a gas pipe.

Underwriters Forbid It

Another good reason against using a gas pipe for a ground is that the fire insurance companies prohibit it. Their theory is that if a gas pipe should happen to spring a leak, and at the same time any large current should happen to go down the wire and make a spark, it would perhaps ignite the gas with resultant fire or explosion. Of course, no such danger attends grounding on a water pipe.

Another mistake along the same lines is illustrated as Fault No. 2. Here we have hot and cold water faucets. You will notice the ground wire is attached to the hot rather than the cold water faucet. The objection to this form of ground is that the electric waves will have to go to the hot water heater and perhaps to the kitchen range before they find the cold water connection and

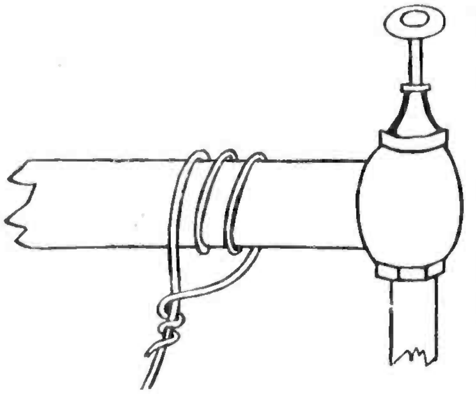


Fault No. 2

are able to run through the cold water pipes out into the ground. You will realize that the electric waves are not interested in the pipe or the wire itself, but are only intent on reaching the real, solid ground, and so have to wander around the piping in your house until they are able to reach the service entrance of the water pipe in your cellar and go directly to the earth. For this reason, be sure that you always ground on the cold water pipe rather than the hot water.

Don't Wrap the Pipe

After you have found the correct pipe on which to ground, perhaps you have made mistake No. 3. This may seem like a simple trouble, but it sometimes causes serious difficulty in the operation of a set. You will notice the wire is wrapped around the pipe several times and then twisted back on itself. Such a method will sometimes make a good ground which will last for a short while, but eventually it is very apt to fail through corrosion of the pipe or the wire.



Fault No. 3

The only satisfactory way to attach your ground wire to the pipe is to use a copper ground clamp. Such a clamp can be obtained at the cost of eight or ten cents, and it is foolish to attempt to make a homemade device do the work of such a cheap piece of apparatus.

Of course, if the wire had been soldered to the pipe, it would have made a satisfactory connection, but if you have ever tried to solder to a pipe with water in it, you will know it is almost an absolute impossibility, and it is quite a lot of bother to draw the water off before attempting to solder. It is better to use the clamp.

Do You Go Up to Ground?

Some installations look like picture No. 4. You will notice here the ground wire does not run straight down, but first goes up to the ceiling and across the room before going down cellar to the water pipe. This is a mistake, because it runs so much higher than the set that it has the tendency to act as an aerial and robs the set of some of the energy it would otherwise have. If at all possible, the ground wire should run down from the set and should not rise above its level at any time before going down into the cellar. If necessary, a bare braided copper wire may be run under the carpet from one side of the room to the other. Then you won't have to go up to the ceiling at all. The braided wire will be flattened out enough so that it will not damage the carpet nor be injured itself by people walking over it.

Have you seen a radio installed with Fault No. 5? You will observe that the aerial and ground wire run side by side for a considerable distance before separating. This is like the mistake we depicted in the article on aerials in our last issue. Where the ground approaches so close to the aerial wire the condenser action between the two will steal a large proportion of the music which comes in through the air. In the illustration shown, if the ground wire had been run straight down to the floor, then along the floor to the left hand corner, it would have separated the two wires several feet apart and this would have caused no trouble.

One Wire Per Hole

Also, be sure that you do not make the mistake, which is seen so often, of running both wires through the same hole in the wall or partition. If you do, you are throwing away a good deal of your energy.

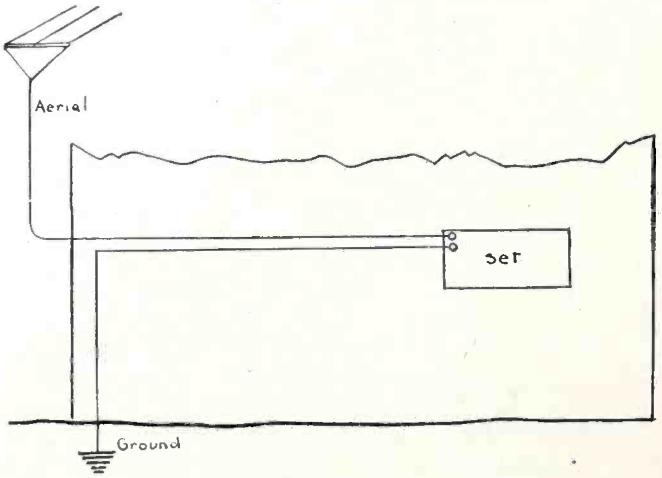
Now look at Fault No. 6. Here we have a set connected quite properly to the water pipe in the cellar, but you will notice that the wire is not continuous. Evidently in installing this set the wire was a little short and had to be pieced to enable it to reach down to the cellar to the water pipe. Of course, such a thing often happens, but when it does,

Fault No. 4

the joint should not be wrapped only, as shown in the picture; after wrapping it should be soldered. The reason for this requirement is that the underwriters specify that all joints in the ground wire must be soldered unless fastened by some sort of approved clamp. Their attitude is that the same ground wire is usually connected to the lightning arrester, and if lightning should strike your house you naturally want the ground wire as near one hundred per cent. perfect as possible, so as to make sure that all electricity will be brought to ground and none of it be left to wander around your rooms to set fire to your furniture.

Moonlight Rambles Bad for Ground

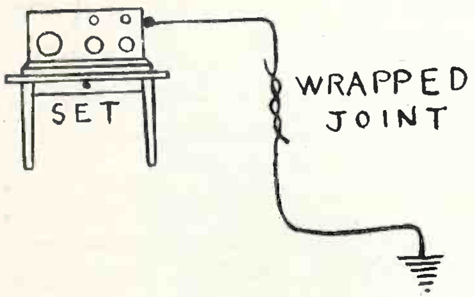
Fault No. 7 shows how a ground wire often rambles all around a house before reaching the cold water pipe. This is quite undesirable. The more direct and short a ground can be made the better your set will operate. When you have such a long wire as is shown in the picture it adds considerably to the resistance of the circuit, and this is a two-



Fault No. 5

fold disadvantage. In the first place it reduces the loudness of the broadcasting, and in the second place it makes it more difficult to tune out undesirable stations. If your set does not reach out as far as your neighbors, make sure that your ground wire is direct and as short as possible.

If you find trouble in running the wire direct to the cellar, the difficulty usually is that you can not get through some floor or wall. So you must run the wire to some actual opening like a door or a crack which already exists. But this is unnecessary. For about ten cents you can buy an electrician's auger, which is about one foot long, and with it you can drill a hole through the wall or floor quite quickly and easily. The size of the hole is so small, smaller than the diameter of an ordinary telephone cord, that it is very unobtrusive. Through such a hole you can run your bare ground wire without experiencing difficulty, and by doing so the wire will be short and direct, as it is necessary for best reception.



Fault No. 6

Oftentimes grounding on your radiator is a case of rambling. Before you ground on your radiator, make sure that the radiator pipes are pretty straight down to your cellar, and that the cold water pipe running to your furnace is not unduly long and winding. You see, the radiator itself is not a ground, nor is the furnace. It is only because the radiator pipes connect to the furnace, and the furnace connects with the cold water pipe that it is satisfactory to use the radiator at all. If these pipes are comparatively short and direct, then no harm can be done to your reception, but if they ramble around the house before getting to the cold water outlet, you will get better operation if you run a ground wire direct to the water pipe. A further objection to grounding on the radiator is that if you have an outside aerial the underwriters require that you have a direct wire ground running down to the water pipe, and they will not pay your fire losses when the house burns if they find you used the radiator for a ground.

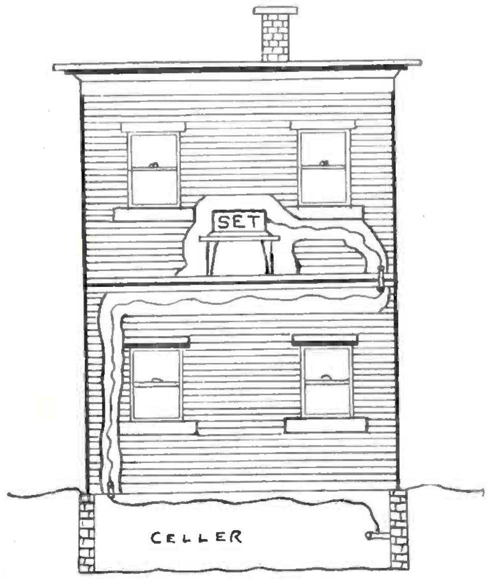
Just Where Should Ground Be Connected to Pipe?

By the underwriters' rule the place to attach your ground clamp and wire is on the cold water pipe just as close as possible to the point where it enters your cellar. This is usually right by the water meter. If your house is wired for electricity, you will doubtless find that the lighting people have used the same place as a ground for their equipment. If such is the case, it does no harm for you to ground an inch or so away from these connections, and right on the same pipe.

If You Have No Running Water

But let us suppose you are in the country and have no running water. What is the best method of making a ground under such conditions? Some exhaustive tests on grounds have lately been conducted by the *Electrical World* and reported by them in recent issues. Should you have no city water supply coming into your cellar, the best method is to drive some pipes down into the ground and connect to them. However, do not make the mistake illustrated in Fault No. 8. You will notice this pipe is not driven very deep. In order to make a good ground, it should enter permanently moist soil to a depth of three or more feet. Since the permanently moist soil is usually found at least four feet below the surface, it means that your pipe should be driven to a depth of seven or eight feet. In driving it is not necessary to buy a special tip, as it is found that a pipe with an open end will penetrate most soils that are not too stony in character. In case your land contains too many small stones it becomes rather difficult to force a pipe down to such a depth. Here the best method is to get a sharp pointed steel rod and drive it down first, then remove it and drive the pipe in the same hole. Care should be taken to use a steel rod smaller in diameter than the iron pipe because it is quite necessary that the pipe fit tight in the hole to give a good contact to the surrounding earth. The upper end of the pipe may be left projecting as far as you like. It should be attached to the ground wire by a copper ground clamp.

If you are using this style of clamp do not make mistake shown in Fault No. 9. This mistake consists in using a *single* pipe driven in as described. Such a pipe, owing to its short length, has a high resistance. If you are using driven pipes for ground, at least *two* should be used, and three would be better still. If they are spaced as far as five feet apart, the resistance is reduced to half or one-third, but even if they are only a couple of feet apart, the second helps quite a lot in reducing the resistance and so improving the operation of your set. In connecting up two or three pipes, run a wire to each pipe, and then solder these two or three wires together and to the ground wire running to your set. This will make quite a satisfactory installation.



Fault No. 7

Fault No. 10 is difficult to illustrate. It consists of attaching a ground clamp to your pipe without properly attending to its surface. When a pipe has been in use for some time it becomes dirty and oftentimes rusty or corroded. Such a coating on the outside is a pretty good insulator to prevent radio waves getting from the clamp to the pipe itself. The only good method of removing this scale is to take a piece of sandpaper and polish the outside of the pipe for the length of a couple of inches. When it has been brightened up so it shines all the way around, you can put the ground clamp on. If you screw it down tight, you will find the good contact you get will last over a long term of years.

This may seem like a small point, but many a radio set is crippled somewhat in its operation by carelessness in this regard.

Continued on Page 8

HOW TO MAKE YOUR GROUND BETTER

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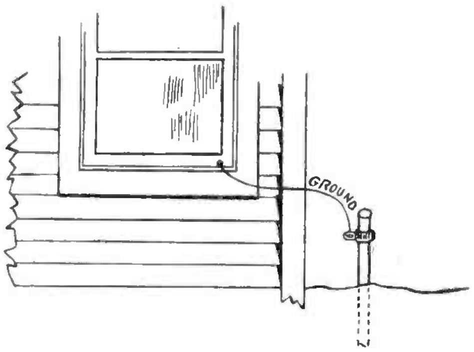

Faults Nos. 8 and 9

What About Insulated Wire?

Many amateurs use insulated wire for the ground. There is no real objection to this practice. However, it is going to unnecessary expense to put an insulated coating on the wire you are to use for the ground. The idea is the radio waves come in through your aerial and do their best to get to ground. The aerial for this reason must be insulated (either by using insulated wire, or by supporting bare wire on insulators) if you want the waves to go through your set; but after they have gone through and made music in your phones, you want them to reach home (ground) as soon as possible. How unnecessary it is, then, to cover the ground wire with insulation. If this wire *should* happen to touch any piece of metal, like a furnace pipe, for instance, it would improve the operation, if it had any effect at all, because it would give the radio waves an even shorter path to ground. On the other hand, if it did not happen to touch any metal, then it would be insulated, even though bare wire, and any further insulation on the wire would be entirely superfluous. Dry wood or plaster, you known, is a good insulator. With nothing to lose and the possibility of gain, there is no reason why bare wire should not be used. But if you already have insulated wire installed, there is no particular advantage in tearing it up, but on new work, use bare wire. Ordinarily, No. 14 is recommended by the fire insurance companies, unless it is connected to the lightning arrester, in which case No. 10 wire is specified.

On the whole, if you will look over your wiring with the idea of getting the electricity from your set to a good moist ground just as quick and direct as possible, you may find that you can improve the operation of your set at a very small outlay of money and time.

In the next issue we shall discuss some of the ordinary errors we find in the installation of lightning arresters.