# The Importance of a Good Earth

## Ground Connections for all Conditions

*(By "R.W.H.")*

*THE summer months have brought more forcibly before every set owner the need of a good ground connection. Correspondents almost weekly comment on different types they have tried, quite often with remarkable success. It pays to experiment, and to those interested in radio reception the following article is very suggestive.*

A CONSIDERABLE proportion of the wireless receiving sets used to-day have their performances impaired by the fact that they are not properly earthed. There is a prevailing impression that any kind of water-pipe—or even a gas-pipe—makes a satisfactory earth, whilst many of those who use a buried earth plate of one kind or another are content to put a piece of metal with a wire attached to it into a hole dug in some odd corner, believing that they have done all that is necessary. As we shall see in a moment, water-pipe earths may be unsatisfactory, gas-pipe earths usually are, (besides being illegal), and buried earths depend for their goodness or otherwise upon a number of important considerations.

### What is the Earth?

FIRST of all, perhaps, we had better see what is meant in electrical parlance by the term earth. If you take a piece of string a yard or so in length, put your foot on one end of it, and move the other rapidly about, wave forms will pass down the string. One end, that upon which your foot rests, is fixed, and the string shows its greatest variations from the straight line at the end held by the hand which is moving it to and fro.

Oscillating potentials behave in very much the same way in a collector system consisting of an aerial and earth with a coil between them. Electrically the term "earth" means zero potential and corresponds to the fixed end of the string. If the earth connection is as nearly perfect as may be one end of the aerial coil is at earth potential and practically the whole of the oscillations corresponding to the movements of the string then take place across the aerial coil. When this is so the maximum signal strength is obtained in the wireless receiving set. The grid of the first valve is receiving the greatest possible voltage changes and the valve is, therefore, able to do its work effectively.

But suppose that there is a high resistance between the low potential end of the aerial coil and the earth connection what will be the result? Only a portion of the voltage changes will occur across the aerial coil, the rest taking place across the resistance. It follows that the voltage changes applied to the grid of the first valve will be smaller than they ought to be and that signal strength will suffer. We can at once see why it is important to keep the earth lead as short as possible; any wire, whether straight or wound into a coil, possesses both resistance and inductance, hence the longer the earth lead the greater will be the oscillating potentials along it, and therefore the greater the loss to the receiving set itself. Clearly, too, the lead must be of heavy wire in order to keep down the resistance. Remember that though a resistance may have a small direct current value its oscillating current value may be very much higher.

### Water-pipes as Earths.

NOT by any means do all water-pipes make good earths. I have seen earth leads connected to pipes which, on examination, turned out to run simply from cisterns to taps. These are usually hopelessly bad. The only kind of water-pipe that can make a good earth is what is known as the "rising main," that is, a pipe in direct connection with the underground system. In this case we have a metal pipe containing always a column of water. If the joints in the pipe are bad from an electrical point of view the water is there to bridge them. But there is difficulty in making a really satisfactory connection for a wire to such a pipe. Water mains are usually of iron, a metal to which it is exceedingly difficult to solder. The only really satisfactory method is to clean a portion of the pipe until it is quite bright and then to fix the earth lead to it by means of a firmly-clamped clip.

No water-pipe, however, should be accepted as the perfect earth until experiments have been made in other directions.

Gas-pipes are thoroughly bad since they contain no conducting column and their joints are often sealed with a compound which has a high electrical resistance. In addition there must always be a certain element of danger in making use of them for the purpose and most gas companies rightly prohibit the practice.

### The Buried Earth.

WE next come to the buried earth, which is excellent so long as care is taken to see that it is put in a suitable place. Don't imagine that every part of the soil is always a good earth contact. It isn't! In many places the upper layers of the soil consist largely of gravel, which allows moisture to percolate very easily, and in fine weather soon becomes quite dry. Dry gravelly soil may have a very high electrical resistance. An earth connection buried in it may, therefore, lead to surprisingly bad reception results.

A case in point came the way of the writer a couple of years ago. A friend who was the owner of a very good receiving set complained that he could hear nothing but the local station and not very much of that. Since the aerial and the set itself were above reproach, we decided to investigate the earth. On inquiring, I was told that this consisted of a copper plate buried some three feet deep close to the house. We dug down to it, the soil proving to be, as I expected, of a gravelly nature. We then deepened the hole and about a foot further down came upon clay. Immediately the earth plate was placed in contact with the clay signal strength from the local station increased by at least 50 per cent., and no difficulty was found in receiving a number of other transmissions. Clay is a moisture-laden substance which is ideal for earth connection. If you want good results, let your motto be get down to clay.

### When a Good Earth is Impossible

IT may, however, happen that the gravel stratum is so deep that it is impracticable to sink a hole right through it for the earth connection. There are two possible alternatives. The first is to discard the earth connection altogether, and to make use in its stead of a counterpoise. The counterpoise is really a second edition of the aerial, suspended six feet or so above the surface of the ground and just as carefully insulated. In some instances (particularly where interference from trams, electric railways, and so on is a nuisance) the counterpoise may give better results than an earth, and generally speaking it makes for rather greater selectivity. It has, however, one great drawback; it means more wires in one's garden. A simple form of counterpoise which is sometimes effective may be contrived by stapling down fifteen or twenty yards of insulated wire under the carpet in the room in which the receiving set is situated. The wire should be arranged more or less in spiral form. This device, however, will not answer very well in rooms of an upper story.

The second tip is one that will be found useful in many localities. Fix in your mind's eye an imaginary line