The Marconi magnetic detector consists of an endless band built up of 70 strands of number 40 silk-covered iron wire. The band passes over two grooved pulleys which are kept in rotation by a clockwork motor and at a certain point in its journey passes through a small glass tube wound for a length of about two centimetres with a layer of number 36 silk-covered copper wire the ends of this wire which form the primary winding being brought out to terminals. Over this winding is a small bobbin wound with wire of the same gauge to a resistance of about 140 ohms, this forms the secondary winding and the ends are taken to terminals to which the telephone receivers are also connected. Above the coils are arranged two pemanent horseshoe magnets, with like poles together as shown in diagram. The detector depends for its action on the fact that electrical oscillations have the ability to annul the magnetic hysteresis of iron. Reference to (fig. 49) will perhaps help to make this plain. Suppose a certain piece of soft iron, say the core of an alternating-current transformer, to be subjected to a magnetising force H which rises to a maximum, descends to zero, then attains a maximum in the reverse direction and again desends to zero, it will be found that if the magnetising force H is plotted against the density of the lines of force B the curve will assume the shape shown in (fig.49). Starting from zero, if the magnetising force is gradually increased to the maximum and the value of the flux density for each increment of the magnetising force noted, we get the curve to 1. If now the force is decreased to zero the curve will not return on itself, but will follow the direction 1, 2, and if the iron be now subjected to a magnetising force in the reverse direction the curve will take position 2, 3, 4, 5. It will thus be seen that the magnetic effect on the iron owing ti its hysteresis lags behind the magnetising force operating to produce it, and that after it has been magnetised it will retain its magnetism for some time after the withdrawal of the magnetising force. It is this lagging that the electrical oscillations passing through the primairy annul. Consider now the magnetic detector itself. We have here a soft iron band passing before the poles of two permanent magnets, as each portion of the band passes the poles it becomes magnetised and by the action of the clockwork motor this magnetised portion is carried forward. If now electrical oscillations pass through the primairy windings the hystersis of the band is annulled and the magnetised portion which has moved out of the field of the magnet has its magnetism destroyed and a redistribution of the lines of the force through the second ary winding takes place, which sets up a current in it and the telephone receivers which are connected to it and a sound is thus produced. Figure 50 shows the instrument as manufactured by the Marconi Company; it will be seen that there are two sets of coils and magnets. The clockwork and moving iron band being common to both. In the event of one side breaking down all that is necessary is to change over to the other side. On the left hand of the instrument is the winding key and the key to start or stop the clockwork, the adjusting screw at the right is to regulate the tension of the moving iron band.

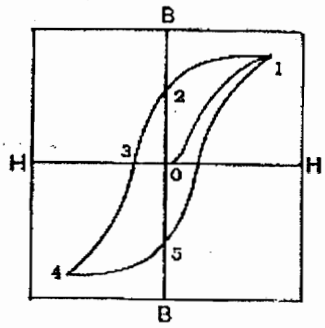

FIG. 49

Figure 51 is a diagram of the detector and shows the magnets in the most sensitive position-*i.e.* with like poles together. In this position, althrough very sensitive, a breathing noise is sometimes produced in the telephone which is very disturbing when reading weak signals.

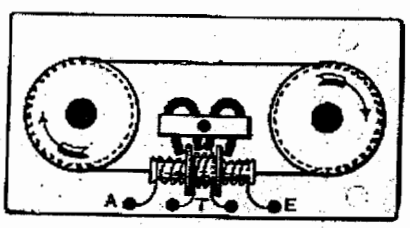

FIG. 51
Magnetic detector

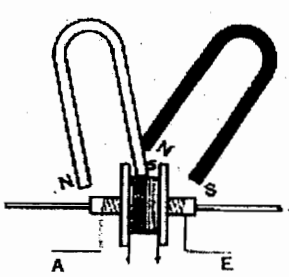

FIG. 52

This can be overcome by placing the magnets, as in (fig.52), with unlike poles together, the pole of one being some little distance up the limb of the other, or moving the magnets away from the band, the best position being found by experiment. The magnets used on this detector have one face brightly polished and the other blackened. When both bright faces or both black faces are to the front like poles will be together, when one bright and one dull face to the front unlike poles will be together. In practical use this detector has proved itself to possess the great merit of reliability. It is also sensitive and needs practically no attention beyond occasional winding of the clockwork