

45.
"Lines of
force."

hood of the poles of magnets;¹ inquired into the nature and condition of the region—afterwards termed the "field"—which surrounded magnetised and electrified bodies; invented the term "electrotonic state" and "dielectric"² to describe the part which the surrounding medium played in the so-called actions at a distance; and conceived it to be in a state of tension, which he further described by filling it with so-called "lines of force." The region or "field"³ of magnetic and electric action, filled with these curved lines of force, possessing definite direction and frequency, gave him a clear mental representation of the direction and intensity of magnetic and electric forces at any point in space in the neighbourhood of magnets or of electric currents. For Faraday, the lines of force in the magnetic field, from being originally merely a convenient geometrical device,⁴ ac-

¹ "By magnetic curves I mean the lines of magnetic forces, however modified by the juxtaposition of poles, which would be depicted by iron filings, or those to which a very small magnetic needle would form a tangent" (Faraday, 'Experimental Researches on Electricity,' 1st series, November 1831, No. 114 note). "When an electrical current is passed through a wire, that wire is surrounded at every part by magnetic curves, diminishing in intensity according to their distance from the wire. . . . These curves, although different in form, are perfectly analogous to those existing between two contrary magnetic poles opposed to each other" (ibid., 2nd series, January 1832, No. 232).

² The term "electrotonic state" was introduced in 1831 to describe the conditions of matter in the neighbourhood of electric bodies. "It is probable that what will affect

a conductor will affect an insulator also, producing, perhaps, what may deserve the term of the electrotonic state" (ibid., No. 1661, 1838), "the intervening particles assuming for the time more or less of a peculiar condition, which (though with a very imperfect idea) I have several times expressed by the term electrotonic state" (ibid., No. 1729). "I use the word 'dielectric' to express that substance through or across which the electric forces are acting" (December 1838, ibid., No. 1168, note).

³ The term "magnetic field" seems to have been used for the first time in the year 1845 (see 'Exp. Res.,' No. 2252, vol. iii. p. 30).

⁴ November 1837: "I use the term *line of inductive force* merely as a temporary conventional mode of expressing the direction of the power in cases of induction. . . . The power, instead of being like