quired gradually a physical[1] significance, for he had very early convinced himself of the fact, known already

that of gravity, which causes particles to act on each other through straight lines, . . . is more analogous to that of a series of magnetic needles. . . . So that in whatever way I view it, and with great suspicion of the influence of favourite notions over myself, I cannot perceive how the ordinary theory . . . can be a correct representation of that great natural principle of electrical action" ('Exp. Res.,' No. 1231). "I have used the phrases *lines of inductive force* and *curved lines* of force in a general sense only. . . . All I am anxious about at present is, that a more particular meaning should not be attached to the expressions used than I contemplate" (ibid., No. 1304). And after having referred to the agreement of his results with those of Poisson, arrived at by starting from "a very different mode of action," and with the experimental results of Snow Harris, he concludes by saying, "I put forth my particular view with doubt and fear, lest it should not bear the test of general examination," &c. (No. 1306).

[1] It took more than ten years before the purely geometrical or conventional use of the term "lines of force" ripened into a physical conception. The latter is definitely expounded in a paper in the 'Philos. Magazine' for June 1852. We can compare this gradual development of a symbolical into a physical theory with the gradual development of the atomic theory; atoms and molecules becoming a physical necessity to chemists long after they had been used simply as a convenient representation of the laws of equivalence and of the fixed proportions of combination (see vol. i. of this work, chap. v., p. 432, &c.) Faraday, during the years 1840 to 1850, laboured at two great problems: the one he solved brilliantly and in the direction he anticipated; the other remains a problem to this day. The first refers to the action of magnets on the dielectric. The dielectric, the space which Continental philosophers considered as a vacuum so far as magnetic and electrical phenomena are concerned, had been filled by Young and Fresnel with the luminiferous ether. Faraday suspected that this luminiferous ether cannot be insensible to magnetic action, and he sought in the experimental proof of the action of magnets on rays of light in the surrounding space a support for his view of the part which the dielectric plays in the transmission of electric and magnetic action. After many ineffectual attempts to prove this, he could at last (November 1845) announce his results to the Royal Society as follows: "These ineffectual exertions . . . could not remove my strong persuasion derived from philosophical considerations; and therefore I recently resumed the inquiry by experiment in a most strict and searching manner, and have at last succeeded in *magnetising and electrifying a ray of light, and in illuminating a magnetic line of force*. . . . Employing a ray of light, we can tell, *by the eye*, the direction of the magnetic lines through a body; and by the alteration of the ray and its optical effect on the eye, can see the course of the lines just as we can see the course of a thread of glass or any other transparent substance, rendered visible by the light" ('Exp. Res.,' vol. iii., No. 2148 and note). The second problem which Faraday attacked was to prove a similar "connection be-