A pupil of Dalton, Joule was early drawn into the circle of ideas and investigations which are contained in Faraday's experimental researches. With much ampler means, and possibly also with a greater love for accurate quantitative measurements, than Faraday possessed, he grasped the great importance of the law of electrolytic equivalence as affording the means of accurately measuring chemical processes, and of giving definite expression to the vaguer ideas supported by Faraday and others that force was indestructible, and that the different forces of nature were mutually convertible. These ideas had received popular circulation and current expression in Grove's celebrated lectures on the "Correlation of Physical Forces" in 1842 and 1843. Joule, in whose mind they seem to have existed as axioms, set himself to devise accurate instruments and methods by which the convertibility of different forces, their "mechanical duty," could be measured, and their equivalence put into figures. The first numbers which Joule found differed considerably,[1] so that the conclusion arrived at that the mechanical duty or "value" of a degree of heat is a constant quantity could only have been drawn by one who had a strong *a priori*[2] con-

[1] For details see Helm, 'Energetik,' p. 34; also vol. i. p. 265, note, of the present work. Joule's equivalent varied from 742 to 890 foot-pounds, and was finally fixed at 772 in 1850, this figure being correct to ½ per cent (Joule's 'Scientific Papers,' p. 328).

[2] Philosophical considerations are mixed up with all the early enunciations of the principle of the indestructibility of force, or energy as it was later more clearly termed. A predisposition to believe that some quantity besides matter could not be lost or created, but only preserved and transformed, existed in the minds of Mohr, Séguin, Mayer, Colding, Joule, Hirn, and has been traced variously back to the writings of earlier thinkers, such as Montgolfier, Faraday, Davy, Oersted, Leibniz, &c. Prof. Mach ('Wärmelehre,' p. 238, &c.) discusses this point fully. The principle gradually became firmly