the great reciprocal influence which science has gained in the course of this century over practical life, I am still doubtful whether scientific thought has, at the end of our century, as yet balanced the debt which it owes to practical inventors. It is instructive, for instance, to consider how much, in the hands of Rumford, of Sadi Carnot, of Hirn, and of Rankine, science has learnt from the steam-engine, and to reflect whether from all the theoretical insight gained any really radical improvement of the steam-engine—still one of the most imperfect machines—has resulted.[1]

Lord Kelvin; and it has in another direction led to remarkable scientific results in the hands of Gauss, who between the years 1830 and 1840 brought the theory almost to perfection. Here again the physical phenomenon required for its treatment a special mathematical analysis, which Gauss greatly furthered in his 'Allgemeine Lehrsätze in Beziehung auf die im verkehrten Verhältnisse des Quadrats der Entfernung wirkenden Anziehungs- und Abstossungs-Kräfte' (1840). This is a mathematical investigation of the Newtonian gravitation-formula. Gauss followed out the theories of Laplace and Lagrange simultaneously with Green, whose now celebrated memoir on the subject remained long unknown (see *supra*, pp. 231, 247). The mathematical theory showed that in a sphere containing a certain amount of attracting (magnetic) matter an ideal distribution on the surface of the sphere can be found which takes the place of the real but unknown distribution in the interior, and that if through observation the necessary data are supplied, the magnetic condition of any point on the surface can be foretold with great approximation. As an example, Gauss foretold from the imperfect data at his command the position of the south magnetic pole. In 1840 Capt. Sir James Ross approached it sufficiently to show the correctness of the calculation. The theoretical investigations in connection with magnetic attraction and with tidal movements have remodelled the methods of observation of the phenomena themselves, the older methods having proved to be in many ways insufficient. A full account of Gauss's labours here referred to will be found in E. Schering, 'C. F. Gauss und die Erforschung des Erdmagnetismus,' Göttingen, 1887.

[1] I refer in this matter to two addresses delivered recently—one by Prof. Unwin ('Electrician,' vol. 35, pp. 50 and 79) on "The Development of the Experimental Study of Heat-Engines"; the other by Prof. Lodge on "The Second Law of Thermodynamics" ('Electrician,' vol. 35, p. 80 *sqq.*) From a perusal of these papers one gains the impression that science has been more successful in teaching us why the steam-engine is so wasteful a machine than in showing how it can be greatly improved. It is interesting to hear that "al-