

11.
Newton's
'Principia.'

work, however, was conceived in the highest philosophic spirit, inasmuch as the enunciation of the so-called law of gravitation required the clear expression of the general laws of motion. In the first and second parts of the work the discoveries of Galileo and Huygens were absorbed, generalised, and restated in such terms as have up to our age been considered sufficient to form the basis for all purely mechanical reasoning.¹ In the latter part the new rule, corresponding to Kepler's empirical laws, is represented as the key to a system of the universe. The great outlines of this system are boldly drawn, and the working out of it is left as the great bequest of Newton to his successors. At the end of the eighteenth century,

¹ The most recent historian of the subject is Prof. Ernst Mach of Prague, whose 'Mechanik in ihrer Entwicklung, historisch-kritisch dargestellt,' 2nd ed., 1889, I cannot praise too highly. It has been translated into English by M'Cormack (Chicago and London, 1893). Referring to Newton, he says: "Newton has with regard to our subject two great merits. Firstly, he has greatly enlarged the horizon of mechanical physics through the discovery of universal gravitation. Further, he has also completed the enunciation of the principles of mechanics as we now accept them. After him an essentially new principle has not been established. What after him has been done in mechanics refers to the deductive, formal, and mathematical development of mechanics on the ground of Newton's principles" (p. 174). "Newton's principles are sufficient without the introduction of any new principle to clear up every mechanical problem which may present itself, be

it one of statics or of dynamics. If difficulties present themselves, they are always only mathematical, formal, not fundamental" (p. 239). "All important mathematical expressions of modern mechanics were already found and used in the age of Galileo and Newton. The special names . . . have sometimes been fixed much later. Still later came the adoption of uniform measures, and this process is even yet incomplete" (p. 252). In this country it is one of the great merits of Thomson and Tait's 'Natural Philosophy' that they "restored" the teaching of mechanics and placed it on the original foundations afforded by Newton's laws of motion, in his own words, as "every attempt that has been made to supersede them has ended in utter failure" (Preface), and, though they "are only temporarily the best," there does not exist, "as yet, anything nearly as good" (Tait in article "Mechanics," 'Ency. Brit.,' 9th ed., p. 749).