

may be remarked that Newton, having established the laws of Curvilinear Motion independently, has, in a great part of his Seventh Section, deduced the simpler case of the Rectilinear Motion from the more complex problem, by reasonings of great ingenuity and beauty.

*Sect. 3.—Establishment of the Second Law of Motion.—Curvilinear Motions.*

A SLIGHT degree of distinctness in men's mechanical notions enabled them to perceive, as we have already explained, that a body which traces a curved line must be urged by some force, by which it is constantly made to deviate from that rectilinear path, which it would pursue if acted upon by no force. Thus, when a body is made to describe a circle, as when a stone is whirled round in a sling, we find that the string does exert such a force on the stone; for the string is stretched by the effort, and if it be too slender, it may thus be broken. This *centrifugal force* of bodies moving in circles was noticed even by the ancients. The effect of force to produce curvilinear motion also appears in the paths described by projectiles. We have already seen that though Tartalea did not perceive this correctly, Rivius, about the same time, did.

To see that a transverse force would produce a curve, was one step; to determine what the curve is, was another step, which involved the discovery of the Second Law of Motion. This step was made by Galileo. In his *Dialogues on Motion*, he asserts that a body projected horizontally will retain a uniform motion in the horizontal direction, and will have, compounded with this, a uniformly accelerated motion downwards, that is, the motion of a body falling vertically from rest; and will thus describe the curve called a parabola.

The Second Law of Motion consists of this assertion in a general form;—namely, that in all cases the motion which the force will produce is compounded with the motion which the body previously has. This was not obvious; for Cardan had maintained,<sup>11</sup> that “if a body is moved by two motions at once, it will come to the place resulting from their composition slower than by either of them.” The proof of the truth of the law to Galileo's mind was, so far as we collect from the Dialogue itself, the simplicity of the supposition, and his clear perception of the causes which, in some cases, produced an obvious deviation in practice

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<sup>11</sup> *Op.* vol. iv. p. 490.