

make this change was the commencement of one of the most obstinate and curious of the controversies which form part of the history of mechanical science. The celebrated Leibnitz was the author of the new opinion. In 1686, he published, in the Leipsic Acts, "A short Demonstration of a memorable Error of Descartes and others, concerning the natural law by which they think that God always preserves the same quantity of motion; in which they pervert mechanics." The principle that the same quantity of motion, and therefore of moving force, is always preserved in the world, follows from the equality of action and reaction; though Descartes had, after his fashion, given a theological reason for it; Leibnitz allowed that the quantity of moving force remains always the same, but denied that this force is measured by the quantity of motion or momentum. He maintained that the same force is requisite to raise a weight of one pound through four feet, and a weight of four pounds through one foot, though the momenta in this case are as one to two. This was answered by the Abbé de Conti; who truly observed, that allowing the effects in the two cases to be equal, this did not prove the forces to be equal; since the effect, in the first case, was produced in a double time, and therefore it was quite consistent to suppose the force only half as great. Leibnitz, however, persisted in his innovation; and in 1695 laid down the distinction between *vires mortuæ*, or pressures, and *vires vivæ*, the name he gave to his own measure of force. He kept up a correspondence with John Bernoulli, whom he converted to his peculiar opinions on this subject; or rather, as Bernoulli says,¹³ made him think for himself, which ended in his proving directly that which Leibnitz had defended by indirect reasons. Among other arguments, he had pretended to show (what is certainly not true), that if the common measure of forces be adhered to, a perpetual motion would be possible. It is easy to collect many cases which admit of being very simply and conveniently reasoned upon by means of the *vis viva*, that is, by taking the force to be proportional to the *square* of the velocity, and not to the velocity itself. Thus, in order to give the arrow *twice* the velocity, the bow must be *four* times as strong; and in all cases in which no account is taken of the time of producing the effect, we may conveniently use similar methods.

But it was not till a later period that the question excited any general notice. The Academy of Sciences of Paris in 1724 proposed

¹³ *Op.* iii. 40.