

ma, of which the notes are in the ratio of 80 to 81. That the ear really detects this defect of musical coincidence of the two notes under the proper conditions, is a proof of the coincidence of our musical perceptions with the mathematical relations of the notes; and is therefore an experimental confirmation of the mathematical principles of harmony. But it seems to be represented by Plato, that to look out for such confirmation of mathematical principles, implies a disposition to lean on the senses, which he regards as very unphilosophical.

*Hero of Alexandria.*

THE other branches of mathematical science which I have spoken of in the History as cultivated by the Greeks, namely Mechanics and Hydrostatics, are not treated expressly by Plato; though we know from Aristotle and others that some of the propositions of those sciences were known about his time. Machines moved not only by weights and springs, but by water and air, were constructed at an early period. Ctesibius, who lived probably about B. C. 250, under the Ptolemies, is said to have invented a clepsydra or water-clock, and an hydraulic organ; and to have been the first to discover the elastic power of air, and to apply it as a moving power. Of his pupil Hero, the name is to this day familiar, through the little pneumatic instrument called *Hero's Fountain*. He also described pumps and hydraulic machines of various kinds; and an instrument which has been spoken of by some modern writers as a *steam-engine*, but which was merely a toy made to whirl round by the steam emitted from holes in its arms. Concerning mechanism, besides descriptions of *Automatons*, Hero composed two works: the one entitled *Mechanics*, or *Mechanical Introductions*; the other *Barulcos*, the *Weight-lifter*. In these works the elementary contrivances by which weights may be lifted or drawn were spoken of as the *Five Mechanical Powers*, the same enumeration of such machines as prevails to this day; namely, the Lever, the Wheel and Axle, the Pulley, the Wedge, and the Screw. In his *Mechanics*, it appears that Hero reduced all these machines to one single machine, namely to the lever. In the *Barulcos*, Hero proposed and solved the problem which it was the glory of Archimedes to have solved: To move any object (however large) by any power (however small). This, as may easily be conceived by any one acquainted with the elements of Mechanics, is done by means of a combination of the mechanical powers, and especially by means of a train of toothed-wheels and axles.