

CHAPTER II.

PROBLEM OF THE VIBRATIONS OF STRINGS.

THAT the continuation of sound depends on a continued minute and rapid motion, a shaking or trembling, of the parts of the sounding body, was soon seen. Thus Bacon says,¹ "The duration of the sound of a bell or a string when struck, which appears to be prolonged and gradually extinguished, does not proceed from the first percussion; but the trepidation of the body struck perpetually generates a new sound. For if that trepidation be prevented, and the bell or string be stopped, the sound soon dies: as in *spinets*, as soon as the *spine* is let fall so as to touch the string, the sound ceases." In the case of a stretched string, it is not difficult to perceive that the motion is a motion back and forwards across the straight line which the string occupies when at rest. The further examination of the quantitative circumstances of this oscillatory motion was an obvious problem; and especially after oscillations, though of another kind (those of a pendulous body), had attracted attention, as they had done in the school of Galileo. Mersenne, one of the promulgators of Galileo's philosophy in France, is the first author in whom I find an examination of the details of this case (*Harmonicorum Liber*, Paris, 1636). He asserts,² that the differences and concords of acute and grave sounds depend on the rapidity of vibrations, and their ratio; and he proves this doctrine by a series of experimental comparisons. Thus he finds³ that the note of a string is as its length, by taking a string first twice, and then four times as long as the original string, other things remaining the same. This, indeed, was known to the ancients, and was the basis of that numerical indication of the notes which the proposition expresses. Mersenne further proceeds to show the effect of thickness and tension. He finds (Prop. 7) that a string must be four times as thick as another, to give the octave below; he finds, also (Prop. 8), that the tension must be about four times as great in order to produce the octave above. From these proportions various others are deduced, and the *law of the*

¹ *Hist. Son. et Aud.* vol. ix. p. 71.² L. i. Prop. 15.³ L. ii. Prop. 6.