

that Double Stars are held together by a central force, to prove that this force follows a different law from the only law which has hitherto been found to obtain in the universe, and which obtains between all the known masses of the universe, would require very clear and distinct evidence, of which astronomers have as yet seen no trace.

CHAPTER VI.

Sect. 1. Instruments.—2. Clocks.

IN page 473, I have described the manner in which astronomers are able to observe the transit of a star, and other astronomical phenomena, to the exactness of a tenth of a second of time. The mode of observation there described implies that the observer at the moment of observation compares the impressions of the eye and of the ear. Now it is found that the habit which the observer must form of doing this operates differently in different observers, so that one observer notes the same fact as happening a fraction of a second earlier or later than another observer does; and this in every case. Thus, using the term *equation*, as we use it in Astronomy, to express a correction by which we get regularity from irregularity, there is a *personal equation* belonging to this mode of observation, showing that it is liable to error. Can this error be got rid of?

It is at any rate much diminished by a method of observation recently introduced into observatories, and first practised in America. The essential feature of this mode of observation consists in combining the impression of sight with that of touch, instead of with that of hearing. The observer at the moment of observation presses with his finger so as to make a mark on a machine which by its motion measures time with great accuracy and on a large scale; and thus small intervals of time are made visible.

A universal, though not a necessary, part of this machinery, as hitherto adopted, is, that a galvanic circuit has been employed in conveying the impression from the finger to the part where time is measured and marked. The facility with which galvanic wires can