

But this instrument was in fact used rather for dividing the day into portions of time than for determining position.

Eratosthenes⁷ observed the amount of the obliquity of the sun's path to the equator: we are not informed what instruments he used for this purpose; but he is said to have obtained, from the munificence of Ptolemy Euergetes, two *Armils*, or instruments composed of circles, which were placed in the portico at Alexandria, and long used for observations. If a circular rim or hoop were placed so as to coincide with the plane of the equator, the inner concave edge would be enlightened by the sun's rays which came under the front edge, when the sun was south of the equator, and by the rays which came over the front edge, when the sun was north of the equator: the moment of the transition would be the time of the equinox. Such an instrument appears to be referred to by Hipparchus, as quoted by Ptolemy.⁸ "The circle of copper, which stands at Alexandria in what is called the Square Porch, appears to mark, as the day of the equinox, that on which the concave surface begins to be enlightened from the other side." Such an instrument was called an *equinoctial armil*.

A *solstitial armil* is described by Ptolemy, consisting of two circular rims, one sliding round within the other, and the inner one furnished with two pegs standing out from its surface at right angles, and diametrically opposite to each other. These circles being fixed in the plane of the meridian, and the inner one turned, till, at noon, the shadow of the peg in front falls upon the peg behind, the position of the sun at noon would be determined by the degrees on the outer circle.

In calculation, the degree was conceived to be divided into 60 *minutes*, the minute into 60 *seconds*, and so on. But in practice it was impossible to divide the limb of the instrument into parts so small. The armils of Alexandria were divided into no parts smaller than sixths of degrees, or divisions of 10 minutes.

The angles, observed by means of these divisions, were expressed as a fraction of the circumference. Thus Eratosthenes stated the interval between the tropics to be $\frac{11}{8}$ of the circumference.⁹

It was soon remarked that the whole circumference of the circle

⁷ Delambre, *A. A.* i. 86.

⁸ Ptol. *Synt.* iii. 2.

⁹ Delambre, *A. A.* i. 87. It is probable that his observation gave him $47\frac{2}{3}$ degrees. The fraction $\frac{47\frac{2}{3}}{360} = \frac{143}{1080} = \frac{11 \cdot 13}{1080} = \frac{11}{83\frac{1}{13}}$, which is very nearly $\frac{11}{88}$.