

CHAPTER VI.

THE INSTRUMENTS AND AIDS OF ASTRONOMY DURING THE NEWTONIAN PERIOD.

Sect. 1.—Instruments.

SOME instruments or other were employed at all periods of astronomical observation. But it was only when observation had attained a considerable degree of delicacy, that the exact construction of instruments became an object of serious care. Gradually, as the possibility and the value of increased exactness became manifest, it was seen that every thing which could improve the astronomer's instruments was of high importance to him. And hence in some cases a vast increase of size and of expense was introduced; in other cases new combinations, or the result of improvements in other sciences, were brought into play. Extensive knowledge, intense thought, and great ingenuity, were requisite in the astronomical instrument maker. Instead of ranking with artisans, he became a man of science, sharing the honor and dignity of the astronomer himself.

1. *Measure of Angles.*—Tycho Brahe was the first astronomer who acted upon a due appreciation of the importance of good instruments. The collection of such at Uraniburg was by far the finest which had ever existed. He endeavored to give steadiness to the frame, and accuracy to the divisions of his instruments. His Mural Quadrant was well adapted for this purpose; its radius was five cubits: it is clear, that as we enlarge the instrument we are enabled to measure smaller arcs. On this principle many large *gnomons* were erected. Cassini's celebrated one in the church of St. Petronius at Bologna, was eighty-three feet (French) high. But this mode of obtaining accuracy was soon abandoned for better methods. Three great improvements were introduced about the same time. The application of the Micrometer to the telescope, by Huyghens, Malvasia, and Auzout; the application of the Telescope to the astronomical quadrant; and the fixation of the centre of its field by a Cross of fine wires placed in the focus by Gascoigne, and afterwards by Picard. We may judge how great was the improvement which these contrivances introduced into the art of ob-