

eyes fixed upon the telescope or upon the vernier, as he may desire, and without giving any thought to the motion of the hands. But the handles of the steel wheel are much less convenient to take hold of than a rope; and if the motion is at all rapid the operator cannot turn his eyes to the moving telescope without danger of his knuckles being struck by the steel handles as he attempts to take hold of them without looking. The necessity for care in this respect makes the motion hesitating and laborious, at least to one unaccustomed to it.

*The clock motion.*—On the system of the Messrs. Clark, applied in the Washington telescope, the screw which turns the sector does not take hold of the circumference of the latter directly, but gears into a complete worm-wheel, around the axis of which is wrapped a pair of brass or steel bands which also enwrap the arc of the sector. By this arrangement the toothed wheel makes a nearly complete revolution while the sector is moving through its arc, and the effect of the small unavoidable irregularities in the working of the screw is diminished in the ratio of the arc of the sector to the circumference of the wheel. Whatever advantages this arrangement may have in small instruments, I think that in large ones they are more than counterbalanced by the irregularities arising from the elasticity of the band, combined with the variations of friction, and the action of wind and other forces operating to vary the uniform motion of the telescope. Owing to this elasticity, the effect of the wind or of any slight pressure by the observer on the eye-piece is many times greater in the Washington than in the Vienna instrument. But it did not appear to me that the firmness of the connection in the latter instrument between the support of the turning screw and the tube of the telescope was as great as was expected by those who lay stress on large and stable mountings. I found that by a simple pressure of the thumb-nail upon the tube of the Vienna telescope the pointing in right ascension could be changed by several seconds so as to throw an object entirely away from the wire.

The main question is, however, the steadiness of motion when no pressure whatever is applied by the observer, and so far I have found no large telescope which is entirely satisfactory. The Vienna telescope was not supplied with a micrometer at the time of my examination, so that I could not test its motion as thoroughly as I wished to; but by bringing the planet Uranus in the edge of the field I found that when the clock was going there was a constant irregular movement in right ascension, the amount of which I estimated as between one and