

TRUMENTS.

thrust without inter-
 en one of the difficult
 sold instrument the
 axis upon a vertical
 e entire instrument.
 the axis so as to bal-
 can judge, this plan

ibed, combined with
 escope, to some con-
 the mounting of an
 enumerated for the
 his kind.

y stiffness with the
 ial can then be made
 axis the greater the
 the axis contributes
 will have to be in-
 h the hollow axis as

on axis with friction
 at they can be made
 a instrument.

that adopted in the
 n endless rope hand
 which connects the

ation, by means of a
 , requires too strong
 gh a gearing turned
 axis on the Repsold
 e by turning a crank
 wheel.

so that the observer
 s approximate point-
 with the naked eye,
 the Washington tele-

scope. The declination circle being further from the observer, it has to be read with an opera-glass if more than a coarse fraction of a degree is required. By such an arrangement the telescope can always be set by the quick motion so nearly that any object sought shall be in the field of view of the finder. In nine cases out of ten this will be all that is required in practical use. It should never be forgotten that in all quick motions it is very desirable that the observer shall be able to keep his eye upon the movements of the telescope itself in order to save him from any apprehension, even a groundless one, that something may be going wrong.

VI. The slow motion should if possible be endless. There is no difficulty in making it so in right ascension; though there may be in declination.

VII. When the instrument is so large that there is an interval of three feet or more between the center of the polar axis and the side of the tube, the screw which communicates the clock movement should be geared into a complete circle rather than into a sector. The use of the metal band to multiply the effective radius of the wheel offers no advantage in the case of large instruments to compensate for the disadvantage of want of stability arising from elasticity of the band and its fastenings.

VIII. In this connection should be considered the question of applying the system of Aïng, which consists in giving a clock-motion to the verniers of the right-ascension circle so that their position shall represent sidereal time. Every practical astronomer is familiar with the trouble in setting an ordinary equatorial, arising from the necessity of having to calculate the constantly varying hour angle of the object on which he points. With the Greenwich arrangement there is no such trouble. The clamping-wheel being once set to sidereal time, the observer has only to set the other one to the constant right ascension of the object. It is true that practical difficulty arises in the usual construction, owing to the fact that the vernier on the gear-wheel will from time to time be on every point of the circle. But this difficulty can, I think, be obviated by appropriate arrangements.

IX. A clock motion which can be kept up by water or other power is greatly preferable to any system which requires an assistant to wind up a weight.

X. The entire practicability of illuminating the divisions of the circles by a lamp and of reading these divisions from the eye-end of the telescope