

weight of the instrument. How to support this thrust without interfering with the ease and freedom of motion has been one of the difficult problems in mounting a telescope. In the Repsold instrument the thrust is nearly avoided by supporting the polar axis upon a vertical friction-wheel under the center of gravity of the entire instrument. Counterpoises can be placed at the lower end of the axis so as to balance the instrument upon this wheel. So far as I can judge, this plan leaves nothing to be desired.

PRACTICAL CONCLUSIONS.

I have been led by the examination above described, combined with some experience in the use of the Washington telescope, to some conclusions respecting the most appropriate features in the mounting of an instrument of the larger size. They may be here enumerated for the consideration of those engaged in constructions of this kind.

I. I think that in order to secure the necessary stiffness with the least weight the axes should be hollow. The material can then be made comparatively thin. It is true that the larger the axis the greater the friction. But the mass of metal in the interior of the axis contributes so little to its stiffness that the external diameter will have to be increased very little to secure the same stiffness with the hollow axis as with the solid one.

II. It is not worth while to supply the declination axis with friction rollers unless experiment and research shall show that they can be made more effective than they appear to be in the Vienna instrument.

III. The best quick motion in right ascension is that adopted in the Washington telescope, where the observer pulls an endless rope hand over hand, and can lock and unlock the gearing which connects the turning-wheel with the telescope at pleasure.

IV. If, as is possible, the quick motion in declination, by means of a loose rope attached to the two ends of the telescope, requires too strong a pull, the best method of giving this motion is through a gearing turned by an axis passing centrally through the polar axis on the Repsold plan. But it is preferable to have this motion made by turning a crank or pulling a rope rather than by taking hold of a wheel.

V. Coarse divided wheels should be supplied, so that the observer while turning the instrument can constantly see its approximate pointing. It is better if this coarse reading can be made with the naked eye, as is the case in the right ascension movement of the Washington tele-