ing the divisions. On the other hand, the divisions of all the Repsold instruments are copies of a certain large divided circle made by the founders of the firm more than half a century ago. The copy is, however, modified to this extent: instead of each division being copied, the copy is a mean of each five consecutive divisions on the original circle. Supposing the copies to be absolutely perfect and the original circle to have remained unchanged, all the Repsold instruments should exhibit the same errors of division, but I am not aware whether the numbering on the different circles is made to correspond to the same divisions of the original circles, a proceeding which would be necessary to test the uniformity. In this connection I may remark that during my visit to the Repsold establishment they allowed me to examine the divisions on the original circle with the aid of a powerful micrometer microscope attached to it, and used in making a copy. So far as I could judge from a cursory examination there were no sensible accidental errors of division in the minute space over which my observations extended. If so, the errors of division in the copy must be mainly accidental, and perhaps due to elasticity in the mounting of the cutting tool combined with irregularity in the resistance it meets with in cutting the metal. Should the errors of division be wholly due to this cause, we could expect no correspondence between those on different instruments.

The microscopes are about two feet long, and their absolute power is, I think, somewhat less than in the Washington instrument. It did not appear to me, however, from examining the divisions, that they would bear any higher power with advantage. The edges appear deficient in straightness and sharpness, and this appearance is exaggerated by the numerous discolorations upon the silvered surface. The probable error of a single setting of a microscope appeared to be about double of that in the Washington circle, or 0″.2 to 0″.3 against 0″.10 to 0″.15. From these facts I am led to the conclusion that an improved system in the construction of circles is a desideratum.

It is true that the necessary probable error of astronomical observations arising from unavoidable disturbing causes is such that no great additional accuracy in single observations would be obtainable by a more accurate reading of the circle. The object of increased accuracy of reading is to facilitate the determination of errors of division. The latter must be determined with a precision corresponding, not merely to that of a single observation, but to the mean of a great number of observations. To do this without an enormous expenditure of labor, the