The magnifying power of the telescope being about 50, a division of one hundredth of a yard on a rod put up at a distance of 100 yards, is viewed in the telescope, in the same manner as a division $\frac{1}{1000}$ of a yard wide with the naked eye, when about 9 inches distant. It is not hard to satisfy one's self that under such circumstances, the tenth part of a hundredth yard division and even much smaller spaces, can quite easily be estimated with the eye, and therefore that the error we are exposed to make can easily be placed at from $\frac{1}{50}$ to $\frac{1}{20}$ of such a division.

Mean error of a distance R of 100 yards measured by means of the relations :

$$R = \frac{ab + ac + \overline{ad}}{0{\cdot}05} = 20\ (ab + a\overline{c} + ad)$$ for tacheometer No. 1, and

$$R = \frac{ab + a\overline{c} + \overline{ad}}{0{\cdot}045} = 22{\cdot}22\ (ab + ac + \overline{ad})$$ for tacheometer No. 115.

This operation comprises 1 pointing and 3 readings and hence 4 contacts. Moreover we have to bear in mind that while the error of pointing Ep does not affect the value of the whole number selected as a starting point for measuring the rod intervals, it modifies by the same quantity Ep each one of the succeeding readings. In making the sum of the rod intervals, the error of the pointing is therefore trebled, that is to say it is increased to 3 Ep. According to the theory of errors, the total error $\mathbf{E}$ of the sum of rod intervals $ab + ac + ad$ determined at a distance of 100 yards is therefore in this case, in general:

$$\mathbf{E} = \sqrt{(3Ep)^2 + 3\,(Er^2) + 4\,(Ec^2)}$$

Now replacing the symbols by their values in thousandths of a yard, as above established, we have for the total error of intervals determined with tacheometer No. 1:

$$\mathbf{E}_1 = \sqrt{(3 \times 0{\cdot}25)^2 + 3\,(0{\cdot}5)^2 + 4(0{\cdot}357)^2} = \sqrt{0{\cdot}5625 + 0{\cdot}75 + 0{\cdot}5098} = \sqrt{1{\cdot}8225} = 1{\cdot}35$$

and for the total error of intervals determined with tacheometer No. 115:

$$\mathbf{E}_{115} = \sqrt{(3 \times 0{\cdot}25)^2 + 3\,(0{\cdot}4)^2 + 4\,(0{\cdot}225)^2} = \sqrt{0\,5625 + 0{\cdot}48 + 0{\cdot}2025} = \sqrt{1{\cdot}245} = 1{\cdot}115$$

The corresponding errors $\mathbf{E}_{R_1}$, $\mathbf{E}_{R_{115}}$ on the distances are:

$$\mathbf{E}_R = 1{\cdot}35 \times 20 = 27{\cdot}00 \text{ or } 0{\cdot}02700 \text{ yd.}$$

$$\mathbf{E}_{R_{115}} = 1{\cdot}115 \times 22{\cdot}22 = 24{\cdot}78 \text{ or } 0{\cdot}02478 \text{ yd.}$$