

zontal line of sight with the rod, at whatever figure such a line may strike the scale; that is to say: almost invariably from a complex number including several decimals, instead of from a round or other exact whole number, as is usually done when distance measurements are made for ordinary purposes. There exists therefore, in the case of a tachometer intended chiefly for precision or geodetic levelling, not the same danger of an observer being tempted to put in fictitious figures, in place of those that would be afforded by actual readings, in order to gain time, and there is no longer the same ground for hesitating to dispose the butting pins so as to determine visual rays that will intercept intervals on the rod, bearing to each other more simple consecutive ratios than those of the numbers 10, 8 and 4, which have been adopted for the ordinary tachometer. Accordingly, for No. 115 the numbers used for such ratios were limited to two, viz., to 10 and its submultiple 5; the butting pins *a*, *b*, *c*, *d* being placed so as to give rod intervals corresponding to:

$$\frac{10R}{1000}, \frac{15R}{1000} \text{ and } \frac{20R}{1000}, \text{ in place of: } \frac{10R}{1000}, \frac{18R}{1000} \text{ and } \frac{22R}{1000}$$

and the number of different ratios thus reduced from six to four, viz.:

$$\text{from 4, 8, 10, 12, 18 and 22—to 5, 10, 15 and 20.}$$

While with the ordinary tachometer (No. 1) the sum of the rod intervals determined by the three pairs of rays, $\overline{ab}$, $\overline{ac}$ and $\overline{ad}$, viz., the greatest height that can be intercepted by any three pairs of the four rays *a*, *b*, *c* and *d* is equal to $0.050R$, the greatest corresponding rod space that can be obtained with tachometer No. 115 is but $0.045R$.

When, however, we take into consideration the fact that in tachometer No. 115 the magnifying power and the radius *r* (or perpendicular distance of the centre of the conical gun metal axis of rotation of the telescope, from the plane travelled in by the steel knife edge), have been increased, viz., the former from about 35 to 50 and the latter from 6.30 to 8 inches, it becomes apparent that although the pencil of visual rays determined in the ordinary tachometer by passing the lever *L* from pin *a* to pin *d* or vice versa, and which intercepts a height $(0.022)R$ on the rod, has been slightly contracted, viz., so as to reduce this distance to $(0.020)R$, it cannot be said that the accuracy of the results as regards distance measurements, has been diminished, indeed the reverse is the case, as we shall see presently.

At the same time a tachometer such as No. 115, where the combination of four consecutive readings from a single pointing—which gives the best results as regards distance measurements—determines an aggregate rod interval of but $0.045R$, is evidently not so well adapted on the whole for measuring distances, as a tachometer of the ordinary construction, where the aggregate rod interval determined by the corresponding combination of four readings from one and the same pointing is exactly equal to $0.05R$.

While in the latter case we have simply to multiply the sum of the rod intervals, or $0.05R$, successively by two and then by ten, in the former, we have to multiply the sum of the said intervals, or $0.045R$ by two by ten and then by 1.11111 When, however, more than one pointing has to be made, in order to secure the four readings corresponding to the positions *a*, *b*, *c* and *d* of the