It may not be superfluous to repeat here that while the result of a very good steel tape measurement will be in excess from 0.03 yd. to 0.06 yd. per 100 yards, as already stated, the tacheometer measurement may indicate in very dry weather a deficiency of from 0.02 yd. to 0.03 yd. The difference of  $\{(3+2)=5\}$  to  $\{(6+3)=9\}$  hundredths may change sign in very cold and wet weather.

With the butting pius placed as above described, it is evident that so long as the netual difference of level between the horizontal optical axis or line of collimation of the telescope and the zero of the rod remains within the limits of the latter, or say within from 4 to 5 yards, and the distance, rod to tacheometer, does not exceed 300 yards, it is always quite possible, not to say easy, to obtain with tacheometer No. 115 a sufficient number of rod readings to determine three intervals which are either themselves contiguous, the same as the spaces intercepted with one pointing, or that will correspond to these spaces, provided we take care to have the lever butted against the proper pin, previous to finally setting the telescope truly level with the aid of the micrometer or slow motion serew and the sensitive double-faced level, for taking the horizontal fore or back sight.

As regards the distance, it may be said that it happens very soldom that the atmosphere is sufficiently clear and pure and the light as well as the ground suitable, for us to venture taking even 300-yard sights on each side of the instrument, for any length of time, and this distance may properly be considered to be the extreme limit, which should not be overstepped in carrying on geodetic levelling operations. It is only under exceptionally favourable circumstances that a few sights between 300 and 400 yards long can be taken consecutively in running lines of precise levels.

With a view of devising a rational and expeditious method of taking series of combined level and distance readings for geodetic levelling purposes, or sets of geodesic readings with tacheometer No. 115—after having levelled the herizontal limb or circle of the tacheometer by means of the three ordinary thumb levelling screws and the level tube fixed on top of the cross-bar—let us take a series of readings on a four yard rod 200 yards distant, with the long lever L successively butted against the pins **a**, **b**, **c** and **d**, and commencing with reading 0, while the lever is kept in place by pin **a**, and let us designate by  $P_{\rm in}$  the series of intersections of the pencil of visual rays determined by the pins **a**, **b**, **c**, **d**, with the rod.

In such case we evidently subdivide by means of the said pencil of rays, the full height figured on the rod into three parts: 0, 2, 2, 3, and 3, 4, which bear to each other the same ratios as ab to bc to cd, intersecting as we do, the rod with the four rays in question; at 0 at the foot; at figures 2 at d 3 near the middle, and at figure 4 at the top. Now, if any one of the four rays producing the series of intersections  $P_R$  be level, it is clear that the three additional intersections and corresponding readings required for geodetic levelling purposes are secured without any special pointing being necessary, that is to say, without the clamp P and knife edge having to be moved up or down on the prismatic guide rod T.

The four positions of the pencil of rays determined by the pins **a**, **b**, **c**, **d**, corresponding to position  $P_{in}$  in each of which a different one of the said rays is horizontal may be termed the fundamental positions of the standard pencil of rays

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