

ordinary Y level (14 inch), with the addition of a compass and a gun-metal circle.

The whole principle upon which the instrument works is contained in this circle, which is a casting made in the shape of a cam; that is, in place of the circle being truly horizontal or at right angles to axis it is curved out of the horizontal, and consequently causes the telescope to tilt either upwards or downwards when revolved, through a vertical angle.

The circle (or gradient limb) is graduated around three-fourths of its circumference with numbers commencing at 1,200 and terminating with 10. Certain numbers are selected and classified as "pairs," each "pair" being engraved on the remaining one-fourth of the gradient limb circumference for reference. The advantages of the Telemeter are as follows:—(1) The automatic measurement of distance, which dispenses with the services of two chainmen; (2) increased accuracy in measurements through rough and broken country; (3) the measurement of vertical distances either up or down hill from 1 to 140 feet (in ordinary practice) with one sight and from one station, in place of the limit being length of rod as with an ordinary level; (4) compass being adjusted to read at right angles to line of sight, so that telescope can be clamped on rod and magnetic bearing taken, thus dispensing with picketman. Briefly, then, two men (an instrument man and rod-man) can make a traverse, with accompanying levels at all necessary points, leaving the two chainmen and picketman available for duty elsewhere; and it may be remarked, *en passant*, that such traverses have, in the writer's experience, yielded most satisfactory results. For more accurate traverse work, the makers add a horizontal circle at small additional cost.

And, now, as to the method of using the instrument, it may be understood that no particular technical or mathematical difficulties bar the way; in fact, the strong point in this instrument is its perfect simplicity in design and theory.

By clamping the index at zero on the cam, the Telemeter becomes an ordinary Y level, and any readings taken at this stage are treated exactly as those of a level in the field-book. By moving the index from zero to 100 in the cam, we use the first "pair," i.e., 0 and 100, and the difference between the two readings (on rod) gives the horizontal distance without any calculation, each vertical foot on the rod representing 100 feet horizontal measurement. With all succeeding pairs, however, the telescope is necessarily tilted for each reading, being directly influenced by the position of index on cam, and although the method of obtaining horizontal distance remains unchanged throughout the pairs, the calculation for difference in elevation follows this formula: