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the word "Rise," and the opposite end "Fall," so that the leveller merely has to keep the telescope eyepiece over the word applicable to his sights.

For example: suppose that a steep rising bank has to be levelled up; the leveller places the eye piece end of his telescope over the word "rise"; he then clamps the index at zero on the horizontal circle and levels the instrument as if it were an ordinary Y level. After this he revolves the telescope until the cross hair intersects the rod, near either extremity. The position of the index on the vernier is then noted and the most adjacent pair selected. Suppose this pair to be  $12\frac{1}{2}$  and  $16\frac{3}{4}$ ; the reading at  $12\frac{1}{2}$  is 12 feet, and at  $16\frac{3}{4}$ , 4 feet, which gives a distance of 800 feet from instrument to rod, because the difference between the two readings of any pair is the horizontal distance in feet, counting each hundredth of a vertical foot on the rod as one foot horizontal. Thus, distance is obtained by the simple method of subtracting the less from the greater reading.

The ground elevation of the rod above the ground elevation of the instrument is computed, for a "full" reading, by dividing either one of the pair numbers into the horizontal distance, then adding the rod reading of the pair number used to the dividend and subtracting the height of the instrument from the result. For a "rise" reading, the height of instrument is added and the rod reading subtracted, just reversing the "fall" computation.

The gradient of the ground surface between instrument and rod is obtained by revolving the telescope on the horizontal circle until the reading on the rod corresponds with the height of instrument; then the number to which the index points on the horizontal circle represents the distance in which a rise, or fall of 1 foot occurs. For example: the height of instrument is 5.0 ft. by revolving the telescope the cross hair is brought to intersection with this number on the rod; the index now rests at 75.7 = gradient, 1 foot in 75.7 feet. The taking of gradients in this manner forms a valuable check on the levels.

The telemeter can be used as an ordinary Y level by reading the rod with the index clamped at zero, then revolving from zero to 100 (to obtain distance), 0 and 100 being a pair. To work the telemeter level to its best advantage, a long base is necessary; that is to say, the longer the horizontal base is, the greater the vertical angle will be. My greatest vertical distance, taken at one reading, was 138 feet, and the base (or distance from instrument to rod) was 1,415 feet. The rod used being a 16-foot one, limited my length of base to 1,600 feet theoretically, but practically to between 1,500 and 1,600 feet.

The gradient-telemeter level is particularly adapted for preliminary surveys, as chaining, traversing and levelling, can all be done with one man (the rodman).

Courses can also be adopted that would be quite inaccessible to chainmen.

In making a traverse of Highwood river during October, I had only a rodman, and pursued the following method: After setting up the instrument, the telescope would be sighted on rod (as picket) and compass reading noted, then readings for elevation and distance would be taken, and the instrument moved on to rodman's station; rodman would proceed to next station, and the above operation be repeated. No backsights were taken, the height of instrument being established from the traverse station elevation, by measurement on tape or rod.