piece, as was first done, about 1840, by Porro, a distinguished officer of the Piedmontese engineer corps. But readings taken on a rod held vertically with the aid of any one of the instruments just mentioned, seldom give us a horizontal distance, which is the only one we care to know when we want to make a plan of a tract of land, a railway, a canal, etc.; but almost invariably a length of some inclined line to which a correction or corrections—the so-called reduction to the horizon—must be applied before it can be used for plotting purposes.

And should we feel disposed to adopt the neither very simple nor very expeditious "method of obtaining linear distances, and also of taking levels on sloping ground, without moving the staff or the instrument," which is recommended by the inventor of the "Milner Measurer," in a leaflet issued about June, 1897, viz., by holding in every case the rod perpendicularly to the line of sight, which operation, if performed as suggested, must of necessity be, in a sense, mere guess work, the difference between two readings corresponding to the lines of sight determined by two stadimetrical wires would again give us but a distance, rod to instrument, along the inclined line of sight. Not only has this sloping distance to be reduced to a corresponding horizontal one; but it is furthermore necessary to diminish or increase, as the case may be, the length so obtained by the small distance intervening between the point on the ground at the foot of the rod of which the position is to be established, and the horizontal projection of the point of intersection of the rod as inclined, with the line of collimation or optical axis of the telescope produced.

True, it may be said, a correction such as that last described is not needed when a vertical rod is employed, or by holding a stadia horizontally over the point the position of which is to be established. As a matter of fact, the vertical stadia is almost invariably used because it is easier to maintain a rod correctly in this position than in any other; but on account of the obliquity of the axis of its divided face to the visual rays, when these are inclined, as is usually the case, the height intercepted on the rod by the wires is greater than that which would obtain, in the same conditions, on a rod held perpendicularly to the line of sight, therefore the distance computed with such a height used as the argument, is greater than that which actually intervenes between the rod and the instrument along the line of collimation, and has to be correspondingly corrected.

In view of the rather complicated and tedious corrections and reductions which are found to be an unavoidable accompaniment of the, at first sight, apparently very simple and attractive ordinary processes of stadimetrical distance measurements, when it is important to attain a certain degree of accuracy, it is not surprising that inventors should at different times have seriously applied themselves to devise mechanical means for securing horizontal distances by direct observation, as far as practicable.

Between, say 1850 and 1852, several ingenious devices applied to instruments of the Porro type and to others have been proposed at various intervals, chiefly by French and German authors, for reducing by means of special processes and manipulations, the distances measured to their horizontal projections, all of which met with but a limited measure of success. Among such may be cited: Porro's sthenallatic telescope, Peaucellier and Wagner's telescope, the Wagner Fennel reducing