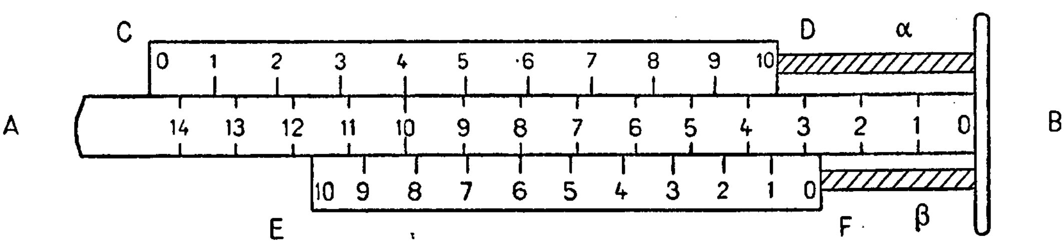
PIERRE VERNIER (c. 1580-1637) (1)

Vernier, Pierre, inventor of the instrument which bears his name, was born at Ornans (near Besançon) in Franche-Comté about 1580. For a considerable period he was commandant of the castle in his native town. In 1631, he published, at Brussels, a treatise entitled *Construction, Usage et Propriétés du Quadrant nouveau de Mathématiques,* in which the instrument associated with his name is described. He died at Ornans in 1637.

The instrument invented by Vernier is frequently called a *Nonius,* particularly in Germany, after Pedro Nunez (1492-1577), Professor of Mathematics at the University of Coimbra; but the appliance described by the latter in his work *De Crepusculis* (1542) is a different one, although the principle is practically the same. Nunez drew on the plane of a quadrant 44 concentric arcs divided respectively into 89, 88,............ 46 equal parts. If the index of the alidade did not coincide with one of the divisions on the principal arc, which was divided into 90 parts, *i. e.* the number of degrees in a quadrant, it would fall more or less accurately on a division line of one of the auxiliary arcs, from which the value of the measured angle could be read off. This instrument was very difficult to make, however, and was but little used. Vernier proposed to attach to a quadrant divided into half-degrees a movable sector of a length equal to 31 half-degrees, but divided into 30 equal parts, whereby single minutes could be read off by noting which division line of the sector coincided with a graduation of the quadrant. The idea had been mentioned by Christopher Clavius (1537-1612) in his *Opera Mathematica,* 1612 (*ii.* 5 and *iii.* 10), but he did not propose permanently to attach an arc divided in this way to the alidade; this propicious application of the principle at all events is due to Vernier.



The principle of the vernier is readily understood from the following account: Let *AB* (see fig.) be the normal scale, *i. e.* a scale graduated in certain units of length; let *CD* be a scale (placed in contact with *AB* for convenience) graduated so that 10 of its divisions are equal in length to 11 divisions of the scale *AB,* and let *EF* be another scale, similarly placed and graduated so that 10 of its divisions are equal to 9 divisions of the scale *AB.* Consider the combination of *AB* and *CD.* Obviously each division of *CD* is 1/10th greater than the normal scale division. Let α represent a length to be measured, placed so that one end is at the zero of the normal scale, and the other end in contact with the end of the vernier *CD* marked 10. It will be seen that graduation 4 of the vernier coincides with a division of the standard, and the determination of the excess of α over 3 scale divisions is reduced to determining the difference between 7 divisions of the normal scale and 6 divisions of the vernier. This is 0.4, since each vernier division equals 1.1 scale divisions. Hence, the vernier scale reading which coincides with a graduation on the normal scale gives the decimal which is to be added to the normal scale reading. Now consider the scales *AB* and *EF,* and let β be the length to be measured; place the scale *EF* so that its zero is in contact with one end of β. Obviously each division of *EF* is 1/10th less than that of the normal scale. It will be seen that division 6 of the vernier coincides with a division on the normal scale and obviously the excess of β over two normal scale divisions equals the difference between 6 normal scale divisions and 6 vernier divisions, *i. e.* 0.6. Thus again in this

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case the vernier reading which coincides with a scale reading gives the decimal to be added to the normal scale. The second type of vernier is that more commonly adopted, and its application to special appliances is quite simple. For example, the normal scale of an English barometer is graduated in 20ths of an inch. The vernier is such that 24 divisions of the normal scale equal 25 of the vernier; each of the latter, therefore, is .002 (or one 500th of an inch) less than the normal division. In the scientific barometer, the normal scale is graduated in millimetres, and the vernier so that 20 scale divisions equal 19 m/m. This combination reads to 0.05 m/m.