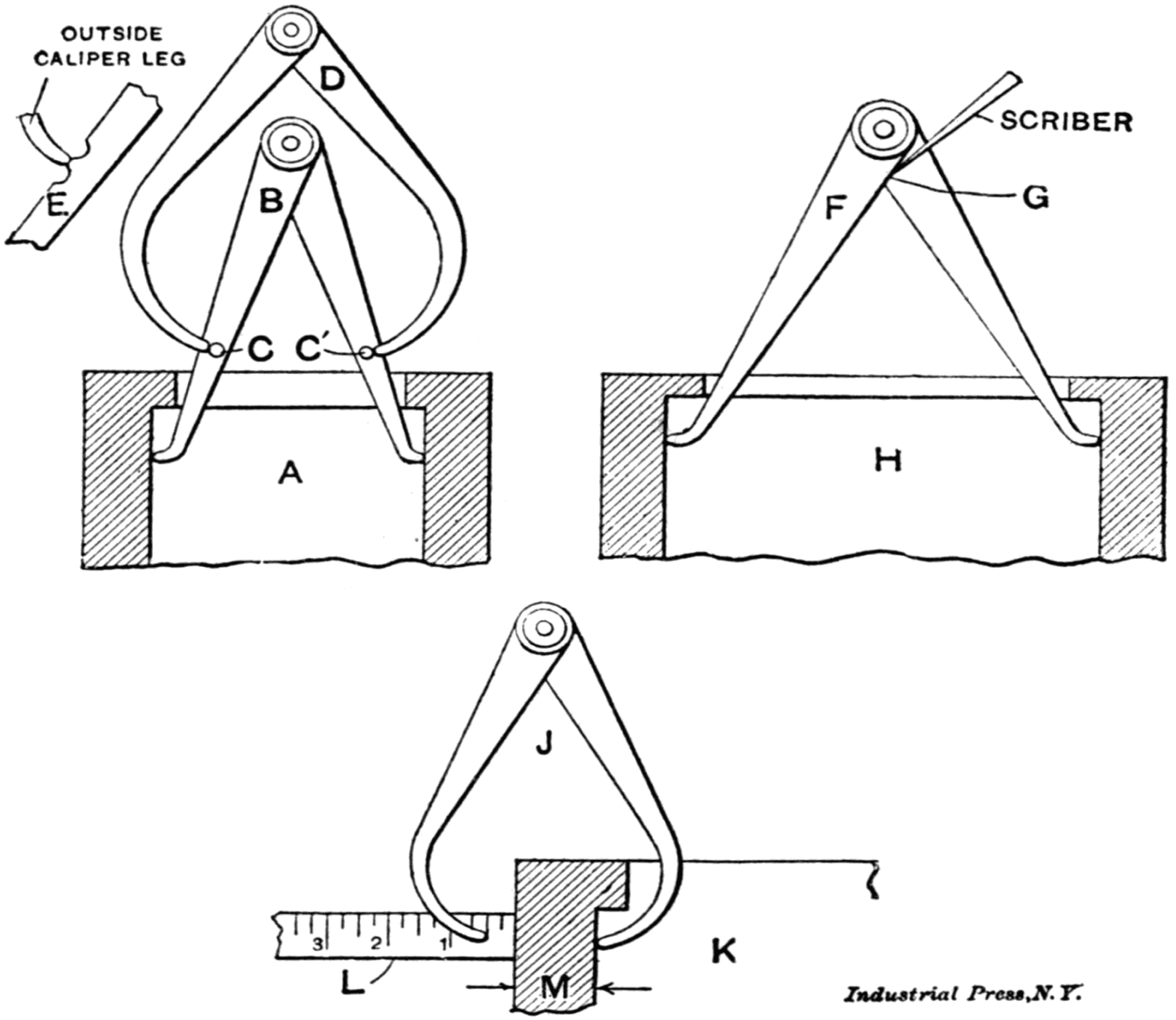
Calipers


OUTSIDE
CALIPER LEG
E
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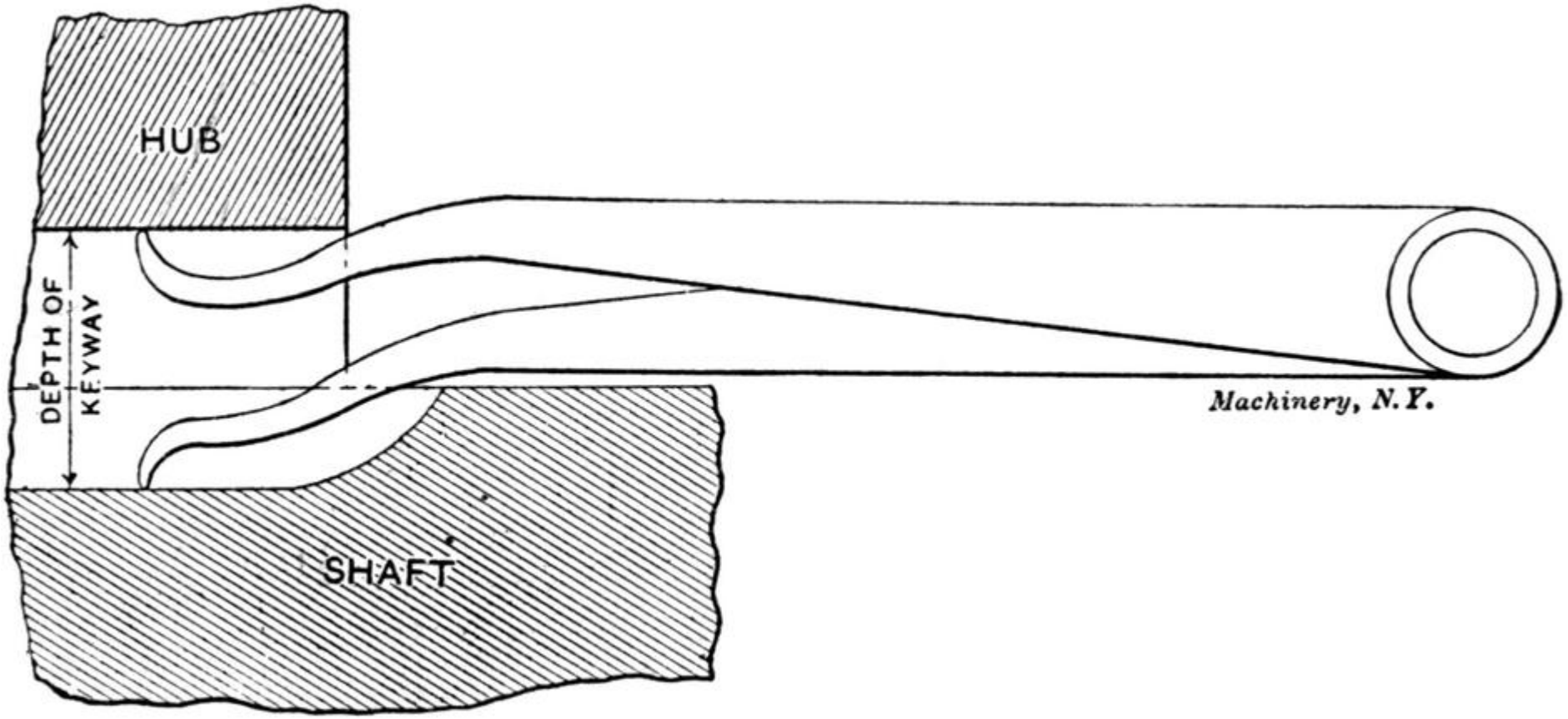
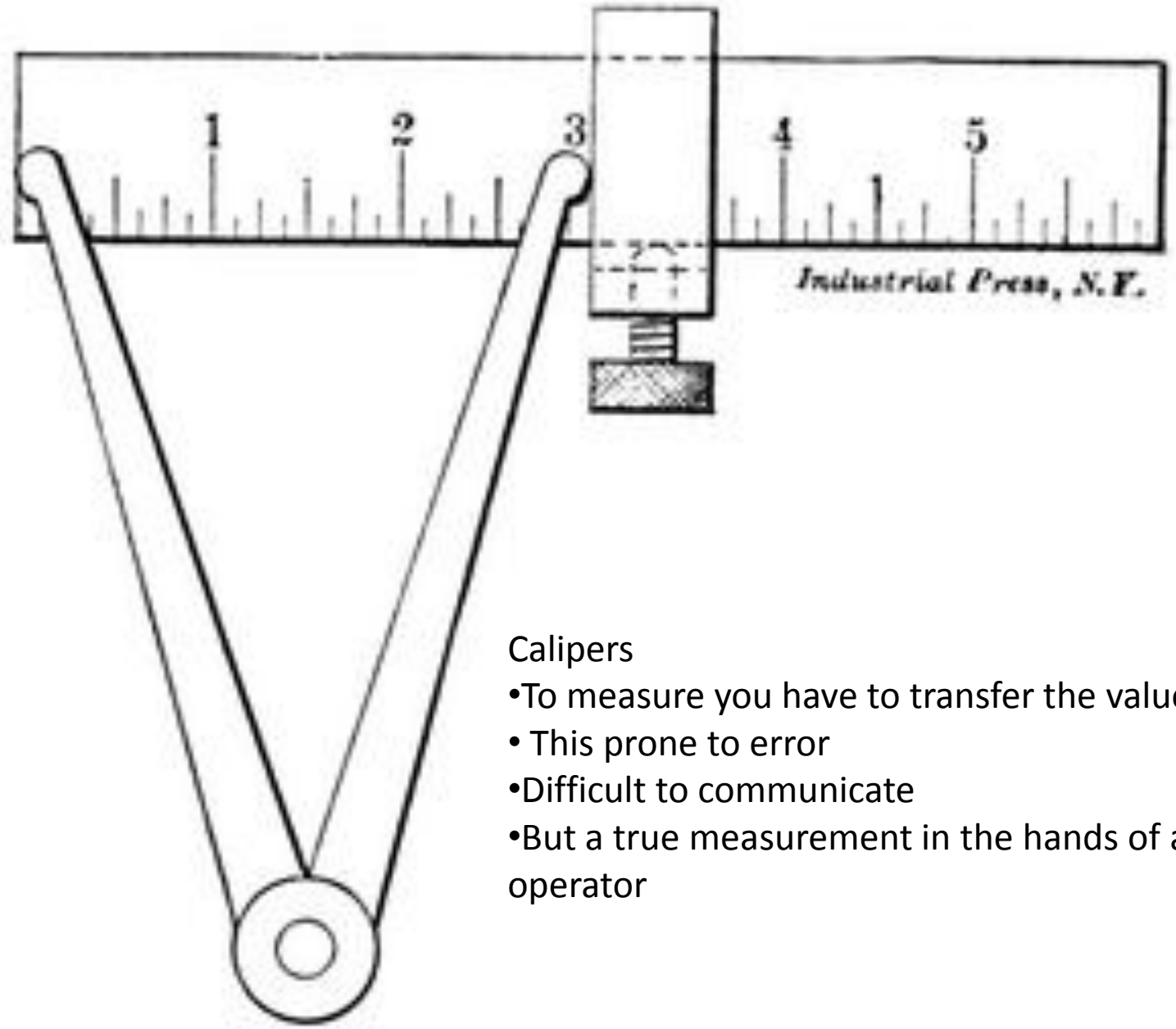
Industrial Press, N. Y.

Calipers





Calipers

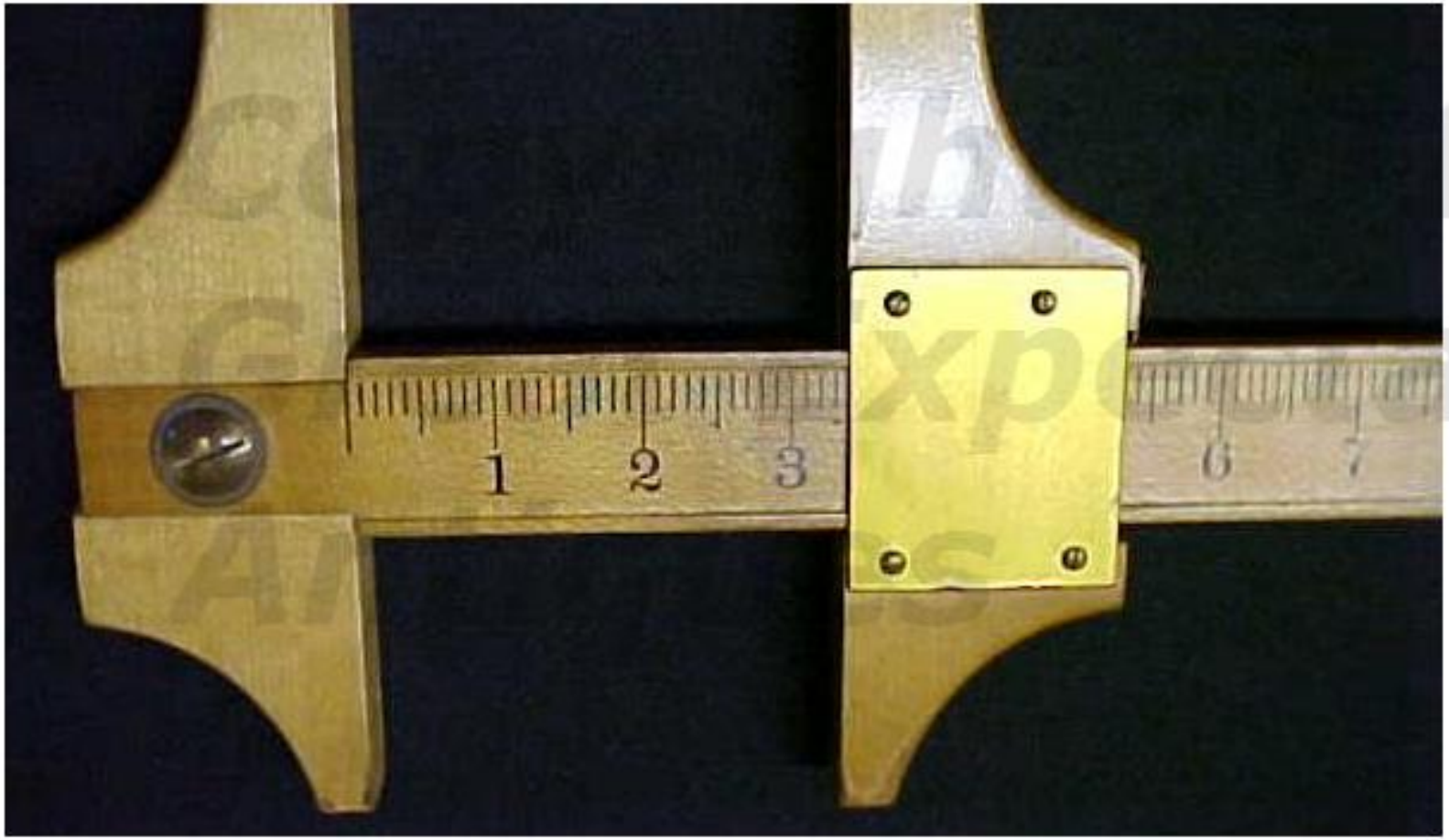
- To measure you have to transfer the values
- This prone to error
- Difficult to communicate
- But a true measurement in the hands of a skilled operator

Calipers What is the next logical development?

For example:

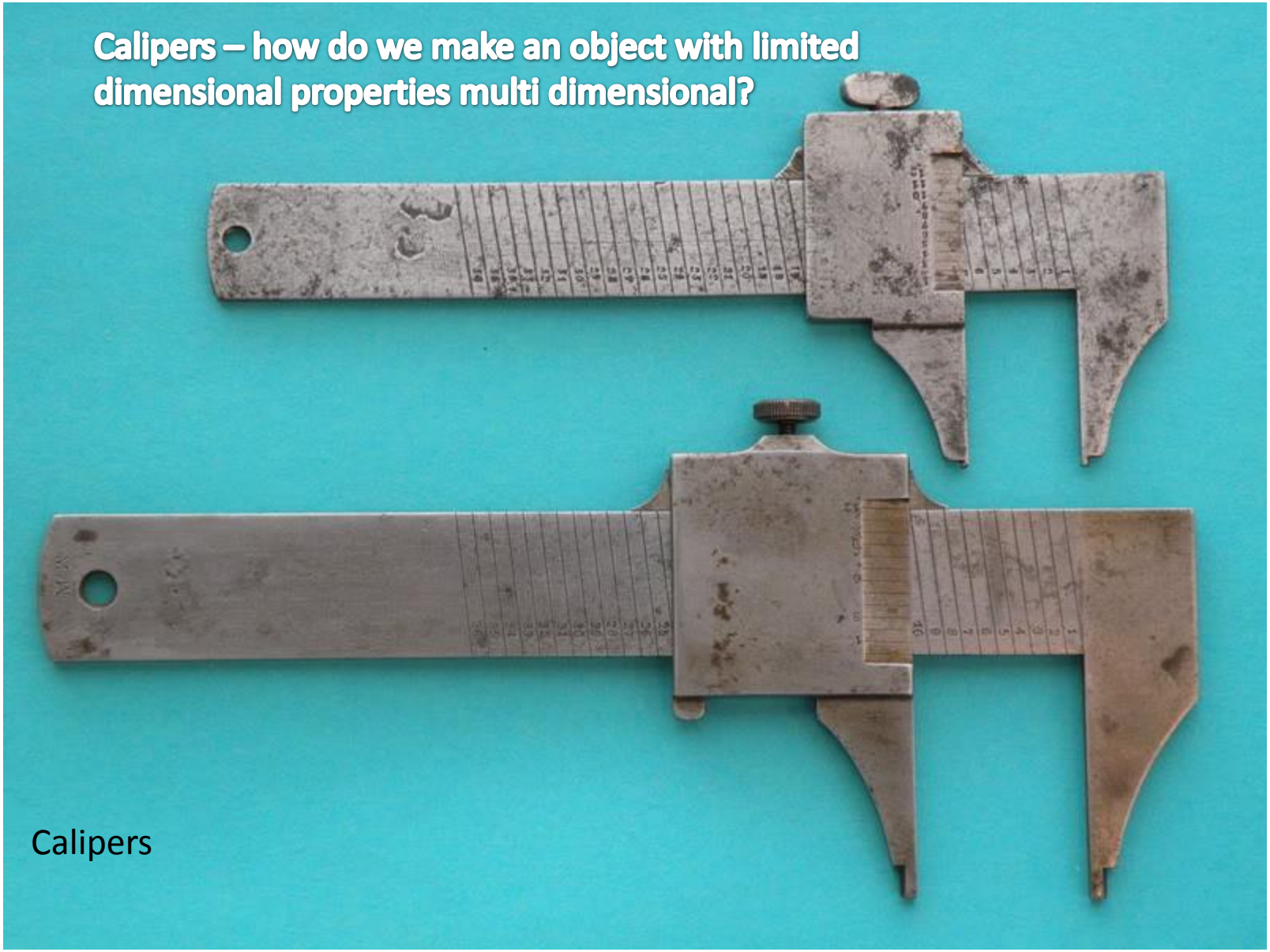
Calipers – two dimensional limitations…

Calipers, the next logical step



This is better but the measurement is still unrefined.

Calipers – how do we make an object with limited dimensional properties multi dimensional?



Calipers

Welcome the French!

Pierre Vernier

From Wikipedia, the free encyclopedia

For the French actor, see Pierre Vernier (actor).

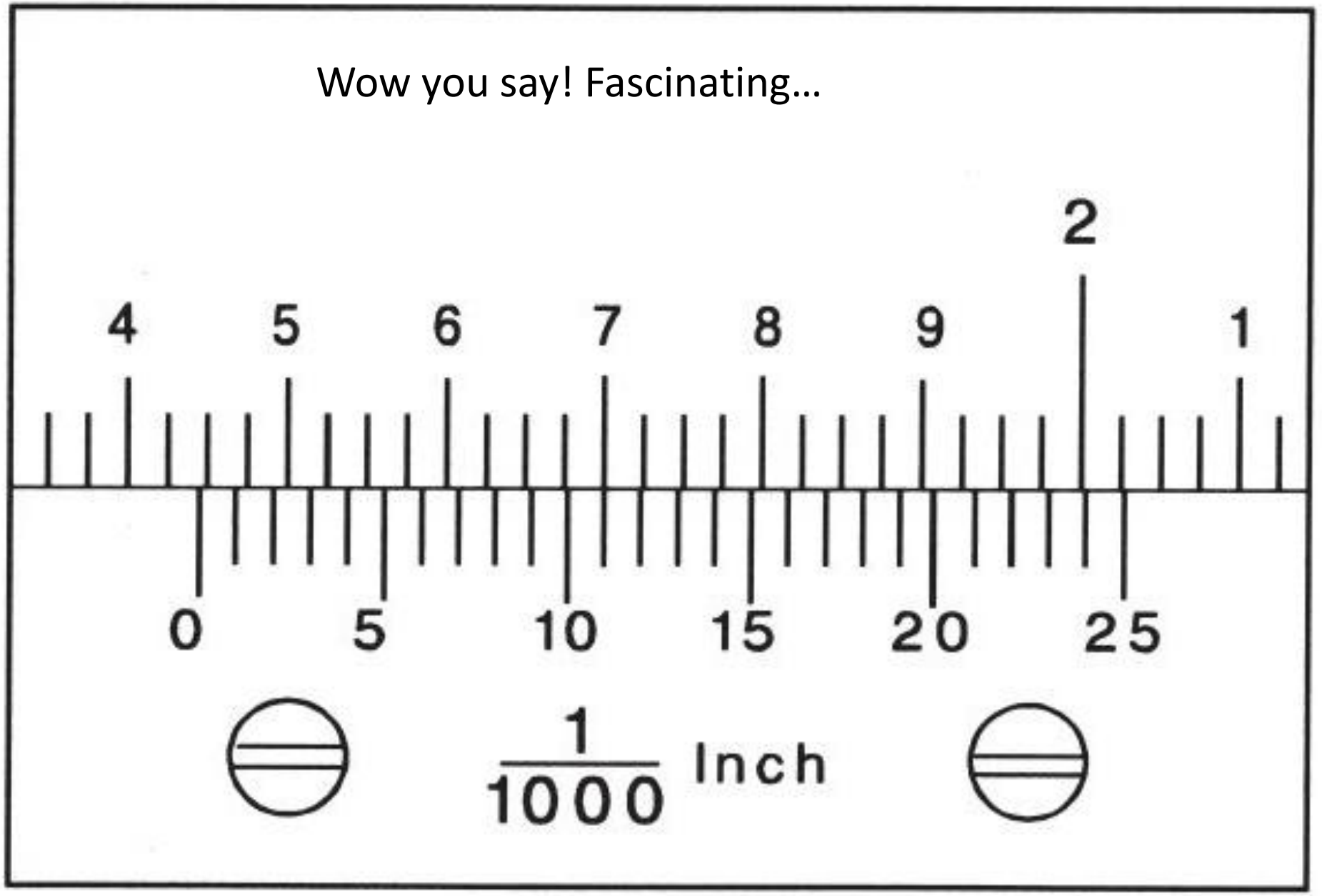
Pierre Vernier (19 August 1580 at Ornans, Franche-Comté, Spanish Habsburgs (now France) – 14 September 1637 same location) was a French mathematician and instrument inventor. He was inventor and eponym of the vernier scale used in measuring devices.

He was born in Ornans, France, in 1580, he was taught science by his father. He later became captain and castellan of the castle at Ornans, for the King of Spain. He was also later councillor and director general of moneys in the County of Burgundy.

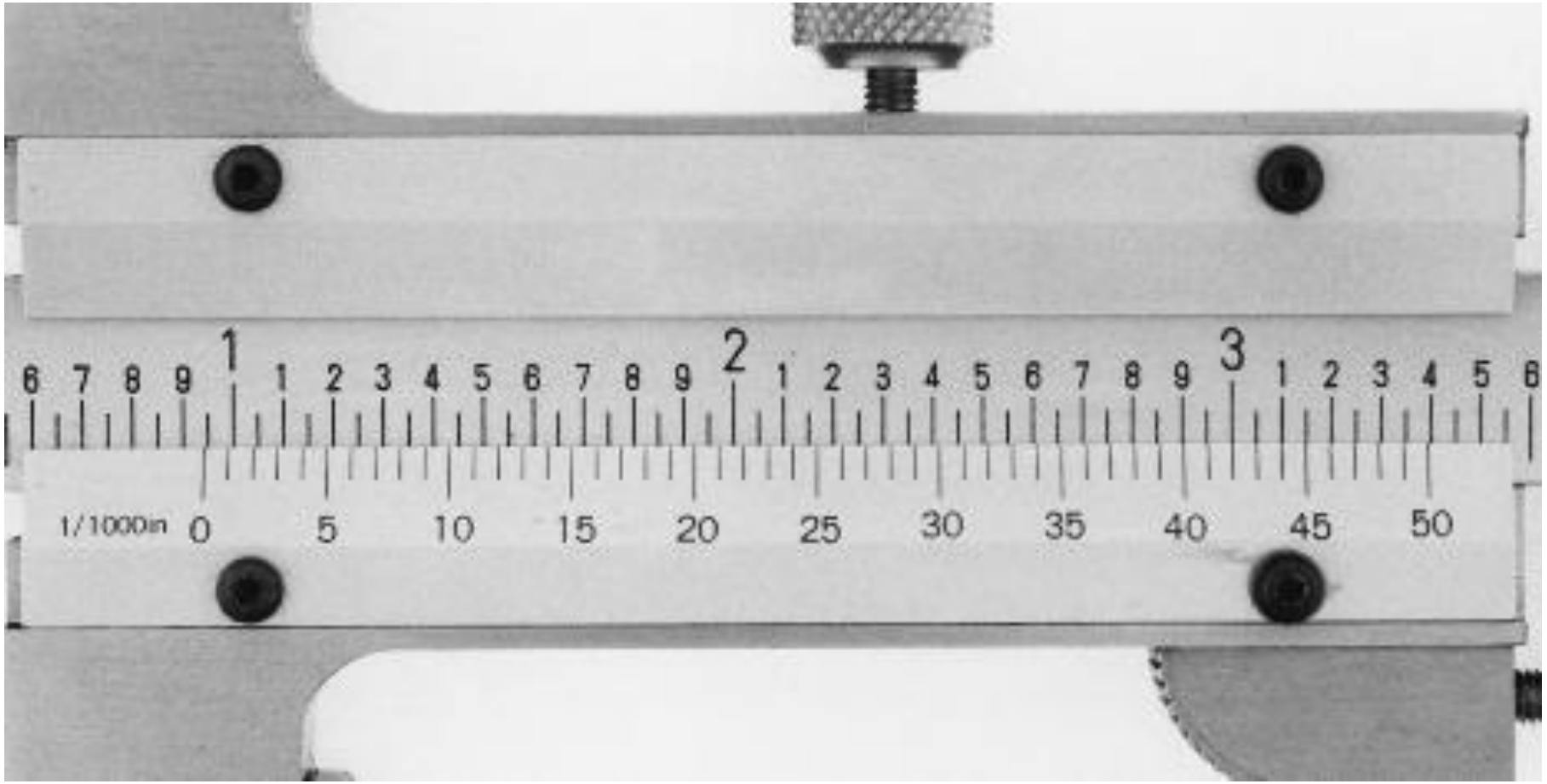
At Brussels, in 1631, he published, his treatise *La construction, l'usage, et les propriétés du quadrant nouveau de mathématique*, and dedicated it to the Infanta. In it he described the ingenious device which now bears his name, the Vernier scale.

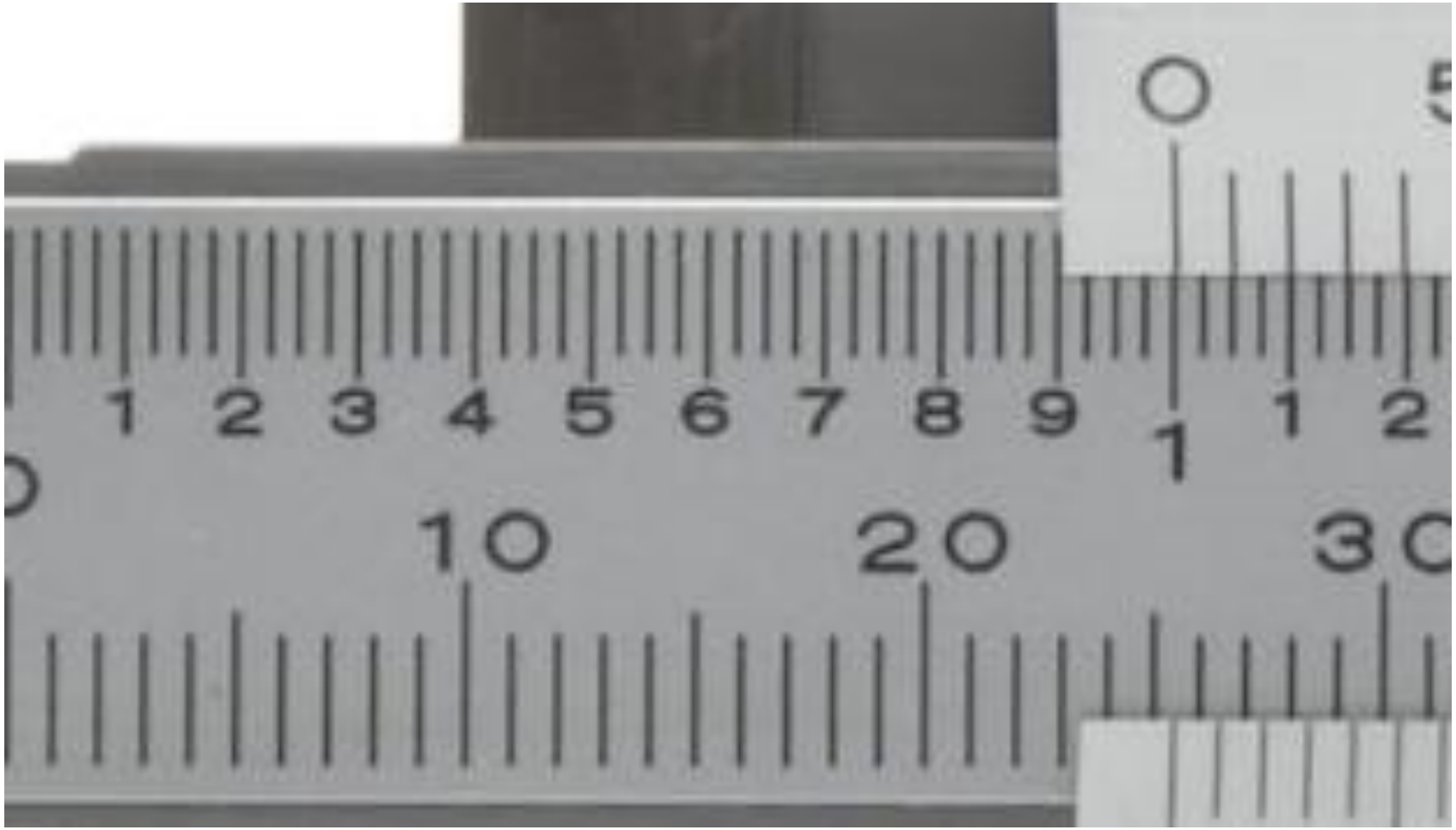
Voilà! The Vernier Scale!

Wow you say! Fascinating…




0 5 10 15 20 25 .001 in.
Mitutoyo
MADE IN JAPAN
0 10 20 30 40 50 60 70
0 1 2 3 4 5 6 7 8 9 10


6 7 8 9 1 1 2 3 4 5 6 7 8 9 2 1 2 3 4 5 6 7 8 9 3 1 2 3 4 5 6
1/1000in 0 5 10 15 20 25 30 35 40 45 50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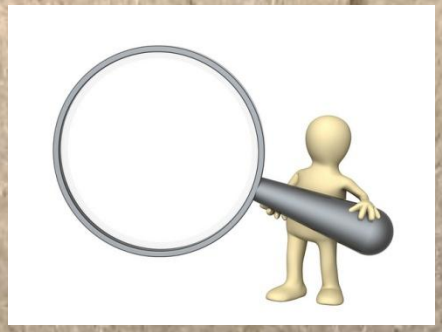
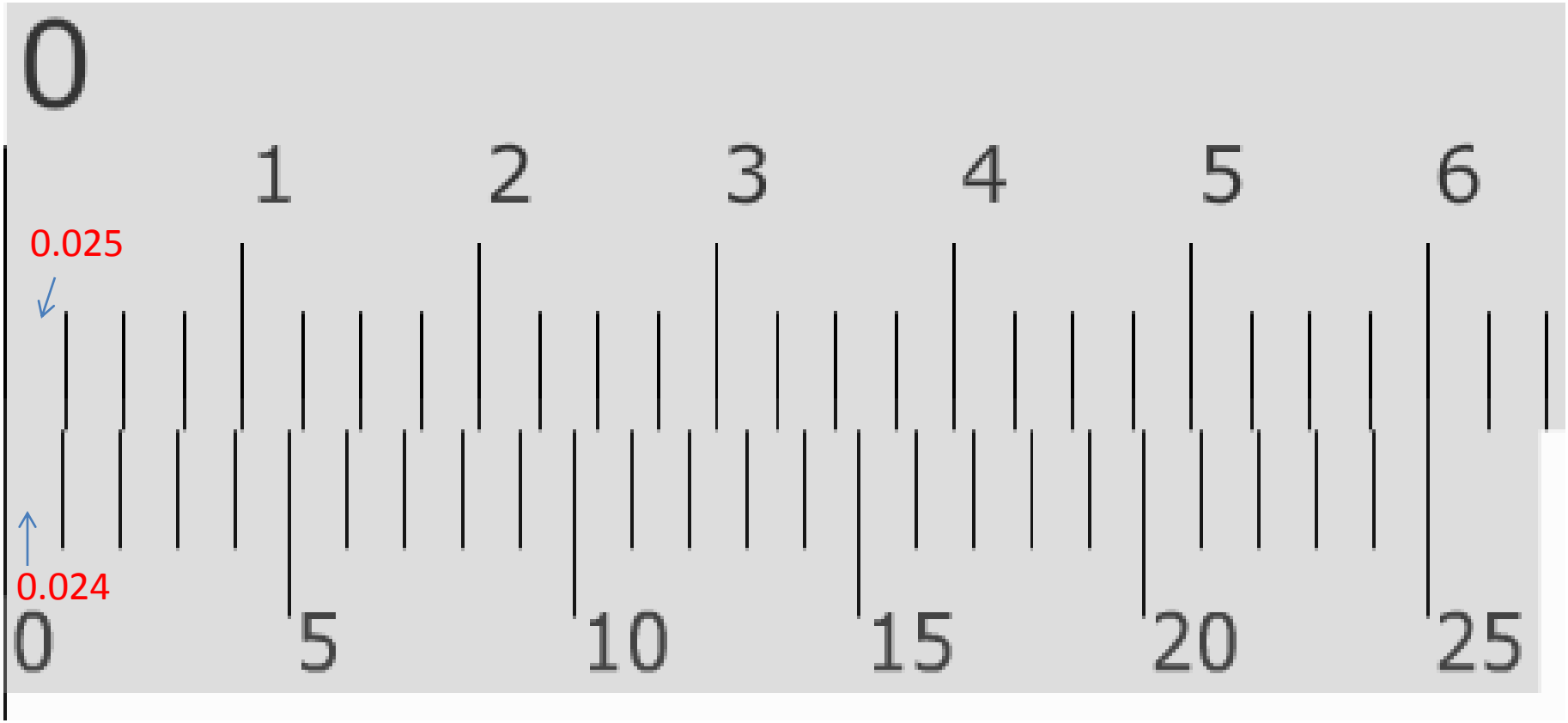


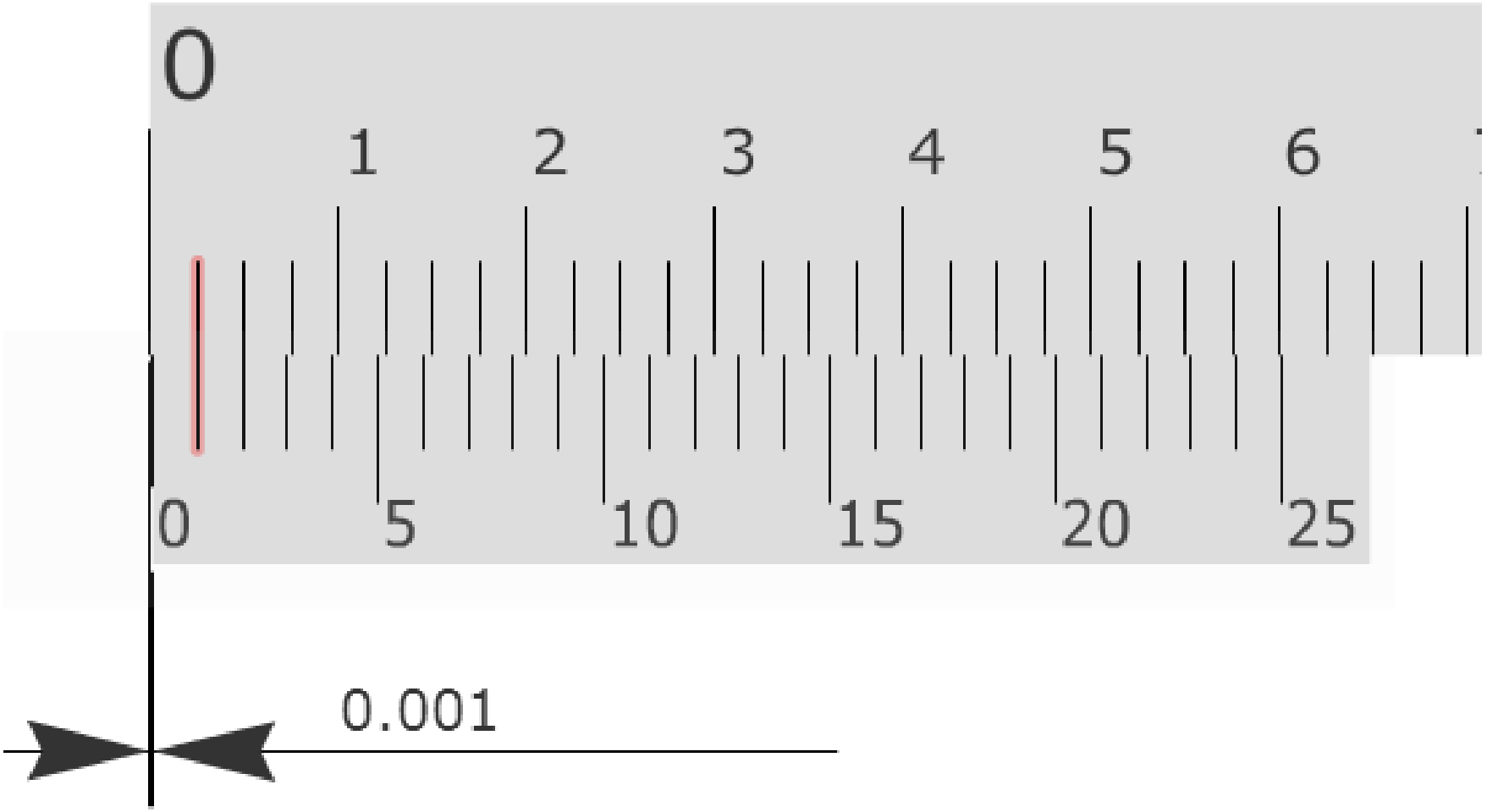
Vernier realized that the “and change” measurement was also a linier offset.

His approach was to create a scale proportional but to decrement each division to a value of 0.024.



Vernier realized that if the “and change” was (for instance) 0.001 **and** he set his scale at increment at 0.024, the mark for “one” would align.

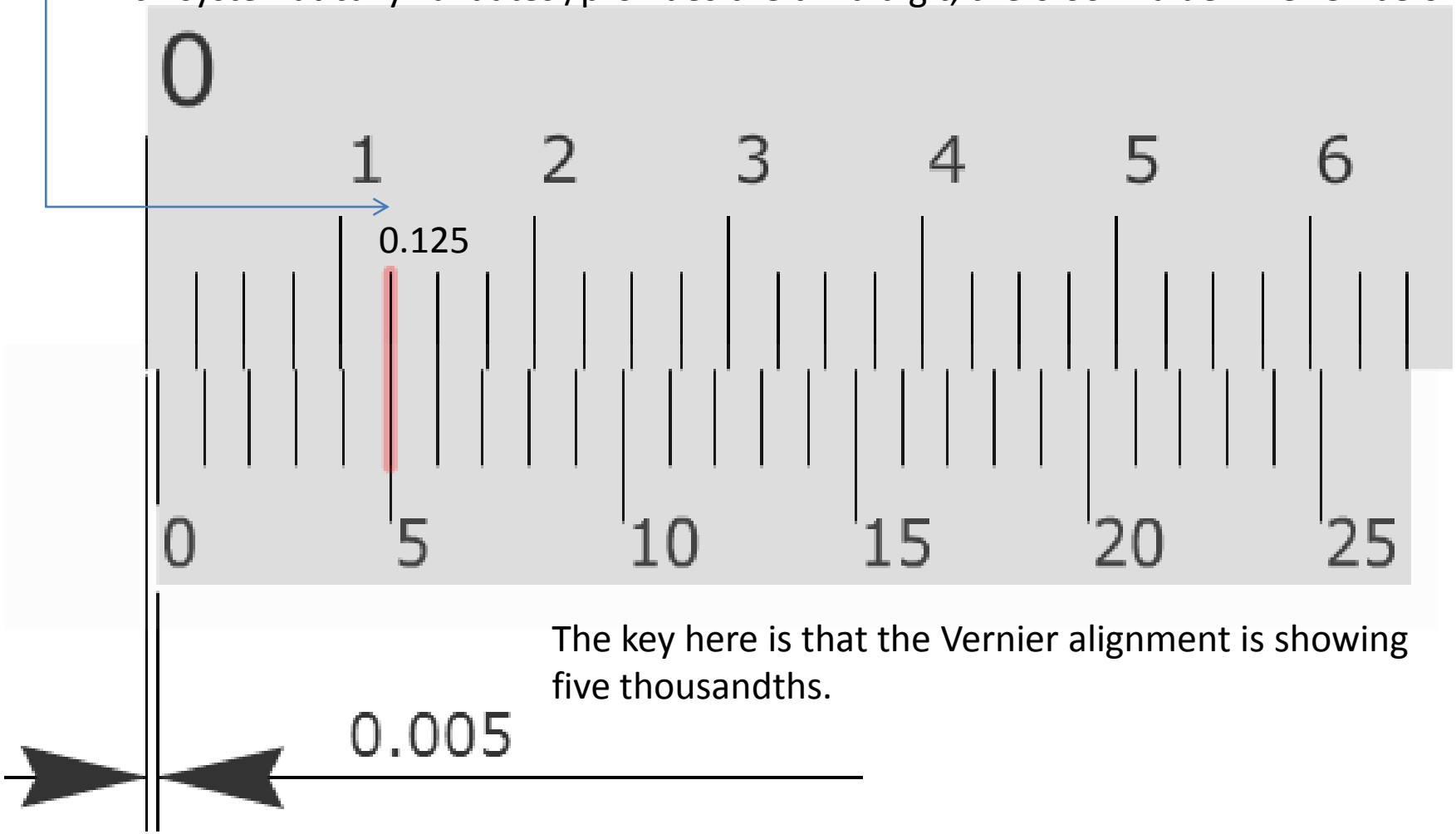
The first mark is offset by 0.024, and adding the “and change” 0.001 (0.001 + 0.024) should cause the very first mark (1) to align, and only that mark would align.



If the “and change” was .005, the offsets should line up

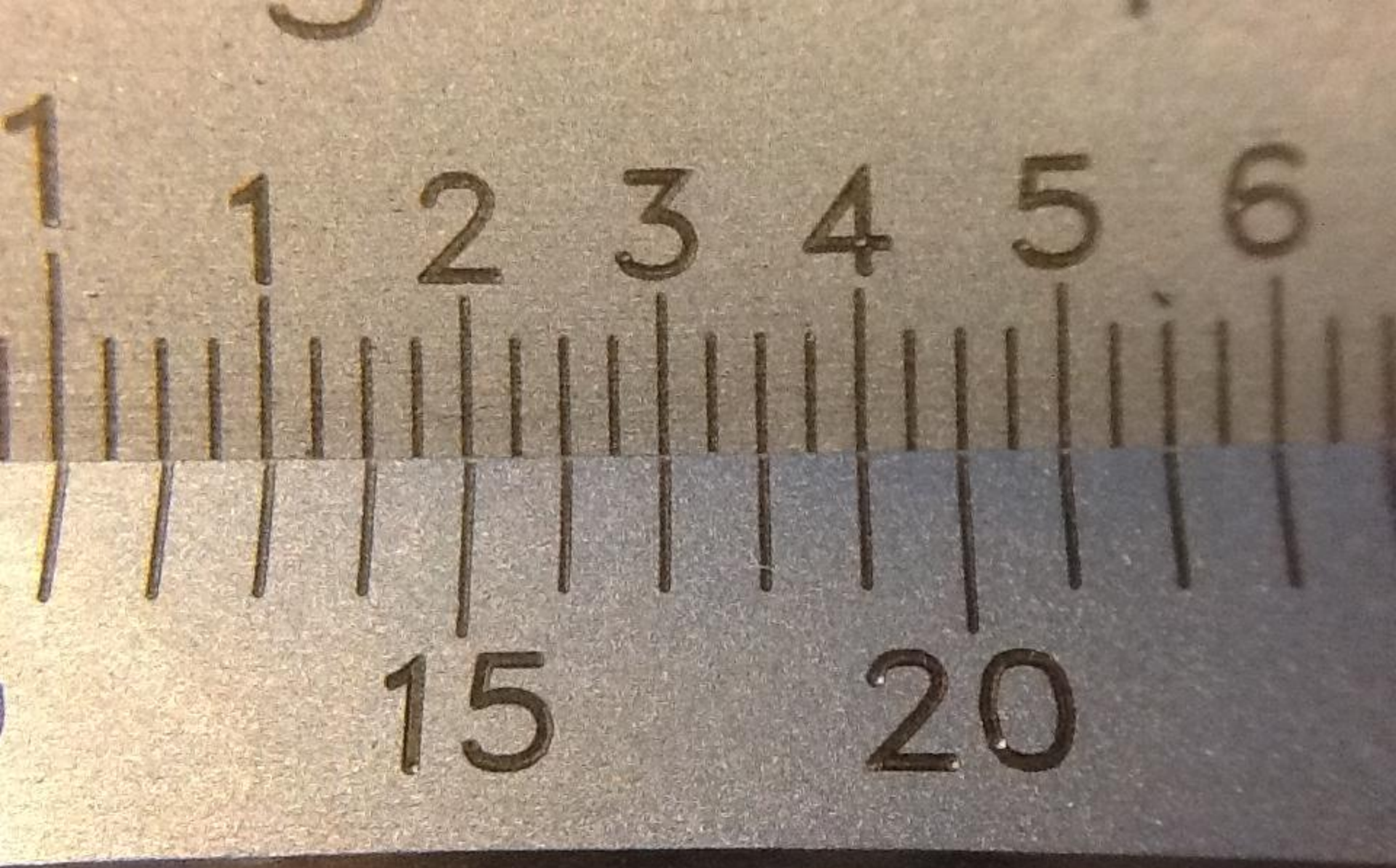
(0.005+ (0.024 x 5 = 0.012)) =.0125

Note: .0125 is irrelevant as a measurement, it is merely the mechanism Vernier found which systematically validates /provides the third digit, the 0.00X value. The “5” below:



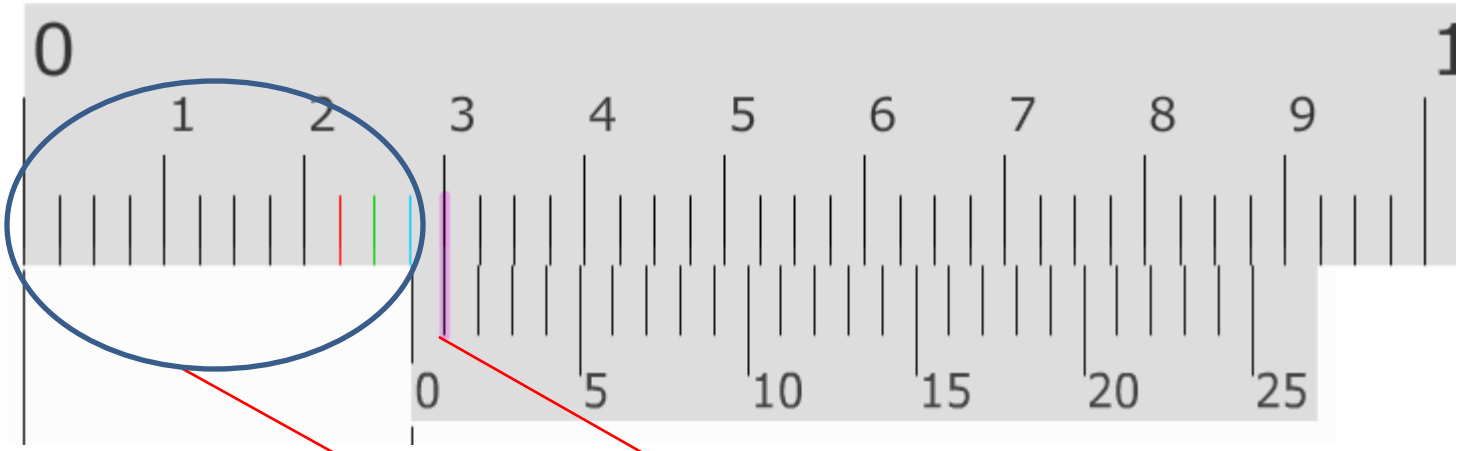
The key here is that the Vernier alignment is showing five thousandths.


4
5

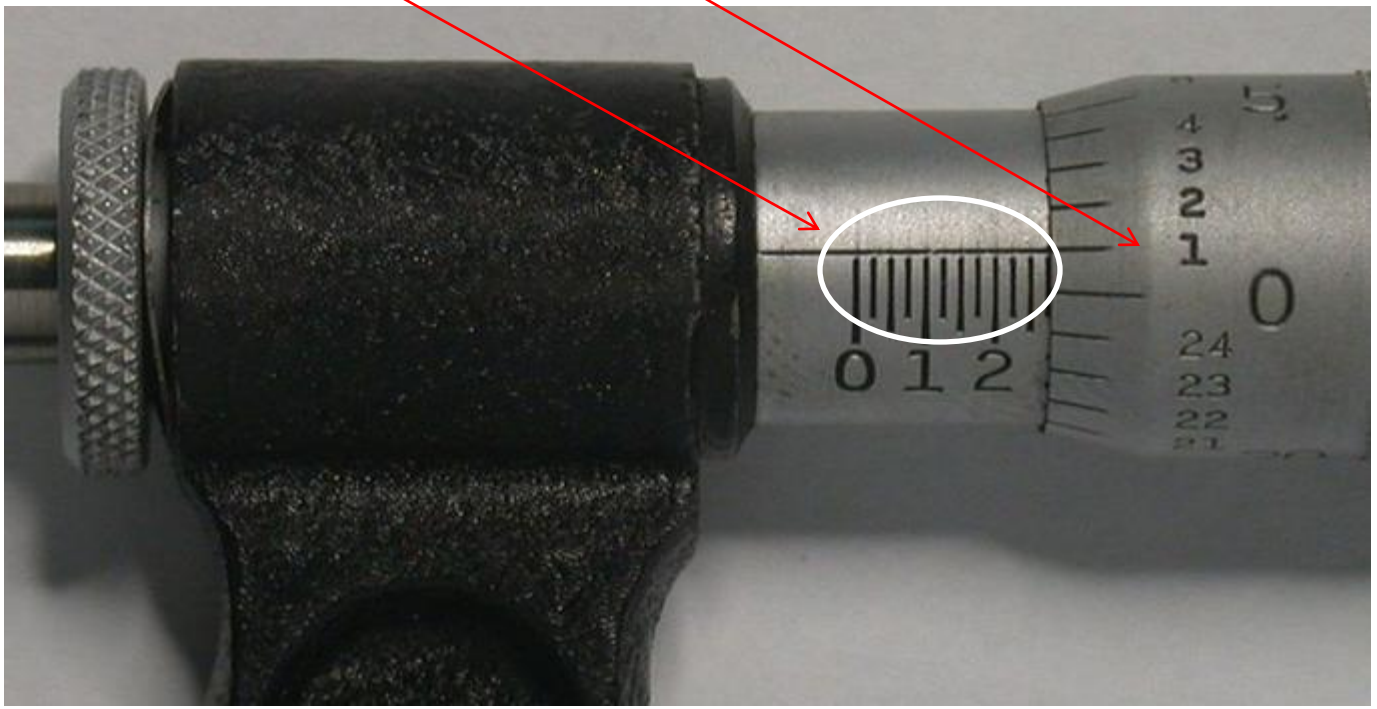


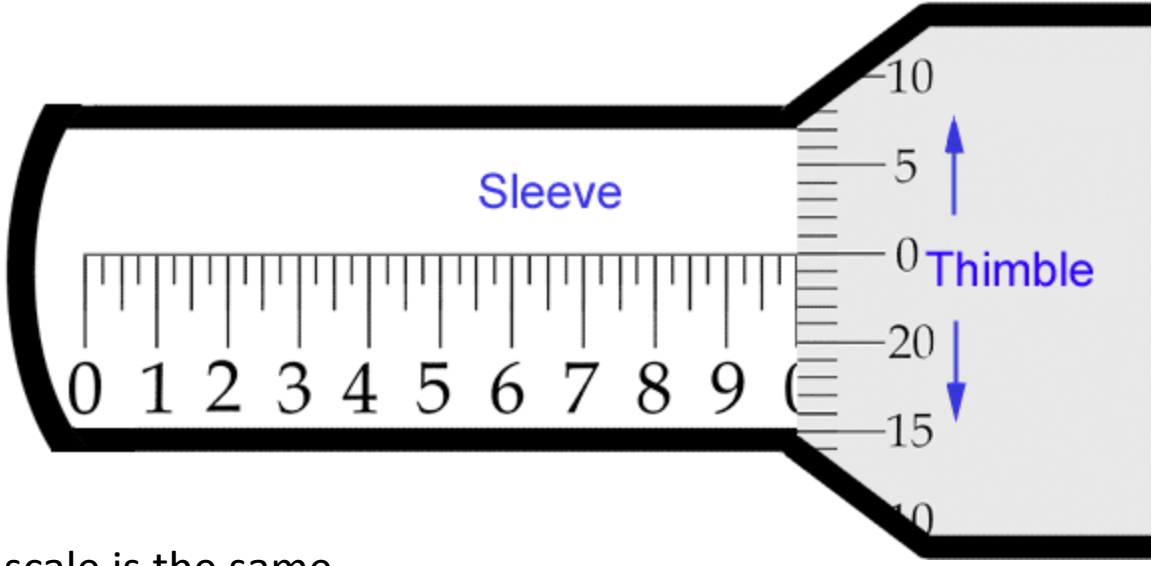
Vernier acuity is the ability by a person to detect the proper alignment of two line segments (200X magnification doesn't hurt either)

The first documented development of handheld micrometer was by Jean Laurent Palmer of Paris in 1848



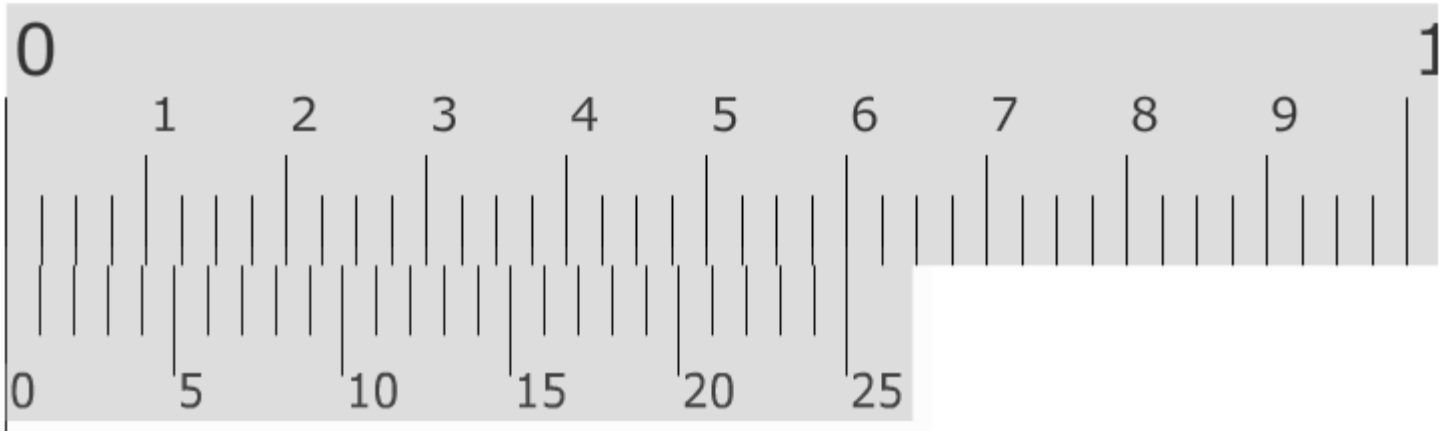
Look like familiar territory?

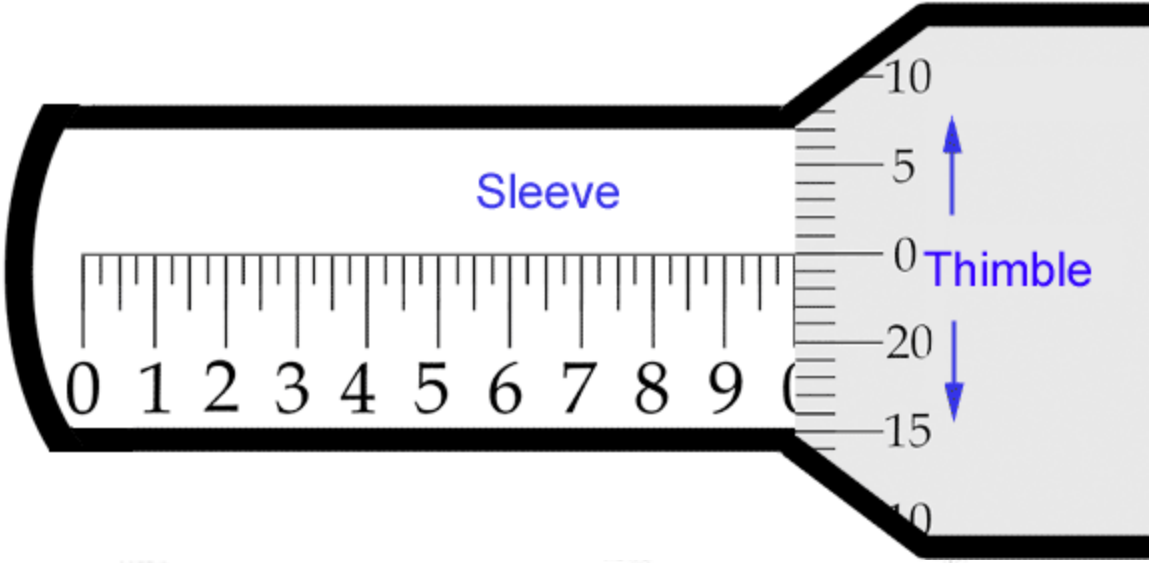


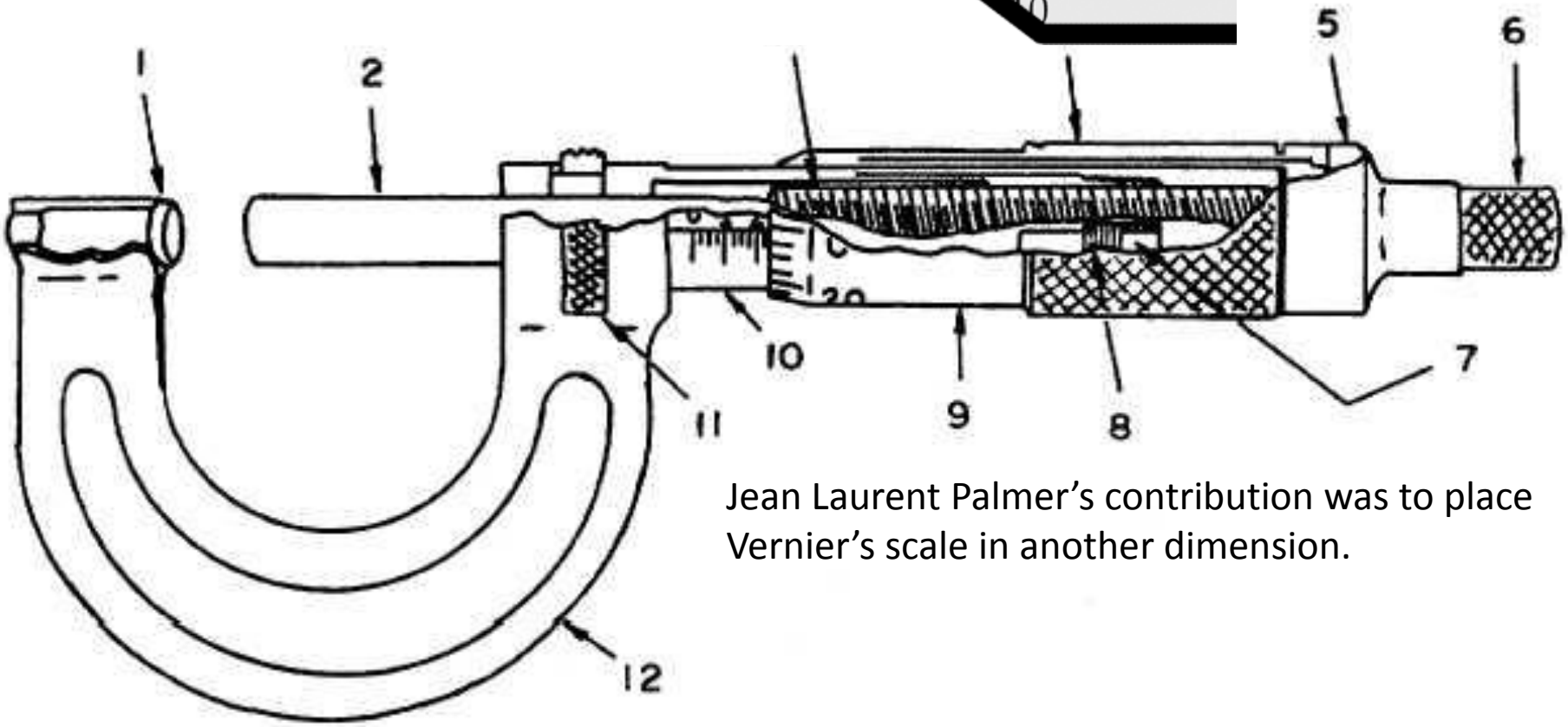


The linear tenth scale is the same.

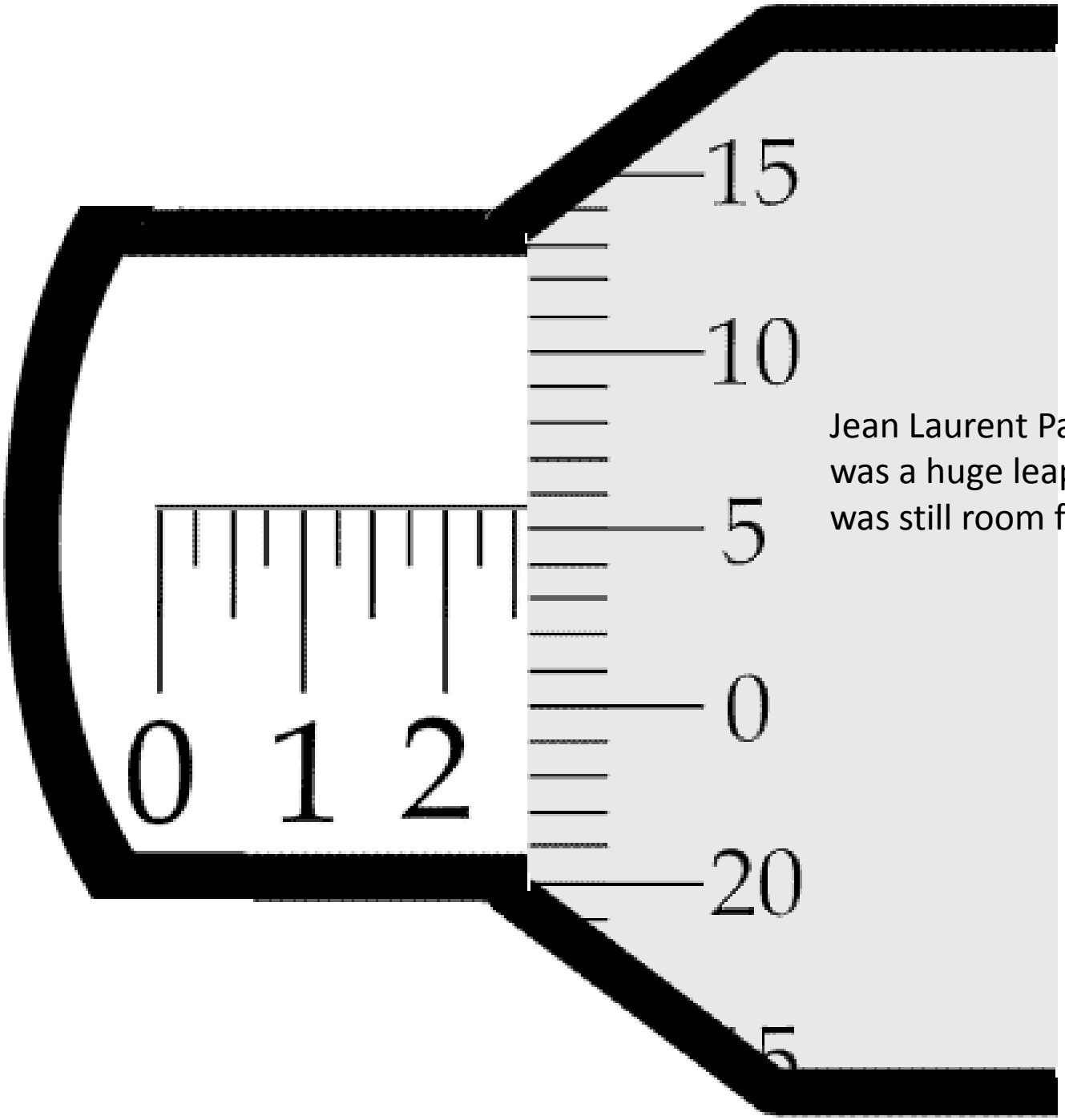
The Vernier scale is wrapped around the barrel. Technically this is no longer a Vernier scale.





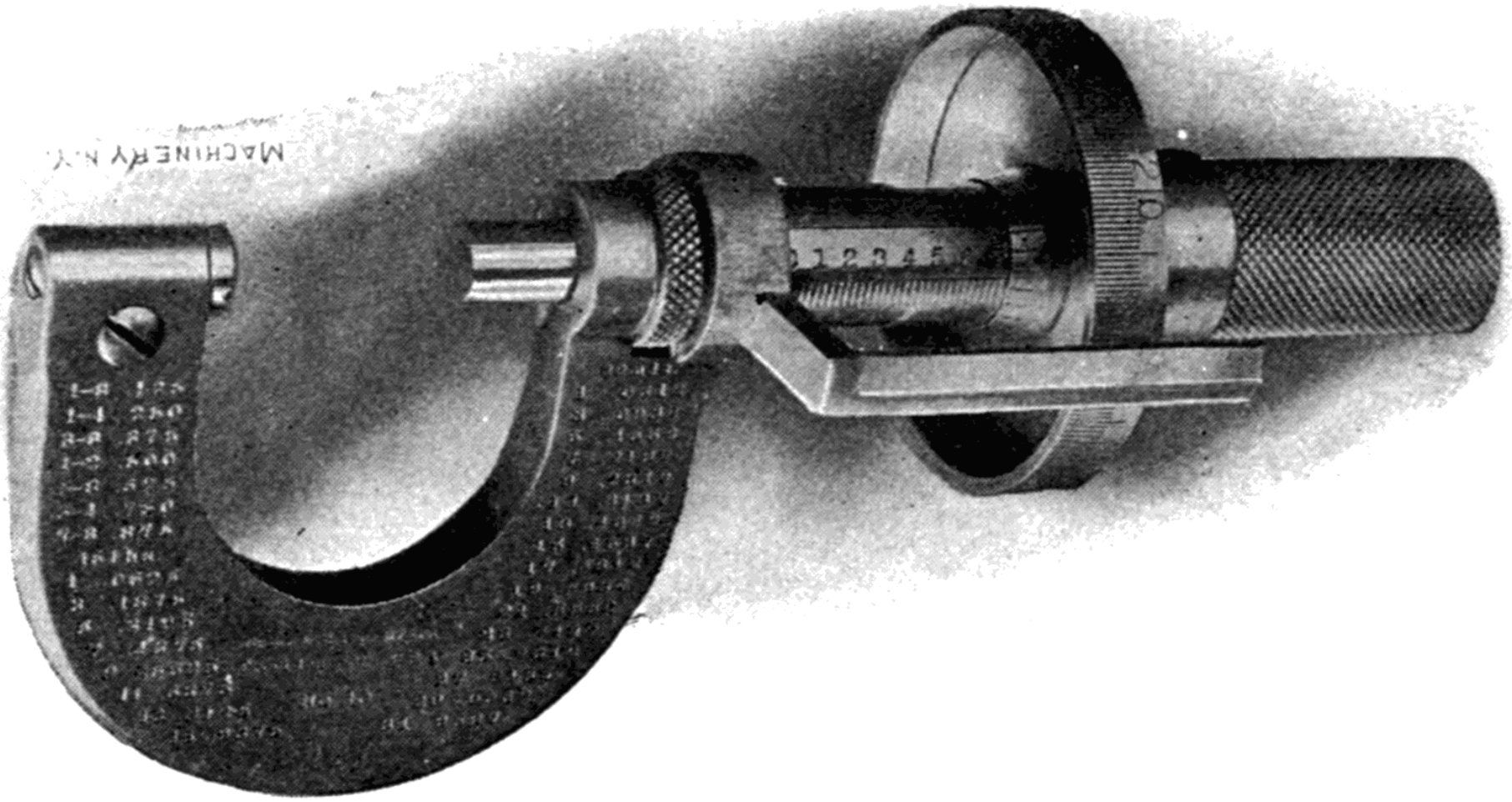


Jean Laurent Palmer's contribution was to place Vernier's scale in another dimension.

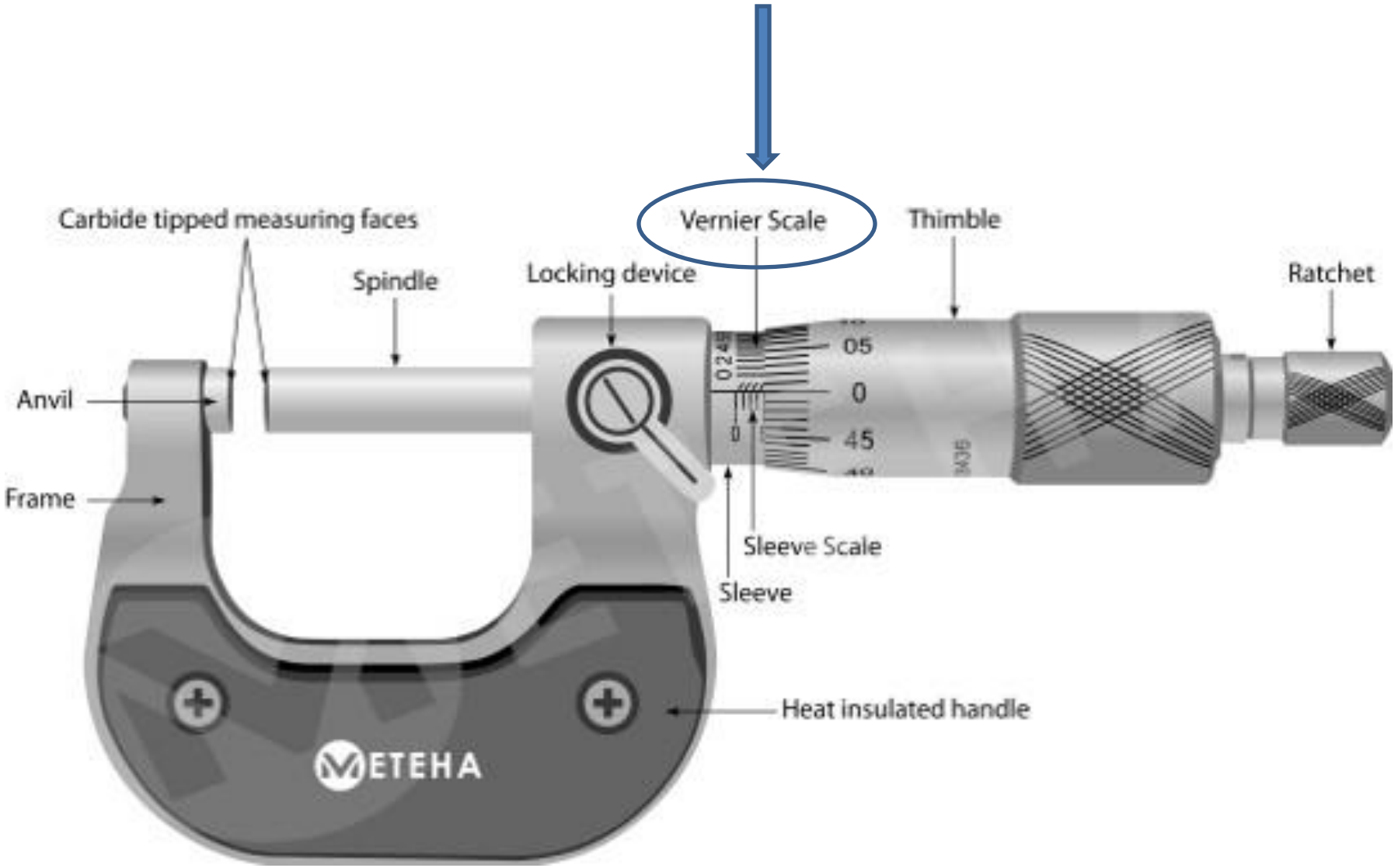


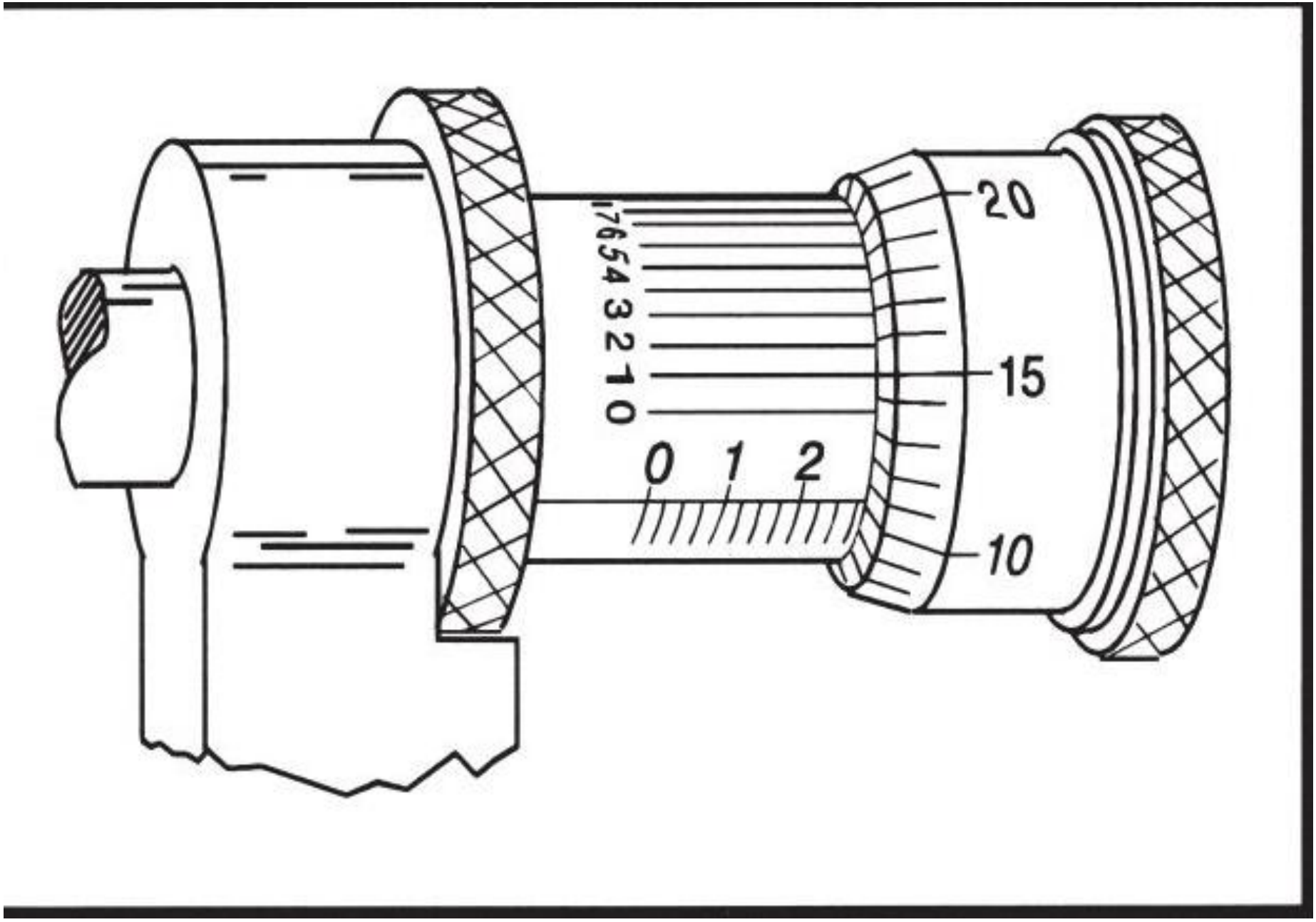
Jean Laurent Palmer's contribution was a huge leap forward, but there was still room for improvement.

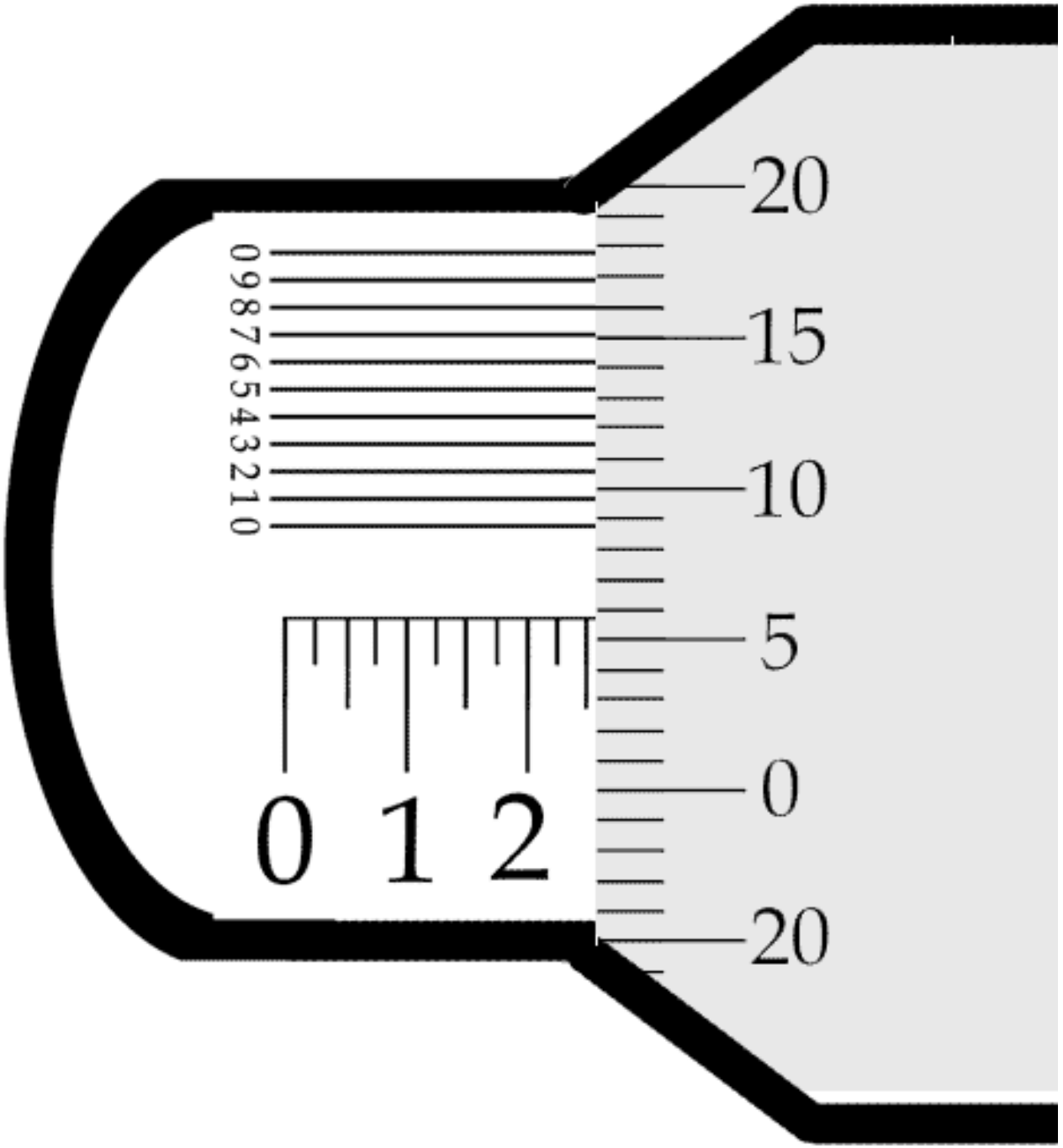
We could ad yet another dimension, and be brought to such small divisions we would need magnification to resolve the alignment …


MACHINERY N.Y.

Add a Vernier scale!!!




20
15
10
0 1 2
7 6 5 4 3 2 1 0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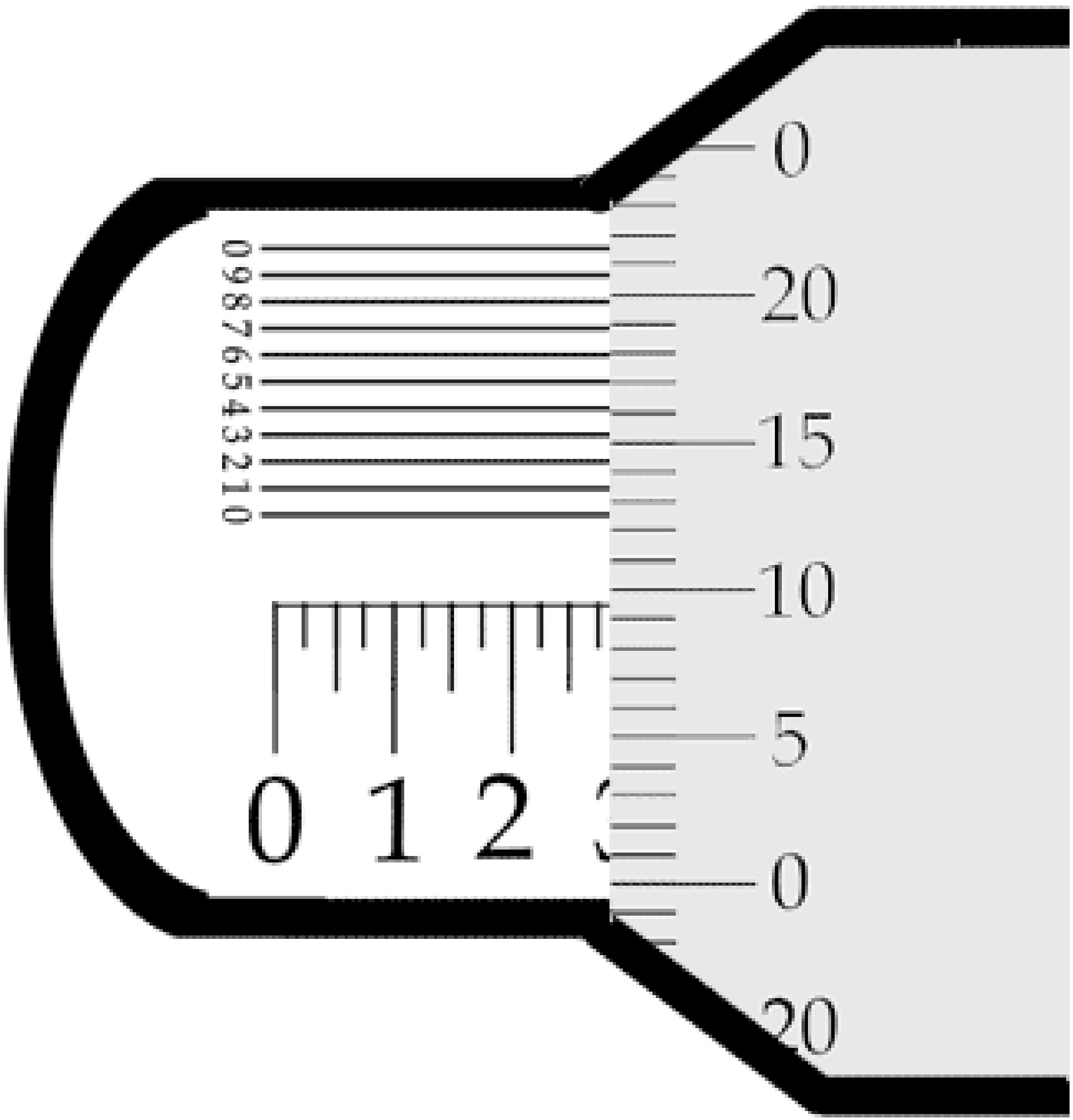
0 1 2



0 9 8 7 6 5 4 3 2 1 0
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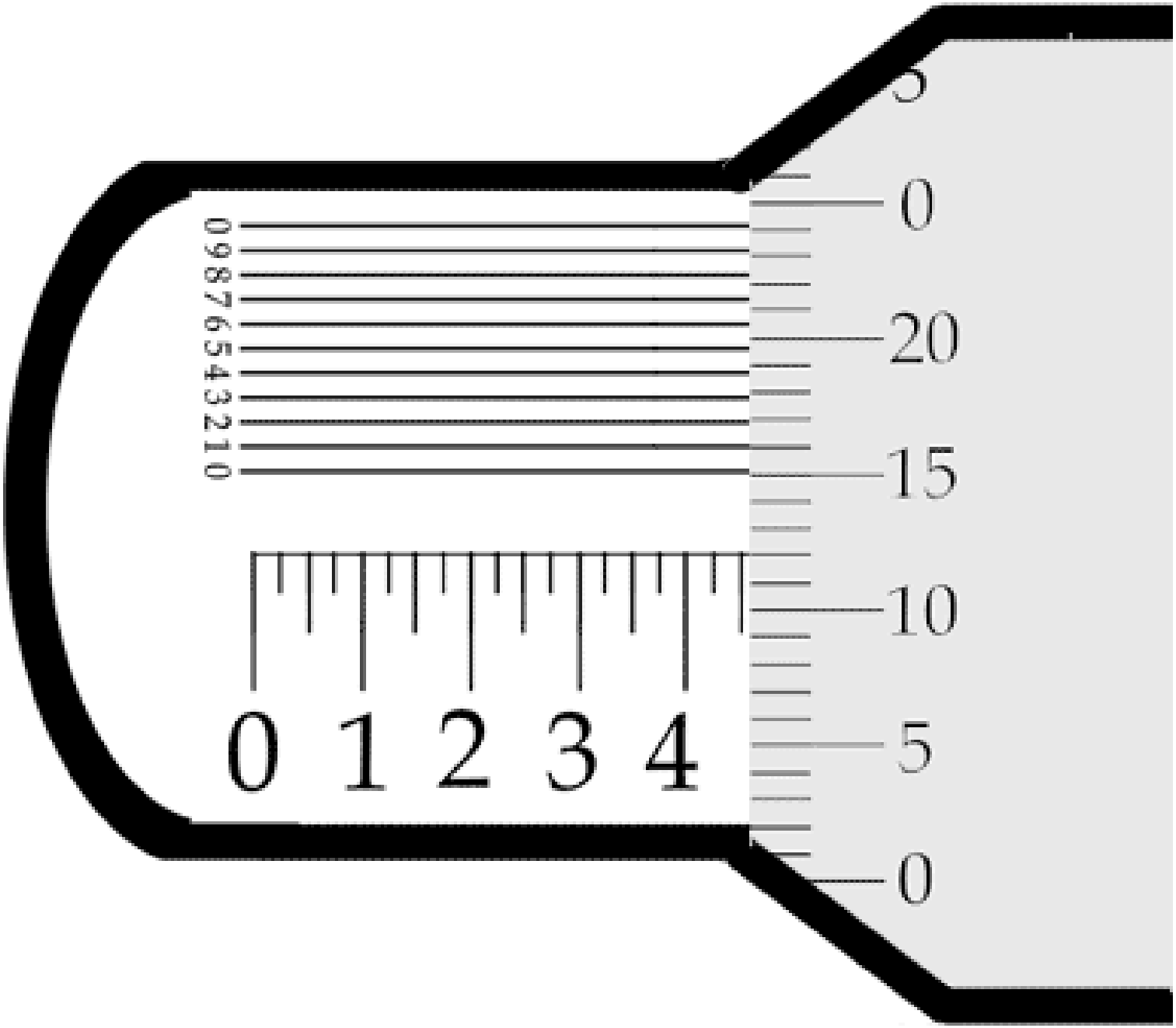
0 9 8 7 6 5 4 3 2 1 0
0 1 2 3 4
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Last One!