Enhancements

to the slide rule. Making rules containing one of these enhancements, or some together, by Gravet, mathematical instruments maker, Paris, 14 rue Cassette .

To shorten, I’ll call in this document « ordinary slide rule » the rule that everybody has in the hands, such I make it. In this note, I’ll not want to go into the details of each model of the rules I describe ; I’ll just specify them.

People who use slide rule have noticed how many results it can give ; but they also should notice that the number of these results impact over the approximation (*precision*, *accuracy*) it gives each of them.

I got the idea of making several rules, each of them having one aim, I'll go through them successively : I'll begin by the ordinary slide rule to which I brought some changes. The *coulisse* will be made such as the slide turned over doesnot pass over the rule so that trigonometric calculations can be made like the ordinary numbers.
A window will be placed in the middle of the rule, with a line mark to make trigonometric calculations without turning the slide over. So it's possible to multiply a number by a trigonometric value by means of this mark.

The ruler on the opposite side of the bezel will be removed. The bezel's ruler will no more begin at the beginning of the rule.

The slide will be placed in its runner (*coulisse)* such as its endings correspond with these of the rule. The marks 1 of the rule and the slide match each other. That will allow using the line mark of the window with the slide turned over.

The lower scale of the slide will be replaced by a square scale (*MANNHEIM!!!)* so that multiplications and divisions can be done with better precision. The log scale on the reverse side of the slide will be put between the sine and tangent scales, this one being inverted.

With this rule it will be convenient to use a cursor for some calculations ; this cursor will be useful for the rules I'm going to speak of.

Some people need only making multiplications, divisions and sometimes calculations with powers or roots, and with a great accuracy. I imagined for that a rule of 0m25 long which will perform products and quotients with the same precision that the ordinaty rule of 1 meter long (see pl. #1, fig. 1).

As we can see, the rule has only one scale, a part of it is drawn on the upper part of the rule, and the other on the lower part. The same on the slide which contains only one scale on each face. To compute a product with such a rule, one brings the mark 1 of the slide in front ot one of the factors read on the rule, and the product is read on the rule in front of the other factor read on the slide. Depending of the cases, one will have to use one or the other mark 1 of the slide and one or the other scale on the slide. With the 20 cm ruler of the rule which will be graduated for that, you will measure the length of logarithms, in order to effect the calculations concerning either the powers or roots.

I have still reduced the length of the rule with the same precision ; it will only be then about 0m18 or 0m19 long. It has the same objective that the previous one (see pl. #1, fig. 2). All I said about the previous rule is applicable to this one.

Sometimes it's avantageous to have on the same rule a square scale in order to obtain cubes or products like a^2b. So I imagined the next rule which will heve the same length that the ordinary rule, will give a better precision, but will not be able to make trigonometric calculations (see pl. #1, fig. 3). This rule contains, at the upper part and the lower part, a scale from 1 to 10. One of the faces of the slide contains a square scale, folded as it is seen on the picture ; back of the slide there is one scale from 1 to 10 and a scale to measure logarithms. The principle formulated earlier applies. The slide is more narrow than that of the ordinary rule ; so it's possible, on a rule of the same dimensions that the ordinary rule, to place two slides, and then the trigonometric computations will be possible (see pl.#2, fig. 1). The principle for trigonometric scales is easily deduced from the principle set out earlier.

Instead of two slides, it's possible to use as a slide a four sided slide like pl. #2, fig. 2. The scales of the earlier rules should be on the 4 faces of this slide. All the runners of this rule will be shorter than the slide.The ends of the external part will be beveled, which will allow to read on the bachk of the slides. This last condition is unnecessary ; one may not shorten the runners, but it must be possible to reverse the slide.

As one see in the earlier rule, we use faces of a polygonal prism ; of course, it's more convenient to use a cylindrical surface which has the advantage to avoid getting the slide out, unless in the case of reversing it. (see pl.#2, fig. 3)

The second rule I spoke about is 0m25 long, giving the same precision that a one meter long rule. The advantage of this rule is due to folded scales. Folding scales on a cylindrical slide, like the previous one, is more advantageous. It will be only 0m125 long.

The cylindrical rule will then have four apertures, each containing a part of the 1 – 10 scale, the cylindrical slide will also contain the same folded scale in front of the apertures. Logarithms will be measured under one of the apertures of the rule, quotients will be done by reversing the slide.

Signed   Gravet, 14 rue Cassette