EARLY FORMS OF A FEW COMMON INSTRUMENTS.

BY WILLIAM E. STARK,

Ethical Culture School, New York.

In the books on practical geometry of the sixteenth and seventeenth centuries, one finds descriptions of many ingenious instruments. Some have been superseded by more exact and more complicated devices, others became obsolete as skill in numerical computation increased, but a few remain unchanged in principle—the same instruments in spite of change of form for convenience or accuracy. Through the courtesy of Professor David Eugene Smith of Columbia University, whose collection of old mathematical books and instruments is a wonderful field for the historical student, I am able to reproduce cuts of three of these survivors in the march of progress.

In "*Seconda Squara Mobile et Arithmetica*," written by Antonio San Giovanni and printed in Vicenza in 1686, the author describes as his own invention a pair of *parallel rulers* which is identical in form with the instrument still in use. Figure I is a

Figure 1.

FROM *Seconda Squara Mobile* BY ANTONIO SAN GIOVANNI, VICENZA, 1686.

Figure 2.

PARALLEL RULERS. FROM *Traité de la Construction et des Principaux Usages des Instruments de Mathématique* BY N. BION.

SECOND EDITION. THE HAGUE, 1723.

reproduction of the cut given in San Giovanni's book. Figure II shows a second form of the same tool taken from a treatise on mathematical instruments published in 1723.

The *pantograph* is said to have been invented by P. Cristoforo Scheiner,¹ who called it a "parallelogram." Scheiner and others who described the instrument evidently expected for it a wider application than it permanently held, for they show methods of adapting it to sketching landscapes and reproducing pictures as well as to enlarging and reducing maps and plans. Figures 3 and 4 showing the construction and use of the parallelogram, are taken from a book of the middle of the seventeenth century.

Figure 3.

FROM *Apiaria Universae Philosophiae Mathematicae*
BY M. BETTINUS, BOLOGNA, 1645.

In "Neuerfundenes Instrumentum Universale" by Johann Matthes Bilern printed in Jena in 1696, the author describes a semicircular slide rule, which, if accurately constructed, would be nearly as efficient for some processes as the instrument in common use to-day.

Referring to the illustration (Figure 5) the semicircle ABCD

¹Del Catasto Romano e di Alcuni Strumenti Antichi di Geodesia. E. N. Legnazzi, 1835

Figure 4.

FROM BETTINUS. (SEE NOTE UNDER FIGURE 3.)

Figure 5.

SLIDE RULE, 1696.

may be turned on its center D within the semicircular band ABCEFG. On the outer edge of the semicircle and the inner edge of the band are corresponding logarithmic scales exactly like those of modern slide rules. The outer edge of the band is marked with a scale of degrees and within this are logarithmic scales of sines and tangents corresponding to the logarithmic scales of numbers mentioned above.

Anyone who understands the principle of the slide rule needs no explanation of the method of multiplying or dividing numbers with this instrument. For multiplying a number by a sine or tangent, a thread, attached to the center of the instrument, was stretched across the proper point on the sine or tangent scale and the semicircle was turned until the zero of the scale of numbers fell under the thread. The reading was then taken as in computation with ordinary numbers. For taking square or cube roots the thread was stretched across the given number, as it appeared on the outer scale of numbers. The reading on the scale of degrees was then divided by two or three and the thread stretched across the resulting number on the scale of degrees. The thread then indicated the result on the scale of numbers.

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