

of the decimal part and 1 above 2 denotes half of the sixth of the decimal part...³ We shall say that fractions which are on a branch [*virga*] will be in grades, so that the first grade of them is the fraction which is at the head of the branch to the right. The second grade is the fraction that follows towards the left. For instance, in the branch above, hence in $\frac{1}{2} \cdot \frac{5}{6} \cdot \frac{7}{10}$, the $\frac{7}{10}$ are in the first grade of this branch, $\frac{5}{6}$ in the second one...

2 RECORDE. ELEMENTARY ARITHMETIC

With the growing interest in mercantile reckoning and the spread of printing, the number of textbooks of elementary arithmetic increased rapidly from the latter half of the fifteenth century onward. Their character has been described in L. C. Karpinski, *The history of arithmetic* (Rand McNally, Chicago, 1925) and in Smith, *History of mathematics*, II, chaps. 1-3, with many illustrations. Smith, *Source book*, 1-12, has an English translation of a section of the so-called *Treviso arithmetic* of 1478 (the first printed arithmetic). Typical of all is their introduction to the art of reckoning with the aid of the decimal position system, with digits almost or exactly the same as those we use. Many books have chapters on finger reckoning and on the use of counters for computation on an abacus. Notations for addition, subtraction, multiplication, and division still vary, though the use of + and - for addition and subtraction is fairly common. As an example we present here, in facsimile, some pages of the first arithmetic printed in the English language, *The ground of artes* by Robert Recorde (c. 1510-1558). Recorde, a Cambridge M.D. and physician to Edward VI and Mary Tudor, wrote several books on mathematics and astronomy that were long in use in England. *The ground of artes*, first published in London between 1540 and 1542 (the oldest extant edition has the date 1543), was regularly reprinted and reedited; there exists an edition of 1699.

In the pages that we reproduce (Figs. 1, 2, 3) we see how Recorde performed division in Arabic numerals, and how he taught addition by means of counters, which have long been in use and are still popular in Russia, Japan, and China. In the United States they are used by Chinese laundrymen and restaurant workers, and on baby pens. Recorde used the + and - signs, and in his algebra, *The whetstone of witte* (London, 1557), he introduced our sign for equality:

I will sette as I doe often in woorke use, a paire of paralleles, or Gemowe lines of one lengthe, thus: \parallel , because noe.2. thynges, can be moare equalle.

In his use of the strange word "Gemowe" we see an example of Recorde's attempt to substitute English technical words for the current Latin ones. Stevin tried the same in

³ Hence $\frac{1}{2} \cdot \frac{5}{6} \cdot \frac{7}{10} = \frac{7}{10} + \frac{5}{6} \cdot \frac{7}{10} + \frac{1}{2} \cdot \frac{5}{6} \cdot \frac{7}{10}$. On connections with an Islamic and perhaps pre-Islamic calculus of fractions see Cantor, *Geschichte*, I, 813.

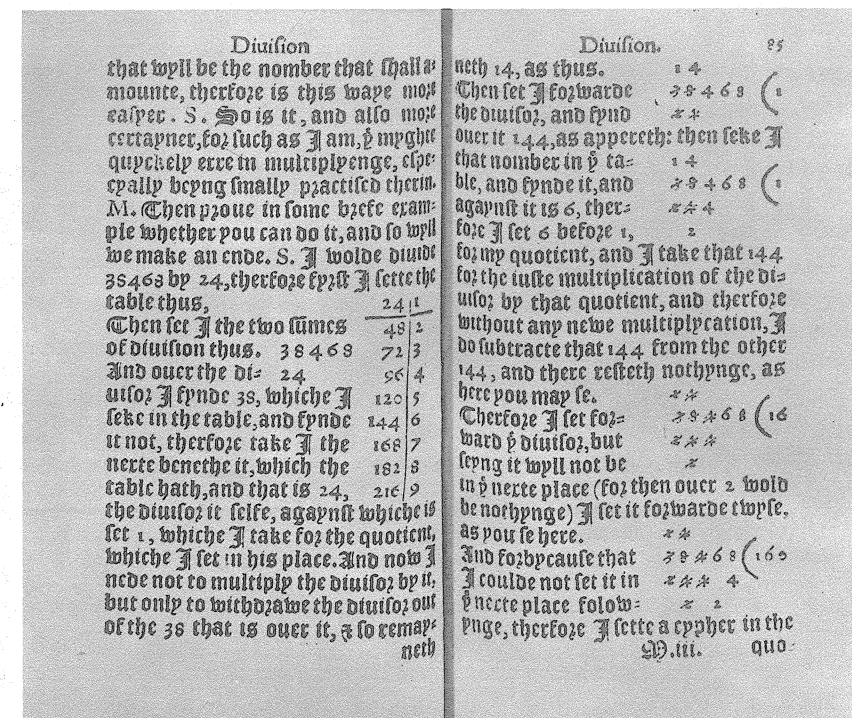


Fig. 1

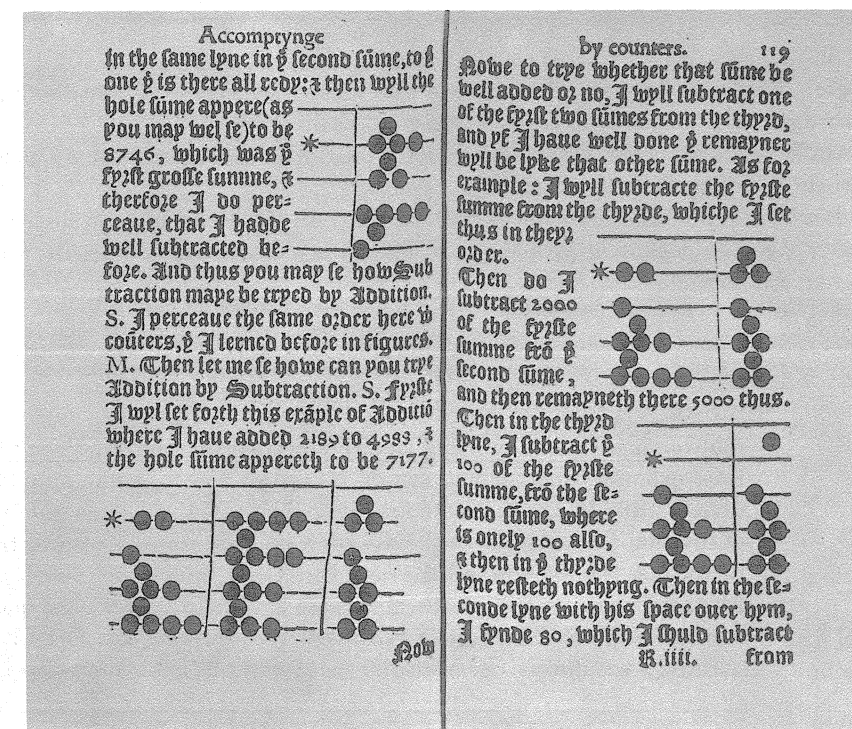


Fig. 2

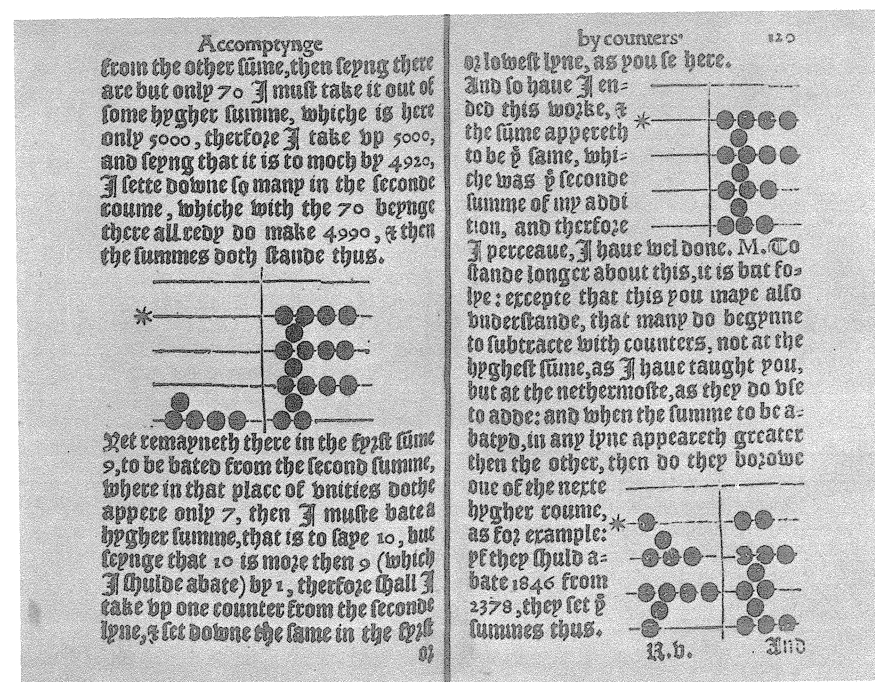


Fig. 3

Dutch, Kepler in German. The only one who was partly successful was Stevin. "Gemowe," also "gemew," means twin (French *géméaux*, Latin *geminus*).

On *Recorde* see F. M. Clarke, "New light on Robert Recorde," *Isis* 8 (1926), 50-70; see also L. D. Patterson, *Isis* 42 (1951), 208-218.

For those who find it difficult to read the text, we transcribe here, in slightly modernized form, page 84^v, beginning with the third line. It is a discussion between *M*, the master, and *S*, the scholar:

S. So is it, and also more certainer, for such as I am, that might quickly err in multiplying, especially being smally practised therein. *M*. Then prove in some brief example whether you can do it, and so will we make an end. *S*. I would divide 38468 by 24, therefore first I set the table thus. Then set I the two sums of division thus. And over the divisor I find 38, which I seek in the table, and find it not, therefore take I the next beneath it, which the table has, and that is 24, the divisor itself, against which is set 1, which I take for the quotient, which I set in his place. And now I need not to multiply the divisor by it, but only to withdraw the divisor out of the 38 that is over it, and so remains 14, as thus.

3 STEVIN. DECIMAL FRACTIONS

The introduction of decimal fractions as a common computational practice can be dated back to the Flemish pamphlet *De Thiende*, published at Leyden in 1585, together with a French translation, *La Disme*, by the Flemish mathematician Simon Stevin (1548-1620), then settled in the Northern Netherlands. It is true that decimal fractions were used by the Chinese many centuries before Stevin and that the Persian astronomer Al-Kāshī used both decimal and sexagesimal fractions with great ease in his *Key to arithmetic* (Samarkand, early fifteenth century).¹ It is also true that Renaissance mathematicians such as Christoff Rudolff (first half sixteenth century) occasionally used decimal fractions, in different types of notation. But the common use of decimal fractions, at any rate in European mathematics, can be directly traced to *De Thiende*, especially after John Napier (see p. 13) had modified Stevin's notation into the present one with the decimal point or comma.

Stevin's notation strikes us as clumsy, showing an unnecessary relation to the notation of sexagesimal fractions. However, for beginners in the difficult arts of multiplication and division, his method may have had a certain advantage. See further the introduction to the edition of *De Thiende* in *The principal works of Simon Stevin*, IIA (Swets-Zeitlinger, Amsterdam, 1958), 373-385. We take from this edition the English translation, based on that of Richard Norton and published in 1608. Another English translation, by V. Sanford, can be found in Smith, *Source book*, 20-34.

THE FIRST PART

Of the Definitions of the Dime.

THE FIRST DEFINITION

Dime is a kind of arithmetic, invented by the tenth progression, consisting in characters of ciphers, whereby a certain number is described and by which also all accounts which happen in human affairs are dispatched by whole numbers, without fractions or broken numbers.

Explication. Let the certain number be one thousand one hundred and eleven, described by the characters of ciphers thus 1111, in which it appears that each 1 is the 10th part of his precedent character 1; likewise in 2378 each unity of 8 is the tenth of each unity of 7, and so of all the others. But because it is convenient that the things whereof we would speak have names, and that this manner of computation is found by the consideration of such tenth or dime progression, that is that it consists therein entirely, as shall hereafter appear, we call this treatise fitly by the name of *Dime*, whereby all accounts happening in the affairs of man may be wrought and effected without fractions or broken numbers, as hereafter appears.

THE SECOND DEFINITION

Every number propounded is called COMMENCEMENT, whose sign is thus ①.

Explication. By example, a certain number is propounded of three hundred

¹ P. Luckey, *Die Rechenkunst bei Ġamšīd b. Mas'ūd al-Kāshī* (Steiner, Wiesbaden, 1951).