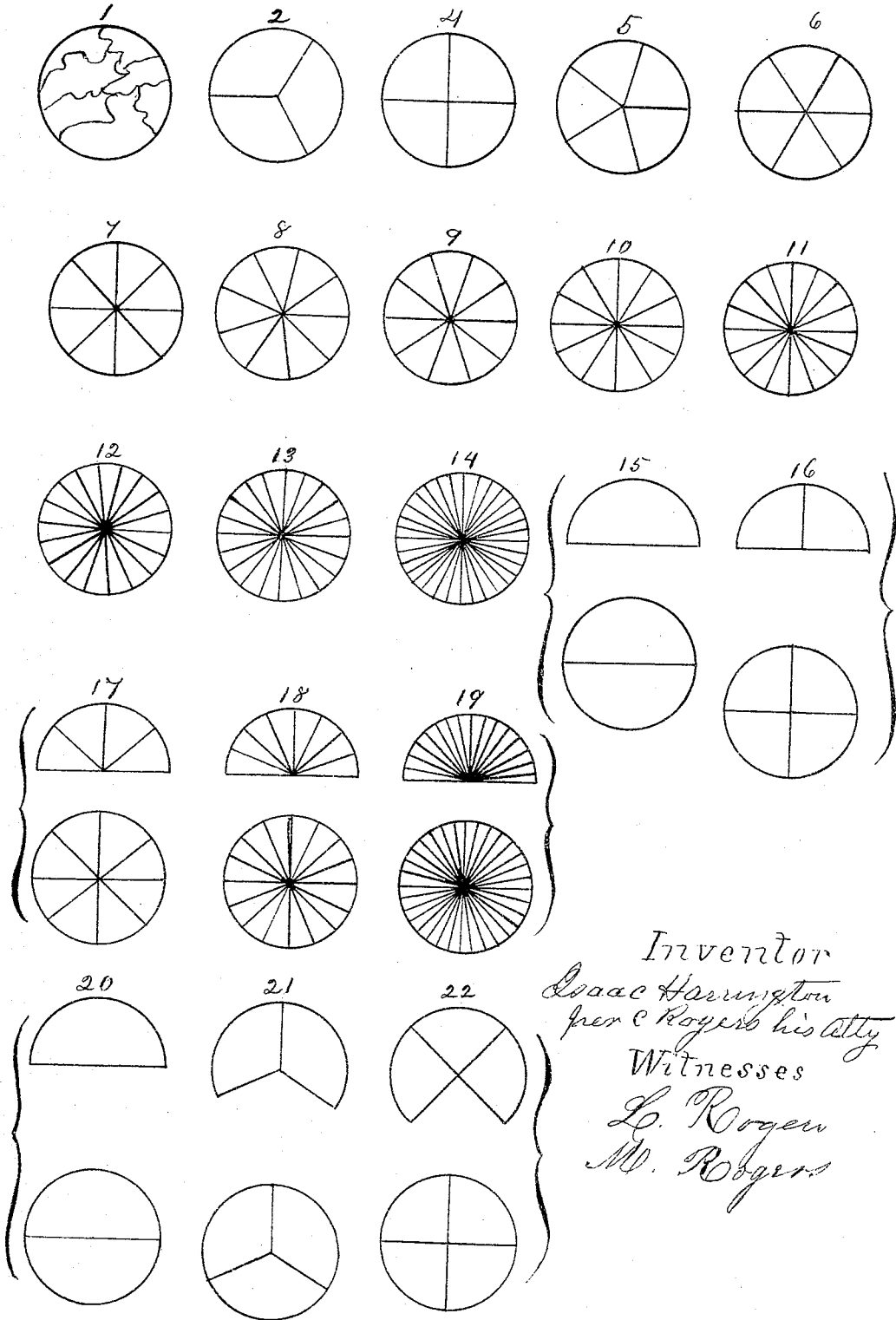


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Means for Teaching Fractions.

No. 151,971.

Patented June 16, 1874.

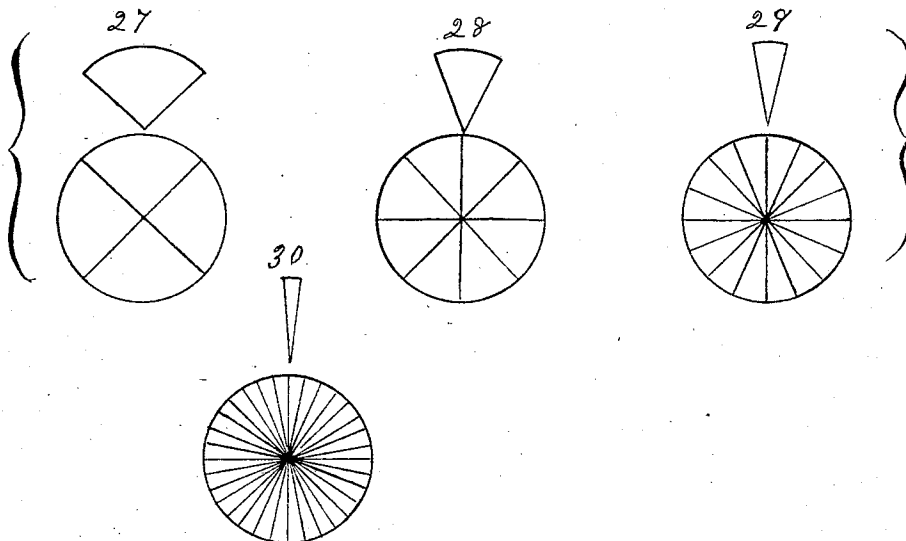
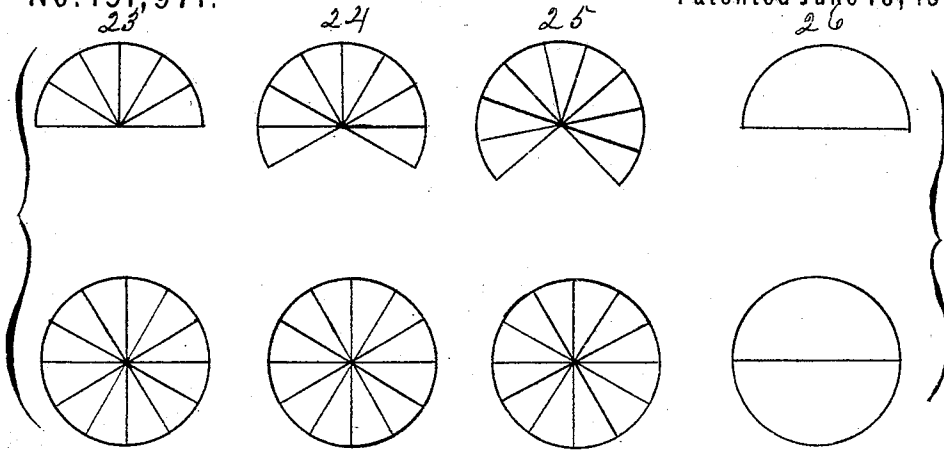


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UNITED STATES PATENT OFFICE.

ISAAC HARRINGTON, OF NEW YORK, N. Y.

IMPROVEMENT IN THE MEANS FOR TEACHING FRACTIONS.

Specification forming part of Letters Patent No. **151,971**, dated June 16, 1874; application filed September 30, 1873.

To all whom it may concern:

Be it known that I, ISAAC HARRINGTON, of the city, county, and State of New York, have invented a new and useful Method of Teaching Fractions by ocular demonstration; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings making a part of this specification.

The object of my invention is to provide a set of fractional blocks designed to demonstrate, first, the elementary idea of fractions, viz., by dividing the unit separated into irregular parts, as though broken by accident; second, to show the unit divided into various regular parts to give the learner a quick and easy conception of the various proportions and relative values of such fractional parts; third, to show various subdivisions of parts to furnish the learner extensive exercises in compound fractions, and aid in imparting clear conception of subdivided parts and their relative values; fourth, to aid in imparting clear conceptions of equivalent fractions by changing a fraction from its first form into other equivalent forms, and by presenting these changes to the eye of the learner to lead easily and clearly to the abstract idea; fifth, to illustrate and present to the eye the process of reducing several fractions to a common denominator with equivalent values without changing their relative values; sixth, to present to the eye the effect produced by multiplying the denominator without changing the numerator, or of multiplying the numerator without changing the denominator; seventh, to show the precise effect produced on a fractional quantity by multiplying or dividing both numerator and denominator by the same number, and how it changes the form of the quantity without changing the value; eighth, to show reasons for all the rules for working fractions, and to prove their connection.

My invention consists of a set of wooden blocks, or other suitable material, so divided, subdivided, and hinged as to take all the forms described without detaching any of the parts, so that they will form a complete set or system.

I am aware that it is not new to divide into parts for the purpose of illustrating fractional quantities; but to construct a set or series of hinged blocks so as to exemplify the rules of fractions has never been accomplished prior to my invention, as it consists of a complete system or series, showing the regular inductions, deductions, specific rules and processes of elementary arithmetic, and presents the whole theory of fractions to the eye.

It is believed that the solution of problems by my invention is a new feature in the adaptation of physical objects to arithmetical science.

To enable others skilled in the art to make and use my invention, I will describe its construction.

Figure 1 illustrates the first idea of fractions by representing a plate broken, as it were, by accident. The figures from 2 to 14 exhibit a unit divided into parts. Figs. 15 to 19 show equivalent fractions produced by multiplying both numerator and denominator by the same number. Reversing them, from 19 to 15 will show equivalent fractions produced by dividing both numerator and denominator by the same number. Figs. 19 to 15 also show the philosophy of reducing fractions to their lowest terms. Figs. 20 to 25 illustrate the reduction of fractions to a common denominator. Fig. 26 represents $\frac{1}{2}$. By multiplying the denominator by 2, retaining the 1 as numerator, we have Fig. 27, $\frac{1}{4}$, which is only one-half as much as before. Multiply this denominator 4 by 2, the numerator remaining the same, gives Fig. 28, or $\frac{1}{8}$, half as much as before. Multiply the denominator 8 by 2 and we have Fig. 29, or $\frac{1}{16}$, which is only half as much as before. Now, multiply the denominator 16 by 2, the numerator remaining the same, and we have Fig. 30, or $\frac{1}{32}$ —half as much as before, or half as much as Fig. 29. This goes far enough to clearly illustrate the rule that multiplying the denominator divides the value of the fraction. Take the same figures, beginning at Fig. 30, divide the denominator by 2, and we have Fig. 29, $\frac{1}{16}$ —twice as much as we had before, or as shown in Fig. 30. Again, divide the denominator 16 by 2, the numerator remaining the same, and we have Fig. 28, $\frac{1}{8}$, or twice as much

as before. Now, divide the denominator 8 by 2, and we have $\frac{1}{2}$, as seen in Fig. 27, just twice as much as before. Divide the denominator 4 by 2 and we have Fig. 26, $\frac{1}{2}$, or twice as much as we had before.

It will be readily seen by reference to the drawings that this fully illustrates the rule that dividing the denominator multiplies the value of the fraction.

The advantages of this invention will be readily seen from the fact that fractions are so clearly illustrated by a complete system of blocks so divided, subdivided, and hinged that the learner cannot fail to fully understand and comprehend the principles and rules as well as the value of fractions relative to the unit. Thus, by my invention a complete and perfect system for teaching fractions is attained, whereby some of the most difficult and intricate rules in mathematics for young learners to comprehend are made easy, as it is entirely unfolded by ocular demonstration.

I do not claim, broadly, the dividing, subdividing, and hinging blocks for demonstrating geometric figures, as Letters Patent of the United States have been granted me for this; but

What I do claim as new, and desire to secure by Letters Patent of the United States, is—

The method of teaching fractions by ocular demonstration by means of a series of hinged blocks in the form of sectors divided and subdivided substantially as described, whereby a block representing a unit may be divided into fractions, and again restored and resolved into itself without being detached, as and for the purpose specified.

ISAAC HARRINGTON.

Witnesses:

WILLIAM C. SMITH,
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