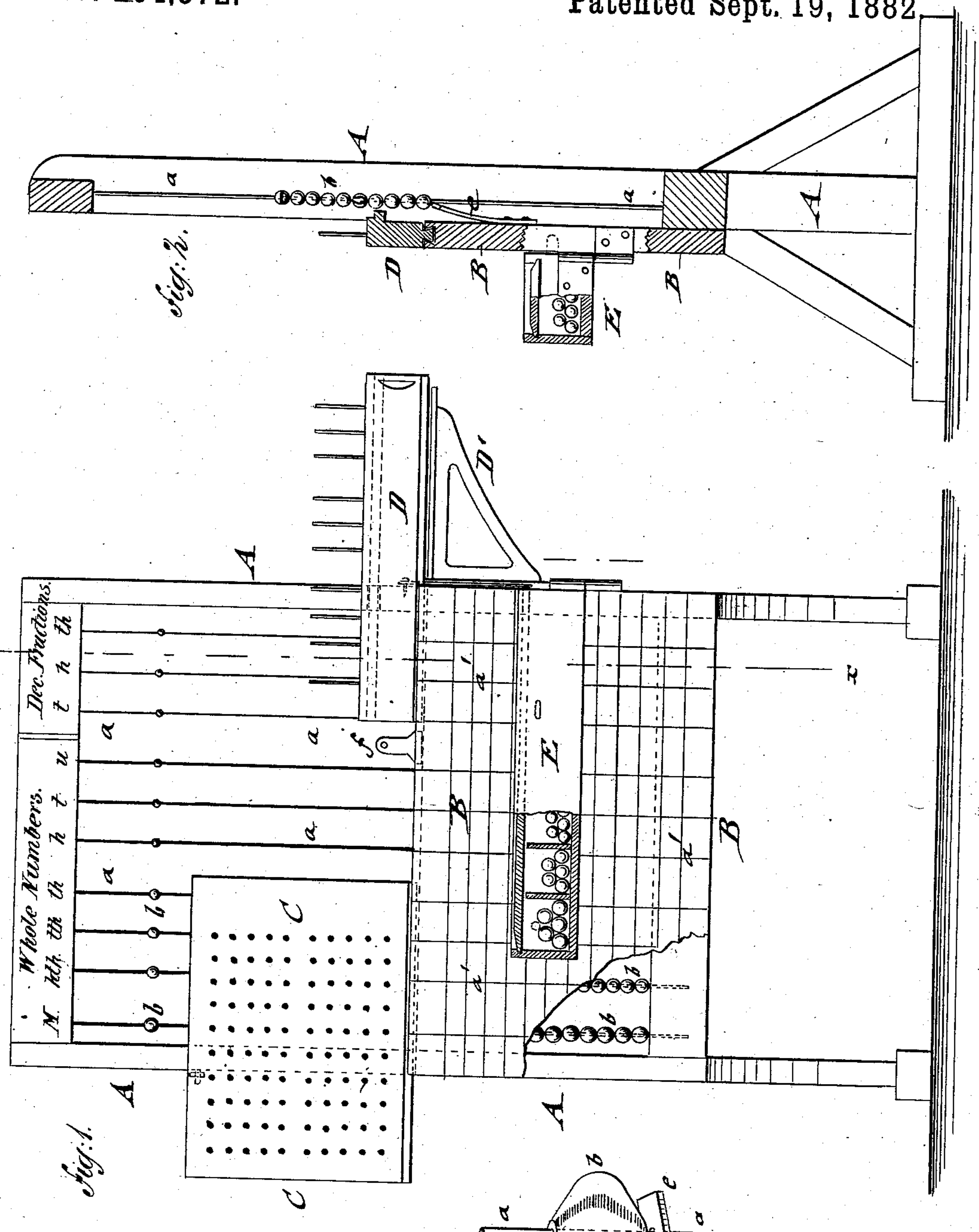
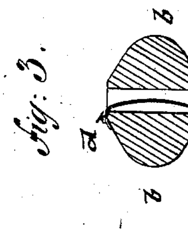
(No Model.)

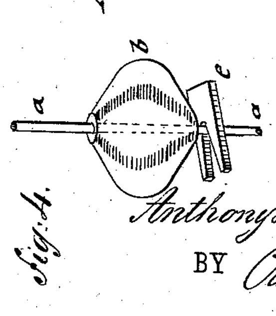
A. B. SCHWENNIGER.

APPARATUS FOR TEACHING ARITHMETIC.

No. 264,572. Patented Sept. 19, 1882.







WITNESSES:

Jol. U. Rosenbaum.

Otto Risch.

INVENTOR

Anthony B. Schwenniger

BY Paul Goepel

ATTORNEY

N. PETERS. Photo-Lithographer. Washington. D. C.

UNITED STATES PATENT OFFICE.

ANTHONY B. SCHWENNIGER, OF NEW YORK, N. Y.

APPARATUS FOR TEACHING ARITHMETIC.

SPECIFICATION forming part of Letters Patent No. 264,572, dated September 19, 1882.

Application filed March 31, 1882. (No model.)

To all whom it may concern:

Be it known that I, ANTHONY B. SCHWENNIGER, of the city, county, and State of New York, have invented certain new and useful Improvements in Apparatus for Teaching Arithmetic, of which the following is a specification.

This invention has reference to an improved apparatus for teaching arithmetic and accomplishing the different arithmetical exercises before the eyes of the pupils by means of object-teaching.

The invention consists of an upright frame carrying vertical wires, along which are guided perforated beads having an interior friction device. At the lower part of the upright frame, in front of the bead-wires, is arranged a blackboard having vertical lines drawn in continuation of the wires. Along the upper edge of the blackboard is guided a laterally-sliding board or "counter," which carries one hundred wire pins arranged in rows of ten each, while a quotient-board is also arranged at the upper part of the blackboard and provided with ten vertical wire pins arranged in groups of three. At the side of the blackboard is hinged to the frame a box, which contains a number of beads, separated according to size and color, for use on the counter or quotient-board.

In the accompanying drawings, Figure 1 represents a front elevation, with parts broken away, of my improved apparatus for teaching arithmetic. Fig. 2 is a vertical transverse section on line *x x*, Fig. 1; and Figs. 3 and 4 are respectively a vertical central section and a perspective sectional view of one of the beads used in my apparatus.

Similar letters of reference indicate corresponding parts.

Referring to the drawings, A represents an upright supporting-frame, which consists of two uprights and of transverse top and bottom pieces connecting the same. A number of wires, preferably ten, are stretched perpendicularly from the top to the bottom piece of frame A, and arranged in groups of three. Upon the perpendicular wires *a* are strung a number of beads, *b*, which are adapted to be slid up and down on the wires, and are retained by means of an interior friction device, *d*—such as a spring—attached to the upper part of the bead and extending down into the central perforation of the same, as shown clearly in Fig. 3, or a felt lining or any other equivalent means whereby the beads are prevented from dropping when they have been raised. Some of the beads are not provided with interior springs; but these are retained in raised or lifted up position by means of wire springs *e*, having forked ends, which wire springs are applied to the back of a blackboard, B, arranged at the lower part of the frame. The blackboard B covers the lower part of the wires *a* and the beads when they are not raised above the board for demonstration. Upon this blackboard red lines *a'* are painted in line with the wires, so as to represent a continuation of the same on the blackboard. The upper edge of the blackboard B is provided with a dovetailed groove, and in the groove is guided, at the left-hand side, a smaller blackboard, C, which is called the "counter." The counter C is moved outwardly in the guide-groove, and is secured by a hook to the left-hand upright of the frame A, as shown in Fig. 1. The counter C is provided with one hundred wire pins, which are arranged in rows of ten each, the fifth row being separated from the sixth by a wide space, while at the right-hand side of the wire pins room is left on the counter for writing down figures.

At the upper right-hand side of the blackboard is arranged a quotient-board, D, which consists of an oblong piece of wood provided with ten upright wire pins, that are arranged in three groups of three with one remaining pin. The quotient-board D also slides in the top groove of the blackboard B, and is supported on a bracket, D', when drawn out, being guided by a tongue at its rear side in a groove of the right-hand upright of the frame, as shown in Figs. 1 and 2.

A box, E, is hinged to the right-hand upright of the frame, and is arranged with partitions so as to form small compartments for storing a number of beads of different colors and sizes. These beads are intended to be put upon the wire pins of the counter and of the quotient-board.

At the top of the blackboard, between the first group of vertical wires, *a*, at the right and the second group, is interposed a decimal-sign board, *f*, which indicates that the beads upon the wires of the first group are to represent decimals, while the beads upon the remaining wires, to the left side of the small board, are to represent whole numbers.

The top piece of the frame A is provided above the wires with the initial letters of the words "units," "tens," "hundreds," &c., for whole numbers and fractions, as shown in Fig. 1.

In order to make the value of the whole numbers, units, tens, hundreds, &c., more conspicuous to the eye of the pupil, the beads representing these numbers are made in different colors and sizes, according to the value of the number represented.

The apparatus is used in the following manner in teaching the five fundamental operations of arithmetic:

Notation and Numeration.—For beginners the counter-board is used. The pupil takes, for instance, beads from the bead-box and places them on the wire pins of the board, with any number of beads from one to nine in line, and the teacher writes opposite the line the figures which represent the number of beads on the several lines, respectively. This is practiced until the pupil becomes familiar with the forms of the figures and the sums which they respectively represent. The beads and corresponding figures on the counter-board will also serve for beginners as an index or reference in the subsequent use of the other parts. To explain the value of the figures, the beads on the unit-wire *a* are copper-colored, those on the ten-wire silver-colored, while those on the remaining wires may be of any other color. By raising, for instance, nine beads on the unit-wire and placing the figure 9 on the line of the blackboard below the unit-wire, and adding then another bead, so as to make ten, the teacher raises then one silver-colored bead on the ten-wire and explains that ten single or unit beads are equal in value to one bead on the ten-wire *a*. The number 1 is then written on the line on the blackboard below the ten-wire and the vacancy on the unit-line filled with a cipher or naught. After this the pupil raises in succession on the unit-wire 1, 2, 3, 4, 5, 6, 7, 8, or 9, and writes down on the blackboard the corresponding numbers, 11 12 13 14 15 16 17 18 19. The next bead gives the number 20. The ten units disappear, and in place of the same a second ten-bead is raised on the wire of tens. By proceeding in this way all the numbers up to one million may be successively obtained. These exercises will make the pupil familiar with the value of figures, according to the rule that "the local value of a figure increases from right to left tenfold." The other four fundamental operations may also be readily demonstrated on the wire of units.

1. *Addition.*—The pupil lifts one bead on the wire of units and places it as high as his hand can reach. Then two or more are raised and placed a small distance from the first. The pupil says "1 + 2 is equal to 3," and another pupil, standing in front of the blackboard, writes the figure 3 on the line below the unit-wire. In this manner as many exercises of addition may be made as the beads on the unit-wire will allow.

2. Subtraction is performed in a similar manner, but in reverse order, by dropping some of the beads raised.

3. Multiplication is explained by first raising one bead once, then raising two beads once, saying "2×1=2," then three, four, up to nine beads are raised and shown once, so as to obtain the result, 9. By using in a similar manner the numbers 2, 3, 4, 5, 6, 7, 8, 9 as multipliers the full multiplication-table is illustrated.

4. Division is illustrated by raising four beads and arranging them in groups of two, then lifting six beads and arranging them in three groups of two each, and so on, saying at the same time, "two is contained twice in four, three times in six, four times in eight," and so on.

In illustrating the last four fundamental operations on all the wires it is best to begin with two wires and gradually add the remaining wires one after the other.

In addition a certain number—for instance, 27—is represented by two beads on the ten-wire and seven on the unit-wire. If 59 is to be added, the pupil moves up five beads on the ten-wire and nine on the unit-wire. He then counts the beads on the unit-wire and finds that there are sixteen. He drops ten of these, and lifts instead one bead on the ten-wire. As six beads are left upon the unit-wire, he writes down 6 upon the unit-line of the blackboard. He then counts the beads upon the ten-wire, and, finding there are eight, he writes down 8 on the ten-line on the blackboard. Thereby he obtains the sum of eighty-six. In a similar manner all other examples of addition are performed up to millions.

Subtraction is accomplished by reversing the process for addition just described.

For multiplication—for instance, multiplying 36×8=288—the pupil raises three ten-beads and six unit-beads, representing the number 36. He places then eight groups of six beads each on the unit-wire and eight groups of three each on the wire of tens. He then exchanges forty unit-beads for four ten-beads, and, further, twenty beads on the wire of tens for two beads on the wire of hundreds, thus representing the number 288, which result is written on the corresponding three lines of the blackboard.

In division the number 78, for instance, is represented by seven ten-beads and eight unit-beads. In order to divide the number represented by 3, the pupil separates the seven ten-beads in groups of three each. He obtains two groups of three and one bead left, which is exchanged for ten unit-beads, thus getting eighteen unit-beads in all. The division by three is performed by arranging the eighteen unit-beads in six equal groups. By this operation the quotient 26 is obtained. To represent the quotient to the eyes, beads from the bead-box E are placed, according to the local value of the figures, on the wires of the quotient-board.

As to decimals, the following remarks may be sufficient for a brief explanation: The wires for the decimals are placed on the right of the remaining wires, according to the rule that the local value of the figures increases from right to left tenfold. As a decimal fraction is such a fraction whose denominator is ten, or a number of tens multiplied together, decimals are written according to the above-mentioned rule as to local value of numbers in such a way that decimal tenths occupy the first place to the right of the units, hundredths to the second place, &c. A point separates decimals from whole numbers.

In practicing the four species with decimals they may be treated like whole numbers, if only the decimal point is placed correctly. In addition and subtraction, point off as many places for decimals as are equal to the greatest number of decimal places in either of the given numbers. In the product of multiplication the number of decimal places to be pointed off must equal the number of decimal places in both factors. In the quotient of division, point off as many decimal places as the decimal places in the dividend exceed those in the divisor.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. An apparatus for teaching arithmetic, consisting of a frame, vertical parallel wires arranged in groups of three upon the frame, each wire being designed to represent a different order of units, beads strung upon the wires, means for retaining the beads in position upon the wires, and a blackboard which covers a portion of the wires, behind which the beads not in use are concealed, and upon which the numbers indicated by the beads may be written, so that the different orders of units will be opposite the respective wires representing the same, substantially as described.

2. An apparatus for teaching arithmetic, consisting of a frame, parallel wires stretched upon the frame, beads strung upon the wires, and a blackboard adjacent to the frame, provided with permanent lines arranged in continuation of the wires, substantially as set forth.

3. An apparatus for teaching arithmetic, consisting of a frame carrying a number of parallel wires adapted to receive beads, a blackboard adjacent to the frame having lines forming continuations of the wires, and a quotient-board provided with pins adapted to receive beads, substantially as described.

4. An apparatus for teaching arithmetic, consisting of a frame, parallel wires stretched upon the frame, adapted to receive beads, a blackboard adjacent to the frame in line with the wires, and a counter-board provided with bead-receiving pins, substantially as described.

5. An apparatus for teaching arithmetic, consisting of a frame, parallel wires upon the frame, adapted to receive beads, a blackboard in front of the lower part of the frame, and a decimal-point board between groups of the bead-wires, substantially as set forth.

In testimony that I claim the foregoing as my invention I have signed my name in presence of two subscribing witnesses.

ANTHONY B. SCHWENNIGER.

Witnesses:

PAUL GOEPEL,
SIDNEY MANN.