

E. HALSEY.

APPARATUS FOR MULTIPLICATION AND OTHER ARITHMETICAL PROCESSES.

No. 344,181.

Patented June 22, 1886.

Fig. 1.

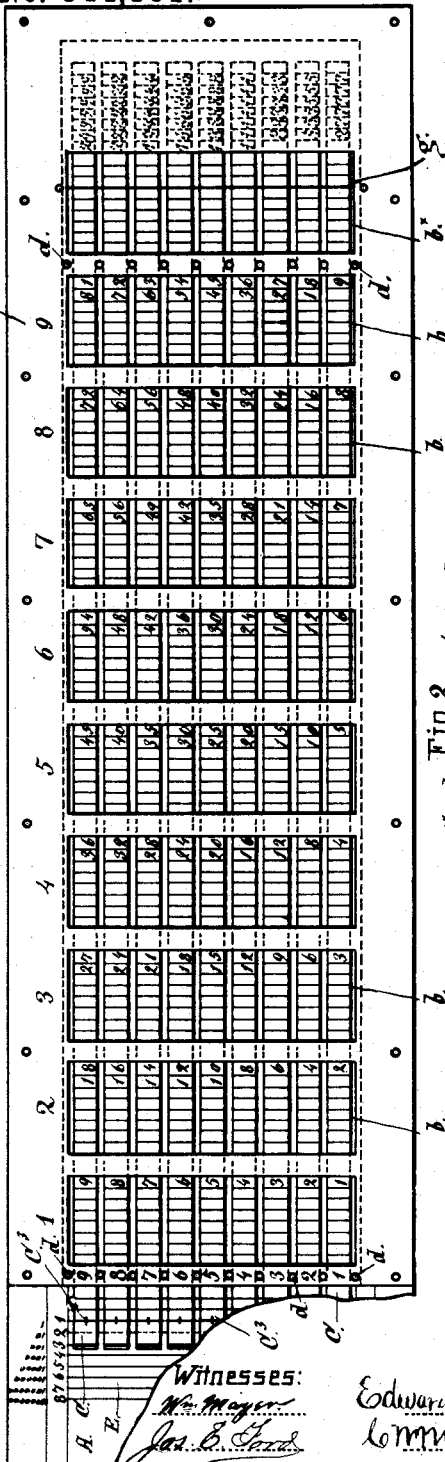
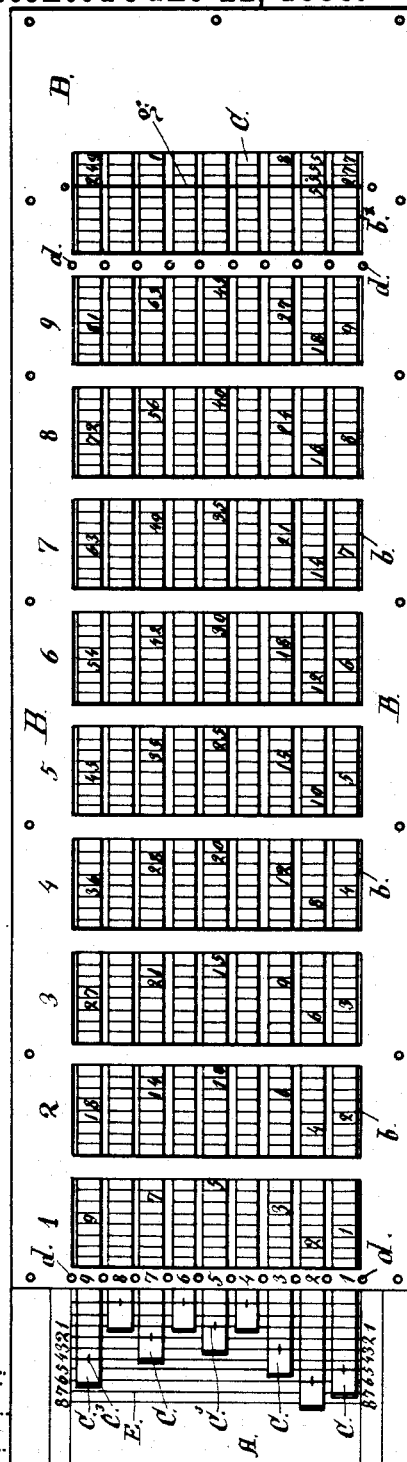


Fig. 3.



Witnesses:

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APPARATUS FOR MULTIPLICATION AND OTHER ARITHMETICAL PROCESSES.

SPECIFICATION forming part of Letters Patent No. 344,181, dated June 22, 1886.

Application filed September 28, 1885. Serial No. 178,479. (No model.)

To all whom it may concern:

Be it known that I, EDWARD HALSEY, a citizen of the United States, residing in San José, in the county of Santa Clara and State of California, have invented certain new and useful Improvements in Machines for Multiplying and Performing Similar Arithmetical Calculations; and I do hereby declare that the following is a full, clear, and exact description of the same and in what manner the machine is used and operated, reference being had by figures and letters to the accompanying drawings.

My invention has for its object to produce a machine for performing arithmetical operations in multiplication, division, and interest; and it consists in a certain construction and combination of parts as hereinafter explained, for operation as set forth.

Referring to the said drawings, Figure 1 is a top view of the machine with all the slides in position ready for use. Fig. 2 is a cross-section. Fig. 3 shows the position of the slides and their numbers in working examples given in the following description by way of example. Fig. 4 is a view in full lines of the portion shown in dotted lines at the right hand of Fig. 1.

A represents a board or tablet forming the base of the machine, and B a top plate which covers the face of the board, excepting the portion at one end, where certain indicating lines and figures are located. The plate B, while being firmly secured in place, is set clear of the face of the board, to leave a space or way for a number of slides, C C, and this space is divided, by means of the pins *d d*, into separate ways across the board, in each of which a slide is held and guided. These slides have easy movement in these guides back and forth from the left-hand end of the board, and they are turned up at this end to form the stop and finger-piece C for each slide. At this end also is an index point or line, C', that is used for setting the slide to the required one of the lines of the indicator E on the board in the operation of working an example. The lines of this table E are spaced as shown, and are numbered from 1 to 8, inclusive, beginning at the end nearer the inner edge of the plate E. These numbers are

placed at the top and bottom. Each slide is likewise divided by transverse parallel lines into spaces of equal width, and when any number of slides are set to one of the lines of the table E the spaces on the slides will register and be in direct line over one another.

In the top plate, B, are rectangular openings *b b*, ten in number, each of suitable width to uncover and expose eight of the spaces on the slides, and of such length that such portion is exposed on the whole nine of slides. These spaces are designated by numbers from 1 to 9, inclusive, the tenth and last opening not being numbered with them, as it is employed for calculating interest, and is not used in connection with the table of lines E and the other openings, except in working such examples. Operations in multiplication and division are performed only with the other nine spaces.

Each slide is designated by a number placed at the extreme left along the edge of the plate B, beginning with No. 1 for the lowest slide and ending with No. 9 at the top one.

In the machine described the table E and the spaces appropriated to each opening *b*, one arranged to perform operation in figures covering eight places or to the "ten millions" place, the extreme right-hand line in table E and the extreme right-hand space of each slide in each of the openings *b* being units, the next one tens, and so on to the eight places. The slides are numbered in these spaces in the following manner: The unit-spaces on the first or lowest slide seen at the extreme right throughout the whole number of nine spaces *b*, show the several products obtained by multiplying the number of the slide by the number designating the opening. Thus in opening 1 is seen the number "1" on the first slide, on opening 2 the number "2," in opening 3 the number "3," and so on, being the products of the slide-number multiplied by the opening-number. In the same manner slide No. 2 is provided with the numerals 2 4 6 8 10 12 14 16 18, exhibited in the openings *b*, from left to right, slide 3 with the numerals 3 6 9 12 15 18 21 24 27, and in the same manner throughout the remaining six slides. The position of these slide-numerals is in a vertical column along the right-hand edge of each opening *b*, when the points C' of all the slides are set to register with line

1 on the table E. The opposite ends of the slides that work in connection with the tenth opening b^* , are covered by the plate B when the slides are thus set, but are divided into spaces which are marked as follows: On the end of the slide 1, the figures 277777; on slide 2, the figures 555555; on slide 3, the figures 833333; on slide 4, the figures 111111; on slide 5, the figures 138888, and the remaining slides carrying the following figures respectively: slide 6, the figures 166666; slide 7, the figures 194444; slide 8, the figures 222222; slide 9, the figures 249999. These figures may, when properly pointed, represent the interest for one day on the number of dollars represented by the slide-number at one per cent. per year of three hundred and sixty days. The space uncovered by the opening b^* is divided into two parts by thread or wire g , stretched perpendicularly across it, and which marks the division between dollars and cents in the row of figures on each slide in the various operations performed where this space is employed.

The operation of the machine in multiplying figures will be understood by performing the following example:

$$219375 \times 349 =$$

Now, as the multiplicand contains figures to the sixth place or to hundreds of thousands, and the first figure to be multiplied is 2, the slide corresponding to that number is drawn out to the hundred-thousands place, or until its points C register with line 6 of the table E, the first slide is drawn out to the fifth place or line 5, the next slide set to the fourth place, the third slide to the third place, the seventh slide to the second place, and the fifth to the first or units place on the table E. Then from the openings 3, 4, and 9 in succession are taken the sums that will be obtained by adding up the several columns of figures exposed, the numbers of the openings thus taken being those of the multiplier given, and resulting sums will be as follows: from opening 3 the sum 658125, which results from the addition of several figures:

27000
210
15
900
600000
30000

from the opening 4 the sum 877500, from the opening 9 the sum 1974375, which being added as follows:

65812500
8775000
1974375

76561875

gives the product required.

The operation of division is simply the reverse of that required in multiplying, the slides being set in the same manner with reference to the lines of the table E to give the figures of the division, and then by examination of the figures seen in the openings b the

sum that can be found the nearest to the dividend, taken as many figures thereof as the divisor is found to be contained in it, and the number of the opening in which this sum is found will be the first figure for the quotient. This sum being subtracted and a new dividend formed in the usual manner, the openings b are again examined to obtain in one of them the sum nearest to that of the new dividend, and when found the number of the opening b shows the second figure of the quotient, and so on until the example is finished.

The method of calculating interest by means of the machine is based on the principle of finding the amount which in one day at one per cent. per year will produce the same amount of interest as a given sum at a given rate for a given time will produce, and then by setting the slides to the lines of the table E according to the sum ascertained the given interest will be the sum of the figures exposed to view in the last openings b^* . The figures shown to the left of the line g are dollars, and those on the right are cents and decimal parts.

The following example in simple interest will illustrate the mode of operation to find the interest on \$625 at three per cent. for three months, twenty-seven days. This will be equal to \$18.75 at one per cent. for the same time, or one hundred and seventeen days; or \$18.75 \times 117 will be the interest at one per cent. for one day on \$219,375. Having set the slides from 6 to 1 inclusive to register with the lines 2 1 9 3 7 5, respectively, on the table E, the following figures will be exposed in the opening b^* .

.249
1
8
5.555
.277
6.090

which is the required sum of \$6.09, the interest on \$625.00 for the given time.

Having thus fully described my invention, what I claim, and desire to secure by Letters Patent, is—

1. The combination of the frame composed of the board A and top plate, B, the former having the table of lines and numbers E, and the latter provided with the openings b , each designated by number, and the numbered slides C C, having their surfaces spaced and marked with figures, which are obtained by multiplying the number of the slide successively by the several numerals designating the openings and placing the product in such opening, substantially as described, for operation as set forth.

2. In a machine of the character described, the numbered slides C C, having their faces divided by spaced lines, into the spaces of which are placed numbers that are obtained by multiplying the designating number of the slide by the numerals from 1 to 9, inclusive, in

succession for operation with reference to a plate, as B, having openings *b*, equal in number to the numerals taken for multipliers, as set forth.

- 5 3. The combination of the plate B, having opening *b*^x, with the line-wire *g*, of the slide C C, numbered from 1 to 9, inclusive, and adapted to be moved back and forth beneath said opening, and having on the end portion
10 beneath said plate numbers which represent

the interest at one per cent. for one day on from one to nine dollars, inclusive, and the table E at the opposite end, for operation as set forth.

In testimony that I claim the foregoing I have hereunto set my hand and seal.

EDWARD HALSEY. [L. S.]

Witnesses:

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CHAS. E. KELLY.