

J. SAWYER.
 Means of Obtaining Arithmetical Results.
 No. 208,037. Patented Sept. 17, 1878.

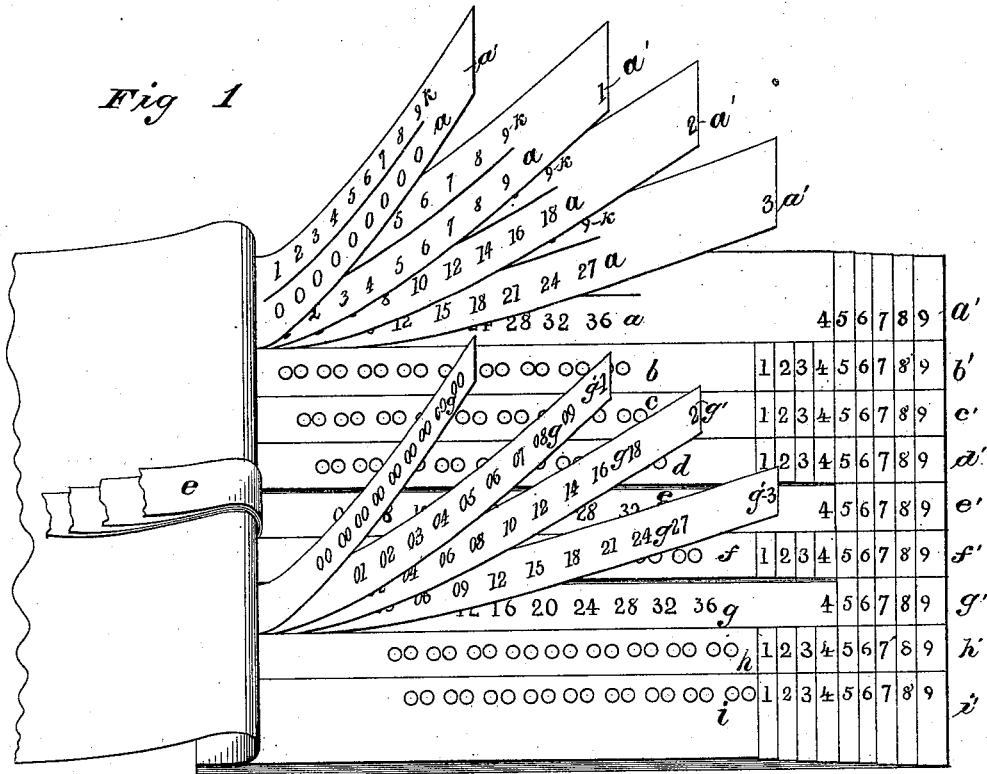
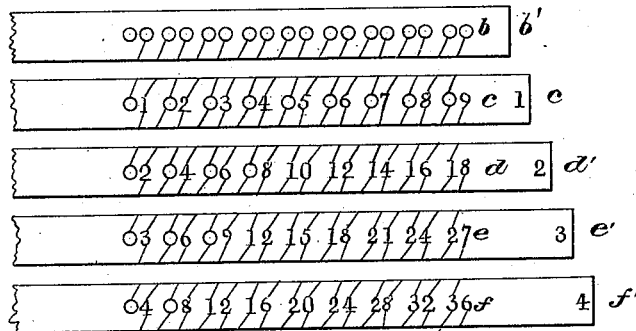


Fig 2



WITNESSES

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IMPROVEMENT IN THE MEANS OF OBTAINING ARITHMETICAL RESULTS.

Specification forming part of Letters Patent No. **208,037**, dated September 17, 1878; application filed November 20, 1877; patented in England, July 28, 1877.

To all whom it may concern:

Be it known that I, JOHN SAWYER, of 3 Adelaide Place, London Bridge, England, have invented or discovered a new and useful Method of and Improved Means for Arriving at the Results of Multiplication, of which the following is a specification:

The object of my invention is to arrive at the results of multiplication of numbers without the mental labor attendant on the ordinary processes of multiplication.

The invention is the same as that shown and described in the English Letters Patent granted to me, dated July 28, 1877, No. 2,885; and consists in a certain arrangement of figures constituting a novel table, scheme, or plan, and in the method and means adopted for bringing such figures into any required combinations.

The figures may be printed, written, or engraved on paper, or on linen, or card-board, or parchment, or wood, or metal, or any other suitable material.

The arrangement of the figures in one way of making up the table, scheme, system, or plan for practicing my method is as follows: The figures are placed at regular distances apart from one another on separate pieces or strips of paper, linen, card-board, parchment, wood, metal, or any other suitable material. The numbers from 1 to 9, both inclusive, are placed on one piece or strip, being grouped in a line at regular distances apart, the numbers 2, 4, 6, 8, 10, 12, 14, 16, and 18 on another piece or strip; the numbers 3, 6, 9, 12, 15, 18, 21, 24, and 27 on another piece or strip; the numbers 4, 8, 12, 16, 20, 24, 28, 32, and 36 on another piece or strip; the numbers 5, 10, 15, 20, 25, 30, 35, 40, and 45 on another piece or strip; the numbers 6, 12, 18, 24, 30, 36, 42, 48, and 54 on another piece or strip; the numbers 7, 14, 21, 28, 35, 42, 49, 56, and 63 on another piece or strip; the numbers 8, 16, 24, 32, 40, 48, 56, 64, and 72 on another piece or strip; and the numbers 9, 18, 27, 36, 45, 54, 63, 72, and 81 on another piece or strip. These nine pieces or strips are arranged in a pile or row, one upon or over another, in the order named, the unitary line or group of figures being first, and then in succession the strips or pieces

with the lines of numbers beginning, respectively, with 2, 3, 4, &c., and severally followed by numbers which are regularly increasing multiples of the starting or left-hand number.

The above-mentioned nine pieces or strips constitute the first series, row, or pile of pieces or strips; and beneath them, or at the side or edge of the pile or row, is placed another series of nine strips, with the same numbers on the respective strips, and arranged in the same order, the numbers which consist of one figure only being preceded by a cipher. The ciphers may also be placed in the first or top row, or before each figure of the unitary or initiatory line, and in addition a tenth piece or strip, with the cipher 0 repeated and placed in the same positions as the numbers on the other strips. These tenth or double cipher-strips are placed at the top of the respective rows, piles, or series.

As many rows, piles, or series of strips as may be considered necessary are placed beneath—that is, lower down than the second row—each successive row containing ten strips precisely similar to those in the second row.

It is advisable that over the respective numbers in each piece or strip in the first row should appear in consecutive order the respective numbers from 1 to 9, both inclusive. These figures serve as an index or guide to the multiplier.

For facility of reference to any required strip it is advisable that an index-figure be placed on each strip, the index-figure being the same as the first and lowest number on the respective strips, and the strips being so arranged that the index-figure on each strip is exposed to view, thus affording a guide by which the multiplicand is readily found, as will hereinafter be explained.

The rows of strips may be so placed that each row shall have the unit-figure of each number the space of one figure to the right of the unit-figure of the number in the row immediately above; or the figures in each row could be placed perpendicularly beneath each other. In the latter case it would be advisable to show the connection between the figures by a line drawn from a figure in the units' place of each number toward the figure in the

tens' place of the number in the row immediately beneath.

Various mechanical means may be adopted for exposing to view the numbers on any desired strip of any desired row or series of the table or scheme, and the addition of the respective columns of numbers falling beneath each other (on the adjustment in any desired way) of any two or more of the rows of slips will give the product resulting from the multiplication by the numbers from 1 to 9 of the numbers formed by the figures, excluding such ciphers as stand before numerals, which stand at the extreme left of the said rows of slips.

The separate strips of each row or series may, for example, be connected together at their left-hand ends, as in binding together the leaves of a book; or the several strips of each row or series may be jointed together to form them into an endless chain, and each such series may be mounted on a roller, either triangular, square, or of other section, and by turning the rollers any one or other of the strips of each series can be brought uppermost and exposed to view.

In the drawings, which show a convenient way—that which I prefer—of connecting the different rows or series of strips together, Figure 1 is a view, in perspective, of a book or pamphlet like arrangement of the strips of the table, some of the strips being turned back and others partly turned. Fig. 2 is plan view, showing several rows with the figures arranged perpedicularly—that is, with the figures of each successive row directly beneath those of the preceding row—instead of the diagonal arrangement shown by Fig. 1. Figs. 3 and 4 are illustrations of the way in which my invention is used.

Nine series, piles, or rows of strips, *a b c d e f g h i*, are shown, each having its multiplicand-index *a' b' c' d' e' f' g' h' i'*. The multiplier-index or guide-figures *k* are in this instance printed in the top strips *a*, which are made broad. The strips are all attached in suitable manner at the inner ends between covers, so that they may be folded back, as the leaves of a book. The strips should be strongly attached, and so that they can be opened or turned up and back, as represented in Fig. 1, to expose the various strips or lines of figures in the scheme or table.

The following is an example of the way in which the apparatus above described is to be used for multiplying:

To multiply 769,250,361 by 98,765,432: To effect this the strip of the first row which has the index-figure 7 at its end is exposed; then the strip of the second row, which has the index-figure 6 at its end, the strip of the third row, which has the index-figure 9, and so on for all of the figures 769,250,361. The figures on the several strips exposed to view will then appear, as shown in the diagram drawing, Fig. 3.

By inspection it will be seen that the figures on the exposed strips in the column under the

heading of the figure 2 on the top strip mount up to 1,538,500,722. These are written down. It will be seen that the figures under the heading 3 amount to 2,307,751,083, and these are written down, and so on for all the figures 98,765,432. These respective amounts having been written down one below the other, as when multiplying in the ordinary manner, and as shown at Fig. 4, the product will be found by adding together the eight lines, as represented.

From the foregoing description, and by reference to the drawings, it will be seen that any given number or numbers may be multiplied by any other number or numbers very quickly, and by addition solely. Either of the numbers of figures may be taken as the multiplicand; but the larger number should be adopted, to lessen the labor of final addition, as the lines to be then footed up will correspond with the number of figures in the multiplier. In finding the amounts or figures for these lines there is never more than one to be carried in adding up the columns of the table.

Any desired number of rows or series of slips may be employed, according to the maximum number of figures that will probably ever be employed in the multiplicand. The table shown is designed to multiply any figures short of 1,000,000,000 by any lesser amount.

I do not wish to be understood as confining myself strictly to the particular contrivances hereinbefore specifically described for securing together or properly connecting the slips, for other and equivalent slip connecting or attaching devices may be employed to secure the slips in the order or relative arrangement described and required to afford the mechanical means for carrying out my invention. Nor do I confine myself to the employment of the cipher-slips, nor to the use of the indexes. These indexes and cipher-slips are, however, preferably employed, and are highly desirable, as they promote accuracy, greatly lessen mental labor, and save time to the user of the table.

I claim as of my own invention—

1. The combination and relative arrangement, substantially as hereinbefore set forth, of the corresponding series of figured rows or strips, said strips of each series severally starting with their lowest numbers, and followed in a line by their respective multiples, and the starting numbers of the several strips being successively higher than the starting numbers of their respectively preceding or overlying strips, as described.

2. The combination, in a book-like or equivalent form, such as set forth, of a series of rows of figured strips, arranged essentially as described, with a multiplicand-index and a multiplier-index, substantially as hereinbefore set forth.

3. The combination of a series of rows of figured strips, arranged parallel with each other, or side by side, one below another, and

each row made up of ten strips, one upon or preceding another, the top or initiatory strip being marked with ciphers, the next strip being marked with a group or line of figures from 1 to 9, inclusive, and the remaining or underlying strips successively starting with higher and regularly-increasing numbers, as 2, 3, 4, &c., than the starting numbers of their respectively preceding or overlying strips, and severally followed in a line by success-

ively and regularly increasing multiples of said starting or left-hand figures, substantially as hereinbefore set forth.

London, 5th October, 1877.

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Witnesses:

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