

J. V. CHARPANTIER.

APPARATUS FOR FACILITATING THE MULTIPLICATION OF NUMBERS.

No. 322,160.

Patented July 14, 1885.

Fig. 3.

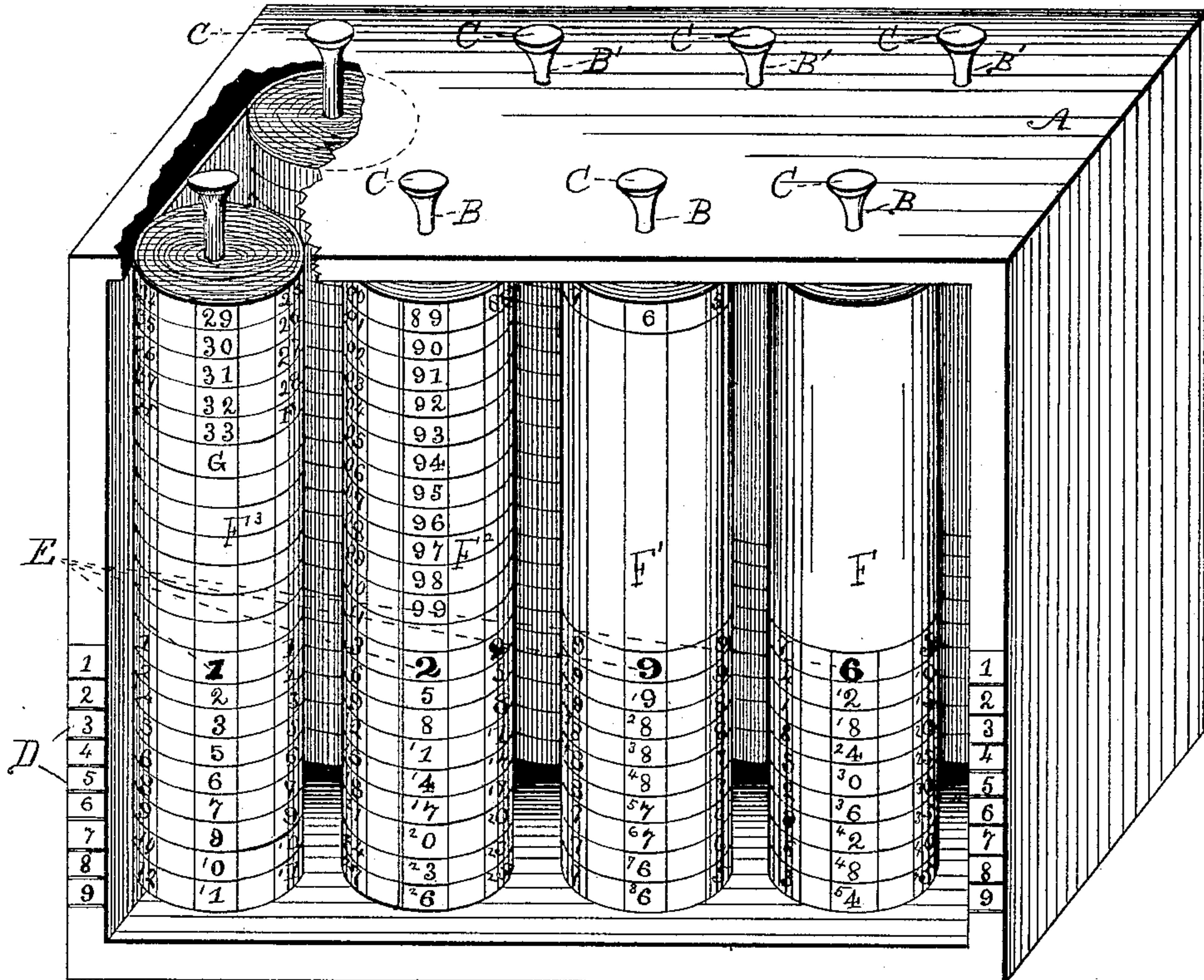
10	9	8	7	6	5	4	3	2	1	0	b

Fig. 2.

9	8	7	6	5	4	3	2	1	0	-a
8	6	4	2	0	8	6	4	2	0	
² 7	² 4	² 1	² 8	² 5	² 2	9	6	3	0	
³ 6	³ 2	³ 8	³ 4	³ 0	³ 6	³ 2	8	4	0	
⁴ 5	⁴ 0	⁴ 5	⁴ 0	⁴ 5	⁴ 0	⁴ 5	⁴ 0	⁴ 5	0	-F
⁵ 4	⁵ 8	⁵ 2	⁵ 6	⁵ 0	⁵ 4	⁵ 8	⁵ 2	6	0	
⁶ 3	⁶ 5	⁶ 4	⁶ 9	⁶ 2	⁶ 5	⁶ 8	⁶ 1	⁶ 4	7	0
⁷ 2	⁷ 6	⁷ 4	⁷ 8	⁷ 0	⁷ 2	⁷ 4	⁷ 6	8	0	
⁸ 1	⁸ 7	⁸ 6	⁸ 3	⁸ 4	⁸ 5	⁸ 6	⁸ 7	⁸ 8	⁸ 9	0

f	1	0	0	0	0	0	0	0	0	e
	2	1	1	1	1	0	0	0	0	
	3	2	2	2	1	1	1	0	0	F'
	4	3	3	2	2	2	1	1	0	
	5	4	4	3	3	2	2	1	1	0
	6	5	4	4	3	3	2	1	1	0
	7	6	5	4	4	3	2	2	1	0
	8	7	6	5	4	4	3	2	1	0
	9	8	7	6	5	4	3	2	1	0

Fig. 1.



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Fig. 4.

Fig. 4. A large grid of numbers, likely a multiplication table or a set of data for the apparatus. The grid is 11 columns wide and 11 rows high, with numbers ranging from 0 to 99. The numbers are arranged in a specific pattern, possibly representing a multiplication table or a set of data for the apparatus.

Fig. 6.

Fig. 6. A smaller grid of numbers, likely a multiplication table or a set of data for the apparatus. The grid is 4 columns wide and 10 rows high, with numbers ranging from 0 to 99. The numbers are arranged in a specific pattern, possibly representing a multiplication table or a set of data for the apparatus.

Fig. 7.

Fig. 7. A small grid of numbers, likely a multiplication table or a set of data for the apparatus. The grid is 4 columns wide and 4 rows high, with numbers ranging from 0 to 99. The numbers are arranged in a specific pattern, possibly representing a multiplication table or a set of data for the apparatus.

Fig. 5.

Fig. 5. A table with two columns, (1) and (2), showing numbers and their corresponding values. The table is 11 rows high, with numbers ranging from 0 to 99. The numbers are arranged in a specific pattern, possibly representing a multiplication table or a set of data for the apparatus.

Fig. 8.

Fig. 8. A table with two columns, (1) and (2), showing numbers and their corresponding values. The table is 11 rows high, with numbers ranging from 0 to 99. The numbers are arranged in a specific pattern, possibly representing a multiplication table or a set of data for the apparatus.

Fig. 9.

Fig. 9. A small grid of numbers, likely a multiplication table or a set of data for the apparatus. The grid is 4 columns wide and 4 rows high, with numbers ranging from 0 to 99. The numbers are arranged in a specific pattern, possibly representing a multiplication table or a set of data for the apparatus.

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APPARATUS FOR FACILITATING THE MULTIPLICATION OF NUMBERS.

SPECIFICATION forming part of Letters Patent No. 322,160, dated July 14, 1885.

Application filed August 26, 1884. (Model.)

To all whom it may concern:

Be it known that I, JULES V. CHARPANTIER, a citizen of the United States, residing at New Orleans, in the parish of Orleans and State of Louisiana, have invented a new and useful Improvement in Apparatus for Facilitating the Multiplication of Numbers, of which the following is a specification.

The object of my invention is to arrive at the results of the multiplication of any numbers by the numerals from two to nine without mental labor on the part of the operator.

The invention consists of a table of figures formed in sections, the sections being separately placed upon rollers within a box, the figures being so arranged upon this table that when a row of numbers to be multiplied is registered or brought to the front of the box by moving the rollers the result of the multiplication of this row of registered figures by each of the numerals from 2 to 9 simultaneously appears on the table at the front of the rollers.

The figures and other marks forming the table may be printed or written upon linen, paper, or other suitable material.

In the accompanying drawings, Figure 1 is a perspective view showing the table arranged within a case or box ready for operation. Fig. 2 is a representation of the first or unit section of the table. Fig. 3 shows a part of the second or tens section of the table. Fig. 4 represents a part of the third or hundreds section of table. Fig. 5 shows reference-tables. Figs. 6, 7, 8, and 9 show examples illustrating the operation of my invention.

A is a box or case, which may be provided with a glass top or front. In this box is placed at the front and rear a series of parallel rods or rollers, B B', having knobs C by which they are turned. On each side of the box, at the front, is fixed a vertical row of numerals from 1 to 9, as shown at D. These are to be used as the multiplying numerals, as will be explained hereinafter.

Upon the rollers B B', Fig. 1, at the right of the box, a section, F, of the table representing units is placed. This section is shown in Fig. 2 of the drawings. On the remaining sets of rollers, sections F¹ F² F³, &c., of the table, representing tens, hundreds, thousands, &c., are respectively arranged.

The numbers to be multiplied by any of the numerals fixed to the side of the box occupy a position on the table in line with the numeral 1 on the side of the box, as shown at E, and they are registered or set up as a multiplicand by being brought to the front of the respective rollers.

The first section of the table, Fig. 2, has upon it, as seen at a, Fig. 2, a row of numerals from 0 to 9 arranged from right to left. (When placed in proper position upon the rollers within the box, this line of figures will be opposite the figure 1, fixed to the margin of the box.) Under these numerals are arranged the multiples of each, from 2 to 9, in line, respectively, with the multiplying-numerals on the sides of the box. The tens, or the number to be carried, are to be marked in red to the left of the figure set down or designated by smaller type, or in some other suitable manner.

In all the operations on the tables, if a cipher is registered to the left of the last number to be multiplied, it will not be necessary to use or pay attention to the figures representing the amount to be carried to the next number to be multiplied. If any one of the ten figures in the registration or multiplicand line of the unit-section of the table be registered or brought to the front of the box by moving the rollers on which this table is placed, the products of the multiplication of the said figure by any of the numerals from 2 to 9 appear on the table under the number registered and in line with the respective multipliers on the margin of the box, the unit of the product being in black or shown by large figure, the tens, if there should be any, being in red or shown by smaller type. If there is only one number to be multiplied, the tens, if any, are of course set down; but if more than one number be registered for multiplication no attention is paid to the carrying figure, it being carried in the other sections of the table.

The second section of the table, the first part of which is shown in Fig. 3, is to be arranged on the second pair of rollers, B B', from the right of the box, and is divided by vertical lines into ten parts, each of which has at its top the numerals from 0 to 9 arranged from right to left, as shown at b. Under these numerals, in the first part of this section, is arranged

a horizontal row of ciphers, *e*; in the second part, which is partly shown in Fig. 3, a row of ones, *f*; in the third, (not shown,) a row of twos, &c., the tenth part having a row of
 5 nines. This horizontal row, formed of ciphers, ones, twos, &c., is the registration-row of the tens, and when the table is placed on the roller is to be in line with the registration-row on the first roller.

10 Under each figure of the rows of ciphers, ones, &c., forming the multiplicand or registration-row, are arranged in vertical lines the results produced by adding to its different multiples (by the figures 2 to 9) the amount
 15 carried in the multiplication of the figure placed above it in the line of figures at the top of the sheet, these figures at the top representing the units that may be registered on the first roller, the amount carried, if any,
 20 from the multiplication of the figures of the unit-column being added in the table. It will be noticed that the registration-line in the first part of this section of the table is formed of a series of ciphers, either one of
 25 which can be brought to the front of the roller or registered, the registration-line in the second part (shown partly at *f*, Fig. 3) being formed of a series of ones, either of which can be registered. The table is so calculated and
 30 arranged that, in order to get the true result when we register a figure for multiplication, that one of the series must be registered which is beneath the figure corresponding to the one registered for multiplication in the
 35 unit-column. If we desire to multiply 2 by 9 we turn the first roller until the figure 2 in the registration-line is brought to the front, and the result is seen opposite the multiplier 9 at the sides of the box. If we want to multiply
 40 92 by 9, the 2 is registered in the manner described, and then the second roller is turned until the part having the series of nines in the registration-line appears, and the figure 9, in this line, which is found under 2 in the line
 45 above, is brought to the front, and the result is correctly shown by the table.

On the third pair of rollers is to be placed another section of the table, the first part of which is shown in Fig. 4. This section of the
 50 table, like the second section, is divided into ten parts, the first part of which is shown completely in Fig. 4, and a portion of the second part being seen to the left of the vertical line *h*, Fig. 4. Each of these ten parts corresponds
 55 in the registration-line to one of the figures, 0 to 9. In the first part, as shown in the drawings at *e*, the registration-row is composed of a series of ciphers; in the second part, a portion of which is shown at *i*, Fig. 4, it will be
 60 formed of a series of ones; in the third, of twos, &c. Above each of the ciphers are arranged, in vertical rows, double figures, from 00 to 99, which represent all of the combinations that can be registered in the preceding operations.
 65 These double figures are arranged in vertical rows, the first row containing the figures 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 10, and 11;

the second containing the figures 12; the third, figures 13 and 14; the fourth, figures 15 and 16; the fifth, figures 17 to 19, inclusive; 70 the sixth, figures 20 to 22, inclusive; the seventh, figures 23 and 24; the eighth, figures 25 to 28, inclusive; the ninth, figures 29 to 33, inclusive; the tenth, figures 34 to 37, inclusive; the eleventh, figures 38 and 39; the 75 twelfth, figures 40 to 42, inclusive; the thirteenth, figures 43 and 44; the fourteenth, figures 45 to 49, inclusive; the fifteenth, figures 50 to 55, inclusive; the sixteenth, figures 56 and 57; the seventeenth, figures 58 and 59; 80 the eighteenth, figures 60 to 62, inclusive; the nineteenth, figures 63 to 66, inclusive; the twentieth, figures 67 to 71, inclusive; the twenty-first, figures 72 to 74, inclusive; the twenty-second, figures 75 to 77, inclusive; the twenty-third, figures 78 and 79; the twenty-fourth, 85 figures 80 to 83, inclusive; the twenty-fifth, figures 84 and 85; the twenty-sixth, figures 86 and 87; the twenty-seventh, figures 88; and the twenty-eighth row, figures 89 to 99, inclusive. 90 It will be seen upon examination that these double figures are so arranged in the several vertical columns that the amount to be carried in their multiplication (if any) is the same for all the figures arranged in any particular column. These double figures are arranged in the manner shown on account of the changes that occur in multiplying. The figures 00 to 11 in the first column, if multiplied by any of the numerals from 2 to 9, have 100 nothing to carry in the horizontal lines of results. Under 12 there is a change in the result given in the ninth horizontal line, for 12 multiplied by 9 gives 1.08, or 1 to carry. Under 13 and 14 there is a change in the eighth horizontal 105 line, 1 to carry; under 15 and 16, a change in the seventh line of result, 1 to carry; under 17, a change in the sixth line, 1 to carry; under the column headed by 20, a change in the fifth line, 1 to carry. Under 23 we have a change 110 in the ninth line, $23 \times 9 = 207$, or 2 to carry. Under 25 there are two changes; in the fourth line we have 1 to carry, and in the eighth line 2 to carry. Under 29, we have 2 to carry in the seventh line. Under the column 115 headed by 34 there are three changes—in the third line, 1 to carry; in the sixth line, 2 to carry, and in the ninth line, 3 to carry. Under 38 there is a change in the eighth line, 3 to carry; under 40, a change in the fifth line, 120 2 to carry; under 43, a change in the seventh line, 3 to carry. Under the column headed by 45 we have 4 to carry in the ninth line. Under 50 there are four changes—1 to carry in the second line, 2 to carry in the fourth 125 line, 3 to carry in the sixth line, and 4 to carry in the eighth line. The next change occurs under 56, where we have 5 to carry in the ninth line. Under 58 we have 4 to carry in the seventh line. Under 60 we have a 130 change in the fifth line, 3 to carry; under 63, a change in the eighth line, 5 to carry. Under the column headed by 67 there are three changes—2 to carry in the third line, 4 to car-

ry in the sixth line, and 6 to carry in the ninth line. Under 72 we have a change in the seventh line, 5 to carry. Under 75 there are two changes—3 to carry in the fourth line, 6 to carry in the eighth line. Under 78 there is a change in the ninth line, 7 to carry. Under 80, in the fifth line, there is 4 to carry. Under 84, in the sixth line, we have 5 to carry; under 86, a change in the seventh line, 6 to carry; under 88, a change in the eighth line, 7 to carry; and under the column headed by 89, a change in the ninth line, 8 to carry. In all the succeeding parts of the third section of the table the same double figures are arranged in the same manner over the series of ones, twos, threes, &c, which form the registration-row of the succeeding parts. Under each figure of the rows of ciphers, ones, &c., forming the multiplicand-line, are arranged the results produced by adding to its different multiples the amount carried in the multiplication of the figures placed above it. This section of the table is used in the same manner as the second, except that two numbers corresponding to the two numbers previously registered are taken into consideration. Thus, if we have the numbers 7 6 5 to multiply, we first register the 5 on the section of the table on the first roller; then on the second roller we register the figure 6 that has the figure 5 above it, and then we turn the third roller until the series of sevens appears, and bring that one to the front which is under the figures 6 5. The sections of the table to be arranged on the fourth and all succeeding rollers to the left are similar in construction to the third section, just described.

In the multiplication of any number of more than three figures we meet with a difficulty. If we have four figures to multiply, and we register the fourth figure under the row of double figures containing the two figures that we have just registered to the right, the answer will not always be correct, because the first figure registered may be such that the amount to be carried in the multiplication of the fourth figure will be changed. If, for example, the sum to be multiplied was 11 12, and we register the figure 1 in the fourth section of the table—that is, underneath the figures 11—representing those just registered to the right, if we use 9 as the multiplier the answer given by the table will be 9 '0 '0 '8, which will be wrong, the correct answer being '0 '0 '0 '8. This difficulty is obviated in the fourth and all succeeding sections of the table by proper references, which prevent any trouble on the part of the operator in arriving at the correct result of the multiplication of any sum from four to any number of figures by the numerals from 2 to 9.

Under the vertical columns of double figures in the fourth and succeeding sections of the table, when any changes are to be made, letters of reference are placed, as shown in the examples at *d*, Fig. 6, and also in Fig. 8. These letters refer the operator to a small book or

table accompanying the apparatus, the letter A being placed under the column ending with 11, the letter B under that ending with 12, the letter C under 14, &c. The first two pages of this book or table, referring, respectively, to the fourth and fifth sections, are shown in Fig. 5 of the accompanying drawings.

The reference-letter A under the column ending with 11 shows, by referring to the book or reference-sheet, that if 11 is registered and the number preceding it in the registration-line is any number from 2 up we must register the next number under 12, because if 11 is preceded by any number from 2 up the ninth horizontal line of results is changed, and this change will correspond to the results given under 12. The reference-letter B under 12 shows that if the 12 be preceded to the right by any number from 5 up we must register under 13, because the eighth line of results is changed. Reference-letter C shows that when 14 is registered and is preceded by any number from 3 up we must register under 15, because the seventh line is changed. Reference D shows that when 16, representing the two numbers just registered to the right, is preceded by any number from 7 up we must register under 17, because the result in such case will correspond to the results given under 17, the sixth horizontal line being changed. E shows that when 22 is preceded by any figure from 3 up we must register under 23, the ninth line being changed. F shows that when 28 is preceded by any of the figures from 6 up we should register under 29, the seventh horizontal line being changed. G, under 33, shows that if 33 is preceded by any figure from 4 up we should register under 34, the third, sixth, and ninth horizontal lines being changed. H, under 37, shows that when 37 is preceded by any figure from 5 up we must register under 38, the eighth horizontal line being changed. I shows that when 42 is preceded by figure 9 we must register under 43, the seventh line being changed. J, under 44, shows by the reference-sheet that when 44 is preceded by any figure from 5 up we must register under 45, because the ninth line is changed. K, under 55, shows that when 55 has 6 or a higher number to the right we must register under 56, because the ninth line of results is changed. L shows that when 57 has 2 or a higher figure to the right we must register under 58, the seventh line being changed. M shows that when 62 has 5 or a higher figure to the right the eighth line is changed, and we must register under 63. When 66 is preceded by any number from 7 up, the reference-letter N informs us that we must register under 67, the third, sixth, and ninth lines being changed. When 71 is preceded by any figure from 5 up, the letter O informs us that we must register under 72, the seventh horizontal line being changed. If 77 has 8 or a higher figure to the right the letter P informs us that we must register under 78, the ninth line being changed. When 83 is preceded by any figure from 4 up,

the sixth line changes, and the letter Q informs us that we must register under 84. When 85 is preceded by 8 or a higher figure, the reference-letter R directs us to register

5 under 86, the seventh line being changed. When 87 has 5 or a higher figure to the right, the letter S shows that we must register under 88, the eighth line being changed. The reference-letter T under 88 indicates, 10 by reference to the corresponding letter on the table, that if 88 is preceded by 9 we must register under 89, the ninth line being changed. Thus, in registering the fourth figure to be multiplied, if the second and third figures just 15 registered are 11, when the fourth roller is turned so as to bring the fourth figure to be registered under the vertical column of figures containing 11, the letter A under that column will refer the operator to the table or page 20 corresponding to the section of the table on the fourth roller, and there he will see that if the figure preceding the 11 in the line to be multiplied be any number from two up he must register the fourth figure which is under 25 the vertical column headed by 12. This is done by simply moving the roller one turn to the right.

The letters of reference on the fourth section of the table refer to the reference-leaf 30 marked 1 in the drawings. If a fifth section is used the references would refer to the leaf marked 2.

Any desired number of sections may be used in the table and the apparatus so arranged as 35 to multiply any number of figures.

The following are examples of the manner in which the device is to be used for multiplying: To multiply 5,632 by 492 we first register 2 on the first roller; then on the second 40 roller, under 2, at the top, we register 3; on the third roller, under 32, at the top, we register 6, and on the fourth roller, under 63, at the top, we register 5, attention being called by letter N. We refer to this letter in the reference-table or book. As we find no reference 45 made to 63, the column stands correct. The figures on the several rollers will then appear as in Fig. 6. The horizontal rows in line with the desired multipliers being set 50 down, as shown at Fig. 7, the operation is completed by one addition. To multiply 4,667 by 3,412, we register 7 in the multiplicand-line on the first roller, 6 on the second roller under 7, 6 on the third roller under 67, and, noticing that letter O has no reference to the 55 present case, we turn the fourth roller until the 4 under 66 comes to the front, which would give the column A, as shown in Fig. 8. The reference N will show that the 4 must be registered under 67. We turn the register one 60 number to the right and obtain 4 in column

containing 67 and have the correct answer, as shown by line B, Fig. 8. The amounts opposite the multipliers 3, 4, 1, and 2 having been set down as shown in Fig. 9, the result will be 65 found by adding them together.

From the above description it will be seen that any given number can be multiplied by any one of the numerals from 2 to 9 without requiring any addition or carrying of figures, 70 and that when we desire to multiply by 2 or more numbers it is only necessary to register the multiplicand in the manner directed, and the result of the multiplication by each of the numerals is found in line with the multipliers on the side of the box. We have only 75 to set down the products of the multiplication found in line with the multipliers as in ordinary multiplication, and one addition will give the result. 80

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

1. A table for facilitating multiplication composed of a series of movable independent 85 sections inscribed with numerals, arranged as shown and described, the first or unit section having a line of figures representing units with their multiples arranged under them in regular numerical succession, as described, the 90 second or tens section having a line of figures representing tens, and above them figures indicating units, and below them figures representing multiples of said tens plus the respective amounts carried in the multiplication of 95 such units, the succeeding (hundreds, thousands, &c.) sections having figures arranged upon the same principle, as set forth.

2. In an apparatus for facilitating multiplication, the combination, with a box or case 100 having a vertical row of multiplying numerals, from 1 to 9 inclusive, arranged upon its margin, of a table of figures formed in sections and arranged upon revolving rods or 105 rollers within said box, said table having a multiplicand or registration line on which any numbers can be arranged for multiplication, figures arranged upon the several sections (with the exception of the first) above the 110 multiplicand-line, which figures represent the numbers registered on the preceding sections and serve as guides in the registration of the multiplicand, and a series of rows of figures representing the result of the multiplication of any number registered arranged opposite 115 the respective multiplying numerals 2 to 9 on the margin of the box, substantially as shown and described.

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Witnesses:

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