(No Model.) 4 Sheets—Sheet 1.

F. W. CHILD.

TABULAR CALCULATOR.

No. 343,566. Patented June 15, 1886.

Fig. 1.

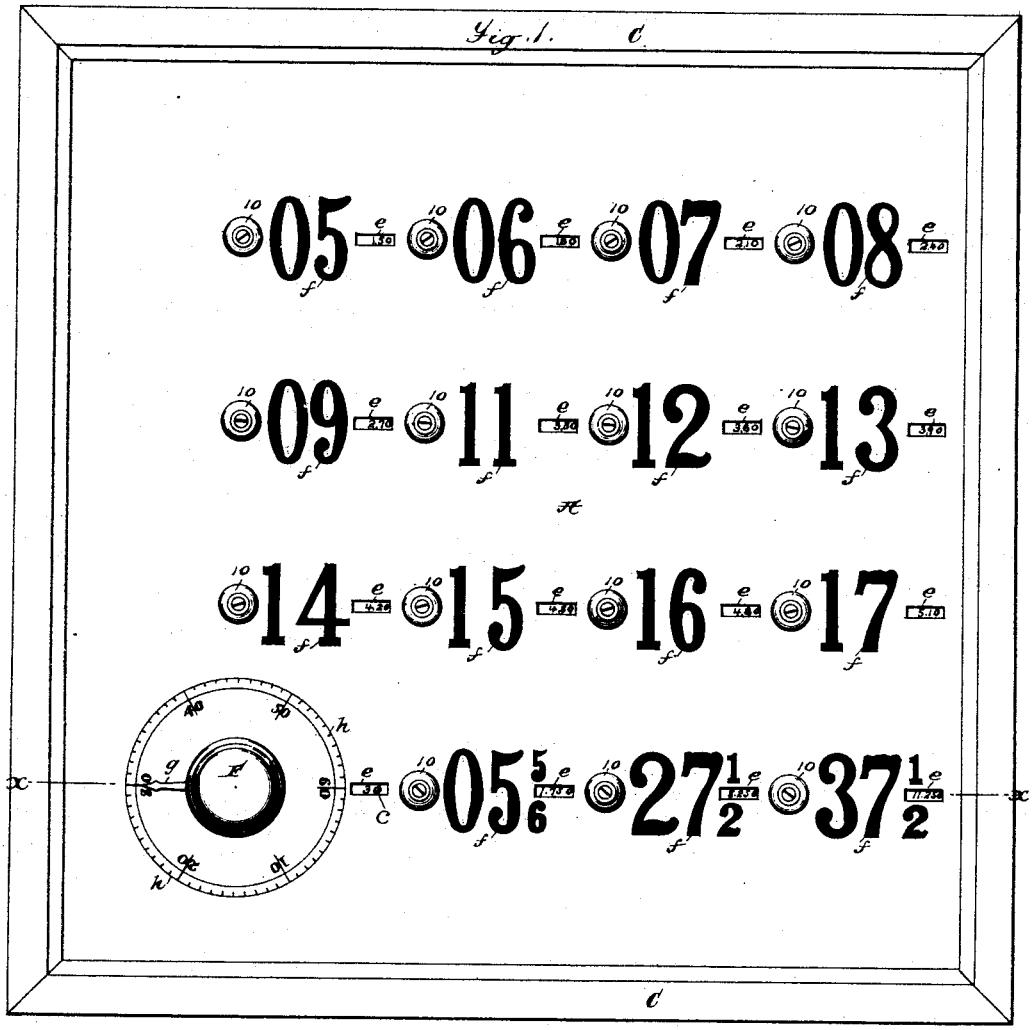
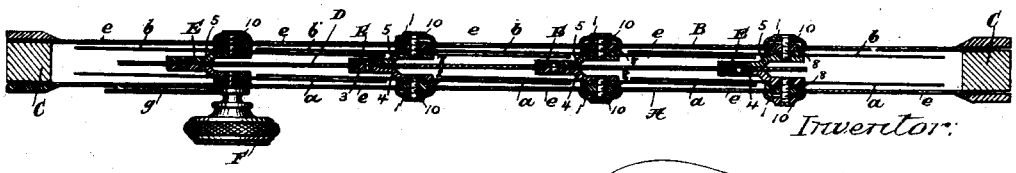


Fig. 4.



Inventor:

Frederick W. Child

by Munson & Philipp

Attys.

Attest.

Geo. H. Botts.

J. A. Harvey

(No Model.)

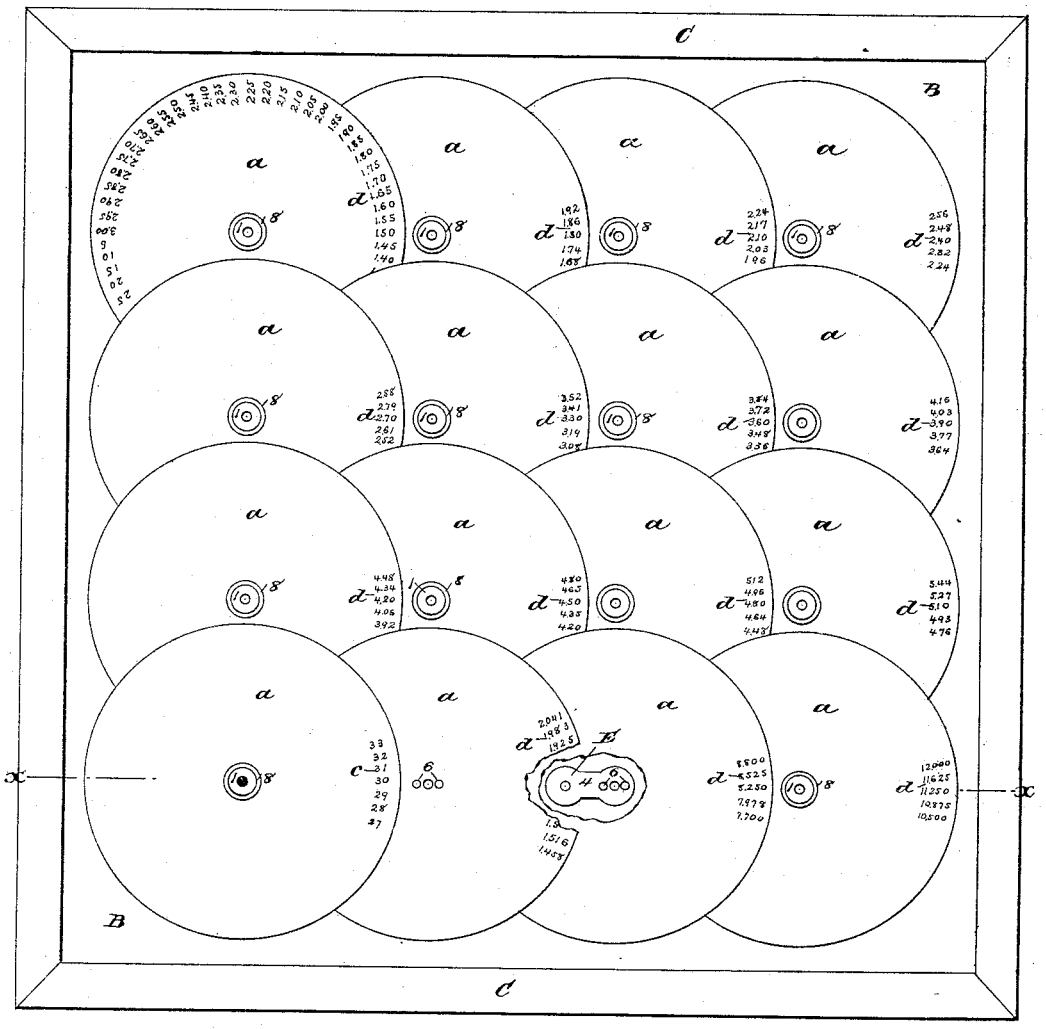
4 Sheets—Sheet 2.

F. W. CHILD.

TABULAR CALCULATOR.

No. 343,566. Patented June 15, 1886.

Fig. 2.



Attest:
G. H. Betts.
J. A. Lowry

Inventor:
Frederick W. Child
by Munson & Cliff
Attys.

(No Model.) 4 Sheets—Sheet 3.

F. W. CHILD.

TABULAR CALCULATOR.

No. 343,566. Patented June 15, 1886.

Fig. 3.

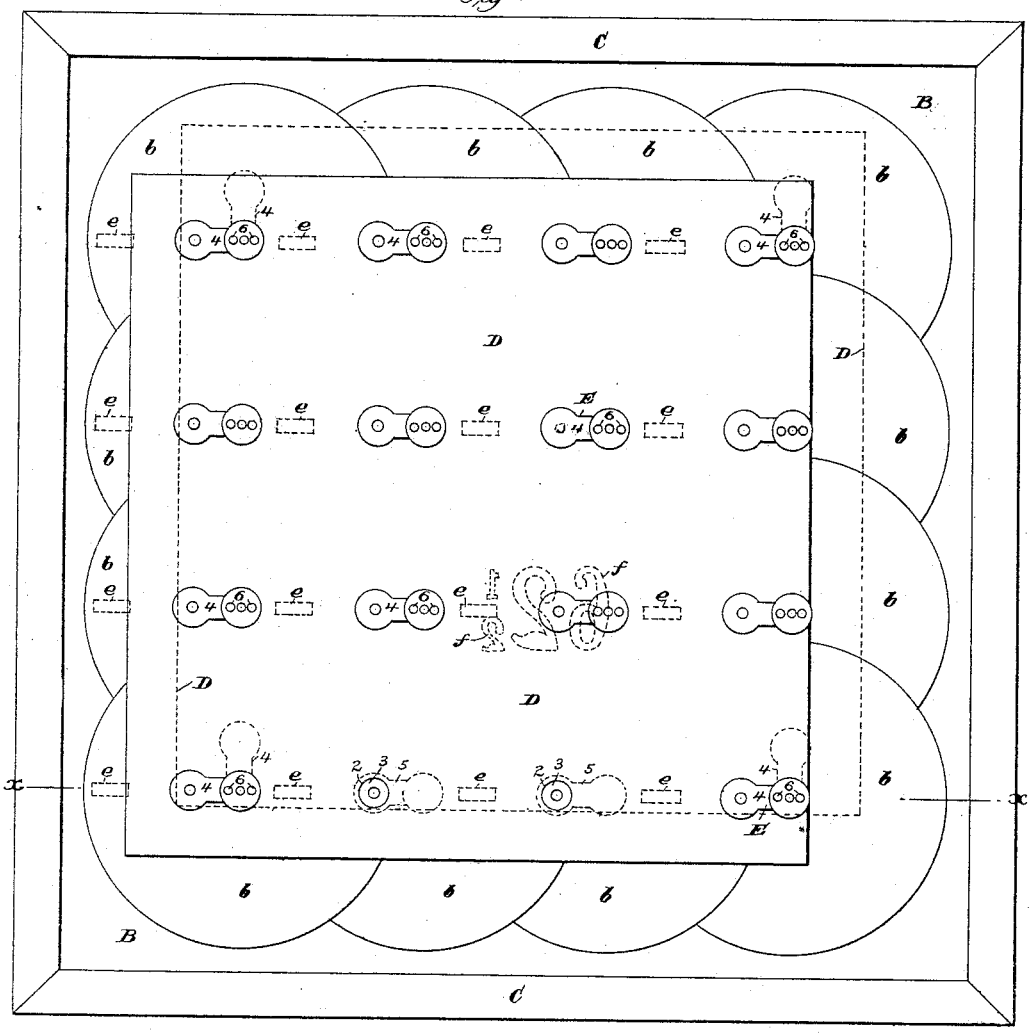


Fig. 6.

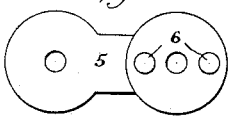


Fig. 5.

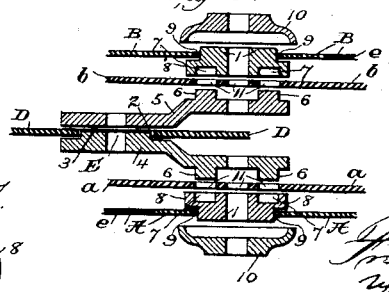
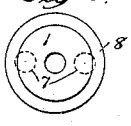


Fig. 7.



Attest:

Geo. H. Botts.

J. A. Harvey

Inventor:

Frederick W. Child

by Munn & Co

Attys.

(No Model.) 4 Sheets—Sheet 4.

F. W. CHILD.

TABULAR CALCULATOR.

No. 343,566. Patented June 15, 1886.

Fig. 8.

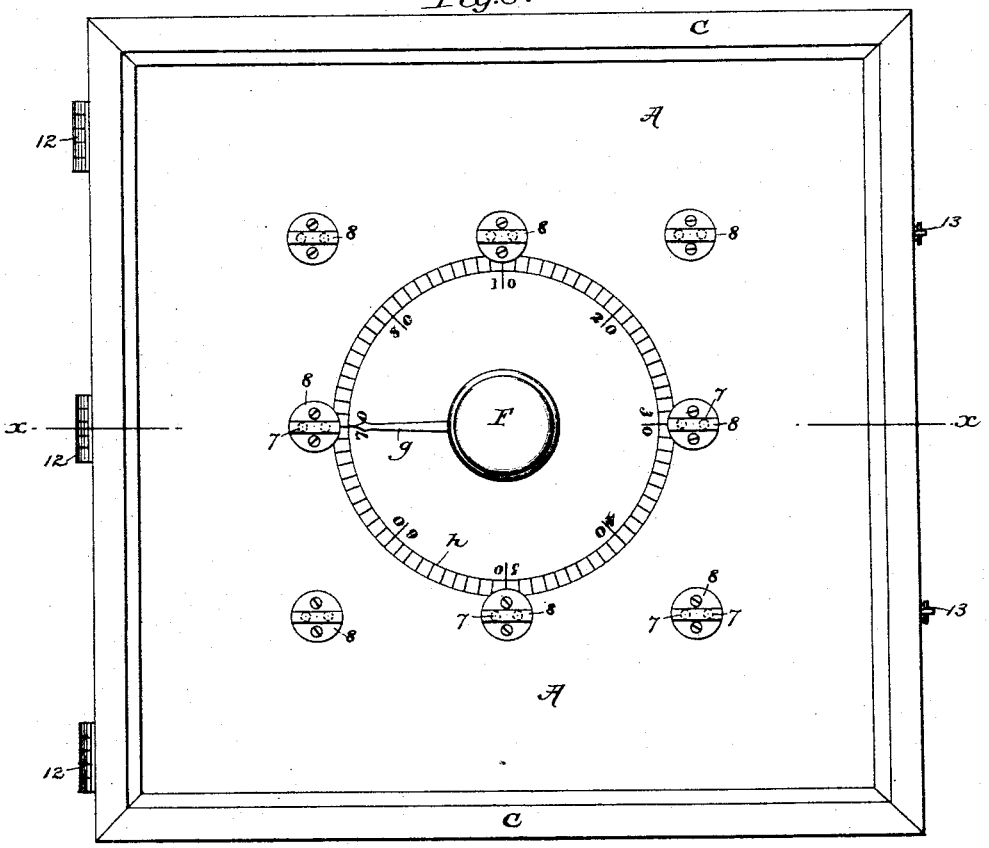
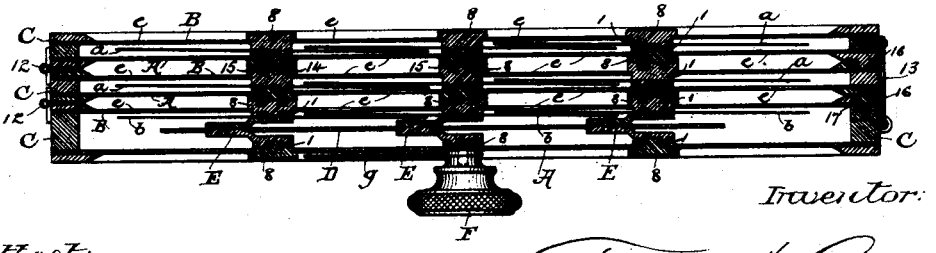


Fig. 9.



Witnesses:
Geo. H. Pitt.
J. A. Lowry

Inventor:
Frederick W. Child
by Munn & Co
Attys.

UNITED STATES PATENT OFFICE.

FREDERICK W. CHILD, OF GREENWICH, CONNECTICUT.

TABULAR CALCULATOR.

SPECIFICATION forming part of Letters Patent No. 343,566, dated June 15, 1886.

Application filed August 29, 1885. Serial No. 175,617 (No model.)

To all whom it may concern:

Be it known that I, FREDERICK W. CHILD, a citizen of the United States, residing at Greenwich, county of Fairfield, and State of Connecticut, have invented certain new and useful Improvements in Apparatus for Displaying Tables, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to an apparatus which is designed and adapted for use in displaying all classes of tables consisting of three factors, it being the object of the invention to provide a simple and compact apparatus by which all classes of tables involving three factors, for whatever purpose intended, can be readily and quickly displayed, and particularly by which calculations involving the process of multiplication can be made with great rapidity, absolute accuracy, and without mental effort.

The apparatus is especially adapted for the use of pay-masters, book-keepers, salesmen, and others who from the nature of their employment are obliged to make a great number of calculations involving the process of multiplication. The apparatus is also particularly adapted for the use of train-dispatchers and other railway officials, for the purpose of indicating the time at which a given train is due at the different stations along the road.

As a full understanding of the invention can be best imparted by a detailed description of the apparatus in which it is embodied, such description will now be given, reference being had to the accompanying drawings, in which—

Figure 1 is a face or plan view of the apparatus. Fig. 2 is a similar view, with the face-plate removed so as to expose the faces of the upper series of revolving disks. Fig. 3 is a similar view, with the disks removed so as to expose the connections by which the disks are revolved. Fig. 4 is a section taken upon the line *x x* of Figs. 1, 2, and 3, looking toward the bottom of said figures. Fig. 5 is an enlarged view of a portion of Fig. 4, showing the parts slightly separated in order to more clearly illustrate the construction. Figs. 6 and 7 illustrate details, which will be hereinafter referred to. Fig. 8 is a view similar to Fig. 1, showing a modified construction; and Fig. 9 is a view similar to Fig. 4, taken upon the line *x x* of Fig. 8.

Referring particularly to Figs. 1 to 7, it is to be understood that the body of the apparatus is composed of two plates, A B, which are made of thin sheet metal or other suitable rigid material, and are supported a short distance from each other by means of a suitable frame, C, in which the edges of the plates are secured.

Located midway between the plates A B is a movable plate, D, which is also made of thin sheet metal or other suitable rigid material, and is of considerable less size than the space within the frame C. The plate D is provided with a series of circular openings, 2, (see Figs. 3 and 5,) which receive the short pins or pivots 3 of a series of cranks, E, which turn in bearings in the plates A B. Each of these cranks E is composed of two arms, 4 5, (see Figs. 4, 5, and 6,) which are arranged upon opposite sides of the plate D, and are connected to each other by means of screws, which pass through the pivots 3. The arms 4 5 are provided at their opposite ends with studs 6, which fit into recesses 7 in the faces of two series of disks, 8, (see Figs. 4, 5, and 7,) which rest upon the insides of the plates A B, and are provided with studs or projections 1, which fit into round openings 9 in the plates A B. The studs 1 are provided with caps 10, which fit over the ends of the studs and rest upon the plates A B, and the arms, disks, and caps are held securely together by means of screws, which pass through all three, as shown in Fig. 4. From this arrangement it will be seen that whenever any one of the cranks E is turned a corresponding movement will be imparted to the plate D, and through the plate to all of the other cranks, so that all of the cranks will be caused to turn in unison, as shown by dotted lines in Fig. 3. For this purpose the cap 10 is omitted from one of the studs 1, (the one at the lower left-hand corner of the apparatus, as shown in the present case,) and the stud is provided with a knob or handle, F, the shank of which overlaps the plate A and serves the same purpose as the cap 10. By means of this knob the crank E, to which it is connected, can be readily turned

to any desired extent, thereby imparting a like movement to the plate D, and through it to the other cranks.

Just inside of the plates A B there are arranged two series of disks, *a* and *b*, which are made of pasteboard or other suitable material, the series *a* being located in close proximity to the plate A and the series *b* in close proximity to the plate B. These disks correspond in number to the cranks E, and are secured at their centers to the axes of the cranks by being interposed between the disks 8 and the arms 4 5 of the cranks, the disks being provided with openings 11 for the passage of the studs 6 and the screws.

When the apparatus is to be used for making calculations involving the process of multiplication, one of the disks *a*, preferably the one beneath the knob F, is provided around the edge of its face with a row of figures, *c*, containing the numbers from 1 up to 50 or 100, or more, according to the capacity which it is desired to give to the apparatus, while the remaining disks of the series *a* and all of the disks of the series *b* are provided with similarly-arranged rows of numbers, *d*, representing the products of the numbers in the row *c* when multiplied by the arbitrarily-selected number representing the unit upon which the computation is based. Only portions of the numbers in the rows *c d* are shown in the drawings; but it is to be understood that these rows extend entirely around the faces of the disks, the row *c* in the apparatus shown containing the numbers from 1 to 60, and the rows *d* the products of these numbers when multiplied, respectively, by the numbers representing the units upon which the computations are based.

The plates A B are each provided with a series of sight-openings, *e*, corresponding in number to the disks *a b*, and so positioned that as the disks are revolved, the numbers in the rows *c d* will be successively brought into view through the openings. The numbers in the rows *c d* are so arranged with relation to each other and to the openings *e* that when any given number in the row *c* is exposed through its opening *e* the numbers in the rows *d*, representing the product of that number when multiplied by the different units, will be exposed through the other openings *e*.

Above each of the disks *a b*, except the disk *a*, which is beneath the knob F, and in close proximity to the sight-openings, the plates A B are each provided with a number, *f*, representing the unit upon which the computations to be made by the use of that particular disk are based.

If the apparatus is designed for use in computing wages, as in the case shown, the unit numbers *f* will represent the rate per hour or per day, or the sum per piece paid to the different classes of workmen; while if the apparatus is designed for the use of salesmen or cashiers the numbers *f* will represent the price per yard or per pound, &c., of the different articles sold. Only one of the unit numbers *f* upon the plate B is shown in the drawings, (see dotted lines in Fig. 3;) but it is to be understood that this plate is provided with one of these numbers for each of the disks *b* and sight-openings *e*.

The manner of using the apparatus just described is as follows: It being assumed that the unit numbers *f* and the numbers in the rows *d* are arranged to compute wages at the rates paid in a certain factory, and that the pay-master upon looking at the pay-roll finds that an apprentice whose wages are thirty-seven and one-half cents per day is entitled to pay for thirty days, he then turns the knob F until the number "30" in the row *c* is exposed through its opening *e*, as shown in Fig. 1. By then glancing at the opening *e* adjacent to the unit number "37½" upon the plate A he reads "11.25," and knows that he is to pay $11.25. If the pay-roll shows that a workman who receives five cents per piece for making a certain article is entitled to pay for fifty-nine of the articles, he turns the knob F until the number "59" in the row *c* is exposed, and by then glancing at the opening *e* adjacent to the number "5" upon the plate A he reads "2.95," and knows that he is to pay $2.95. If the pay-roll shows that a workman whose wages are sixty-two and one-half cents per hour is entitled to pay for fourteen hours, he turns the knob F until the number "14" in the row *c* is exposed, and then turns over the apparatus and glances at the opening *e* adjacent to the number "62½" on the plate B, where he reads "8.75," and knows that he is to pay $8.75, and so the operation will be continued, the knob F being turned until the proper number in the row *c* is exposed through its opening *e*, after which number *f*, representing the proper unit, will be found either upon the plate A or the plate B, and the product read through its opening *e*.

To aid in bringing the proper number in the row *c* into position to be exposed through its opening *e*, the knob F may be provided with a pointer, as *g*, the end of which is arranged to move over a scale, *h*, which is graduated to correspond to the numbers in the row *c*. This will enable the knob F to be turned quickly until the pointer *g* is near the point upon the scale *h* corresponding to the number in the row *c* which it is desired to expose, after which the knob can be turned slowly until the desired number comes into view. By this means considerable time will be saved in bringing the disks into the proper position, thus enabling the computations to be made more rapidly. It will of course be seen that the row of numbers *c* may be upon any other one of the disks *a*, instead of the one beneath the knob F, and also that if the scale *h* is made accurately and of sufficient size this row of numbers need not be placed upon any one of the disks. It is to be understood therefore that the row of numbers *c* and the scale and pointer *g h* are equivalents, and that either may be used without the other, although it is preferable to provide the apparatus with both,

as shown. If the row of numbers *c* is omitted, the disk *a*, upon which they are located, may be provided with a row of numbers, *d*, for making computations the same as the other disks. It will be observed that the disks *a b* are arranged to overlap each other. This is a feature of considerable importance, as it enables a larger number of disks to be employed, thus increasing the capacity of the apparatus without decreasing the size of the disks or making the apparatus of inconvenient size. It will also be observed that the disks are overlapped in such manner that the same portion of each disk comes next to the plates A B. This permits the openings *e* and numbers *f* for all of the disks to be in the same position with relation to the axes of the disks, which facilitates the reading.

As illustrated in the present case, the apparatus is provided with thirty-two of the disks—sixteen on each side; but it will readily be seen that the number may be increased or decreased, according to the capacity which it is desired to give to the apparatus.

If it should be desired to produce an apparatus of only a limited capacity, the series of disks *b* and the openings *e* in the plate B may be omitted, thus using only one side of the apparatus, and in such case the arms 5 of the cranks E may also be omitted; but when the arms 5 are omitted it will be necessary to make the plate A or the plate D somewhat more rigid.

When it is desired to make the apparatus of any greater capacity, it will preferably be made in two or more sections, which will be hinged to each other and arranged to be closed together or swung apart like the leaves of a book. This form of the apparatus is illustrated in Figs. 8 and 9, in which the apparatus is shown as composed of three sections, the upper or main section being of substantially the construction already described, while the other two sections are so constructed and arranged that the disks of all are operated from the single knob F. In this case the disks *a* and the openings *e* in the face-plate A of the main section of the apparatus are omitted, and the knob F is shown as applied to the crank E at the center of the apparatus. In this case also the row of numbers *c* is omitted, the scale *h* and pointer *g* being depended upon to indicate the position of the disks. So, also, instead of there being sixteen of the disks *a b* in each series, there are but nine. These features are not, however, material. The number of the disks in each series may be more or less than shown, and the knob F may be attached to any one of the cranks. The plate A may also be provided with the sight-openings *e* and numbers *f*, and the cranks E with the disks *a*, and in such case one of the disks *a* may be provided with the row of numbers *c*. The other two sections of the apparatus are similar in construction to the main section, except that they are not provided with the plate D and cranks E. Each of these sections consists of two plates, A B, which are similar to the plates A B of the main section, and are secured at their edges in a frame, C, also similar to the frame of the main section. The plates A B of these sections are provided with sight-openings *e* and unit-numbers arranged in the same manner as the openings *e* and numbers *f* of the main section; but as these sections are not provided with the cranks E and plate D their plates A B are placed comparatively close together, and instead of being provided with two series of disks, *a b*, they are provided with a single series, *a*, the rows of numbers corresponding to the rows *d*, which are exposed through the openings *e* of the plates A B, being printed upon the opposite sides of the disks.

In the construction now being considered the disks 8, instead of being arranged as shown in Figs. 4 and 5, are, except in the case of the one to which the knob F is attached, reversed in position—that is to say, the broad portions of the disks are upon the outsides of the plates A B, the projections 1 extending inward through the openings in the plates A B. In the case of the main section the projections 1 are provided with the recesses 7 to receive the studs 6 of the arms 4 5 of the cranks E, while in the case of the other sections the disks *a* are clamped directly between the projections 1 of the two disks, one of the projections being provided with the recesses 7 and the other with the studs 6. In the case of the main section the disks 8 and the arms 4 5 of the cranks are held together by means of screws, as shown in Fig. 8, and in the case of the other sections the two disks 8 are held together in a similar manner. By this means the caps 10 are dispensed with. The several sections thus constructed are hinged to each other as shown at 12, and are provided with a suitable hook or hooks, as 13, by which they are fastened in their closed position.

In order that the disks of the series *a* may be operated by the single knob F, the disks 8 of the several sections are so constructed that when the sections are closed together the disks of all the sections will be connected. To effect this, the outer faces of the disks of one section are provided with recesses 14, and the outer faces of the disks of the next section with studs 15, which are so arranged that when the sections are closed together they will enter the recesses 14, as shown in Fig. 9. By this means any movement which is given to the plate D of the main section is communicated to the disks 8 and the disks *a* of all the sections.

In order that the several sections may be made to fit squarely together and be prevented from having any lateral movement with relation to each other, the several frames C will preferably be provided with one or more recesses, as 17, and pins, as 16, which will engage, as shown in Fig. 8, when the sections are in their closed position.

The manner of using the apparatus when

thus constructed is as follows: The several sections being closed together, the knob F will be turned until the pointer *g* is at the proper number on the scale *h*. This will cause the disks *b* of the main section and the disks *a* of the other sections to be moved to a corresponding position. The sections will then be swung apart on the hinges 12, so as to expose the plate A or B, which bears the desired unit number, and by then glancing at the opening *e* adjacent to that number the result can be read. The sections will then be closed together, so as to connect the disks 8, and the operation repeated.

When the apparatus is composed of a number of sections, as just described, one of the disks *a b* of each section will preferably be provided with the row of numbers *c*, which can be referred to when the sections are swung apart to verify the positions of the other disks.

Although, as before stated, the apparatus is especially adapted for making computations involving the process of multiplication, yet it will be found useful for displaying many other classes of tables. For example, it may be arranged for use in computing interest. In such case the row *c* or the scale *h* will contain the numbers representing the principal from one dollar up to one hundred dollars, and also, if desired, fractions of the dollar. The numbers *f* will represent the different periods of time from one day up to one year, and the numbers in the rows *d* will represent the interest on the sums indicated in the row *c* or on the scale *h* for the time indicated by the numbers *f* at the rate per cent. which the apparatus is designed to compute; or the apparatus may be arranged to display the prices of the different parts of a machine. In such case the numbers in the row *c* or on the scale *h* will represent the different parts of the machine, the numbers *f* its character—*i. e.*, size, &c.—and the numbers in the rows *d* the price; or the apparatus may be arranged for use in railway-stations or by railway officials to display time-tables indicating the time at which the different trains are due at the different stations along the road. In such case the row of numbers *c* or the scale *h* will be arranged like the dial of a clock and will indicate the time the different trains start, the names of the stations along the road will take the place of the numbers *f*, and the numbers in the rows *d* will indicate the time at which the several trains are due at these stations. When a train does not stop at a station, that can be indicated in the row *d* by leaving the time blank; or, in fact, the apparatus may be arranged to display any table consisting of three factors.

There are also many ways in which the apparatus can be used for object teaching and as a pictorial toy. In some of these cases the numbers *c*, *d*, and *f* will some or all of them be replaced by letters, words, characters, or pictures, and in some cases the numbers *f* or their equivalent letters, words, characters, or pictures may be entirely omitted from the plate or plates A B.

What I claim is—

1. The combination, with the plate A or B, having the sight-openings *e*, of a plurality of revolving disks, as *a* or *b*, having cranks, as E, and the plate D, connected to said cranks, substantially as described.

2. The combination, with the plates A B, having the sight-openings *e*, of the disks *a b*, having cranks, as E, and the plate D, connected to said cranks, substantially as described.

3. The combination, with the plate A or B and the cranks E, of the plate D, connected to said cranks, and the knob or handle F, substantially as described.

4. The combination, with the plate A or B, having the sight-openings *e* and numbers *f*, of the disks *a* or *b*, having the cranks E, and the plate D, connected to said cranks, substantially as described.

5. The combination, with the plate A or B, having the sight-openings *e*, of the disks *a* or *b*, having the cranks E, the plate D, connected to said cranks, and the knob or handle F, substantially as described.

6. The combination, with the plate A or B, having the sight-openings *e* and scale *h*, of the disks *a* or *b*, having the cranks E, the plate D, connected to said cranks, and the knob or handle F, having the pointer *g*, substantially as described.

7. The combination, with the plates A B, having the sight-openings *e*, of the disks *a b*, having the cranks E, the plate D, connected to said cranks, and the knob or handle F, substantially as described.

8. The combination, with the plate A or B, of the disks 8 and crank-arms 4 or 5 and the disks *a* or *b*, secured between said crank-arms and the disks 8, substantially as described.

9. The combination, with the main section having the disks 8, cranks E, plate D, and knob or handle F, of one or more supplemental sections hinged to the main section and having the disks 8, and means whereby, when the sections are closed together, the disks 8 of the different sections are connected, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

FREDERICK W. CHILD.

Witnesses:
JAS. A. HOVEY,
JAS. J. KENNEDY.