F. W. RODOLF.

ADDING AND SUBTRACTING MACHINE.

APPLICATION FILED FEB. 13, 1914.

**1,243,224.** Patented Oct. 16, 1917.

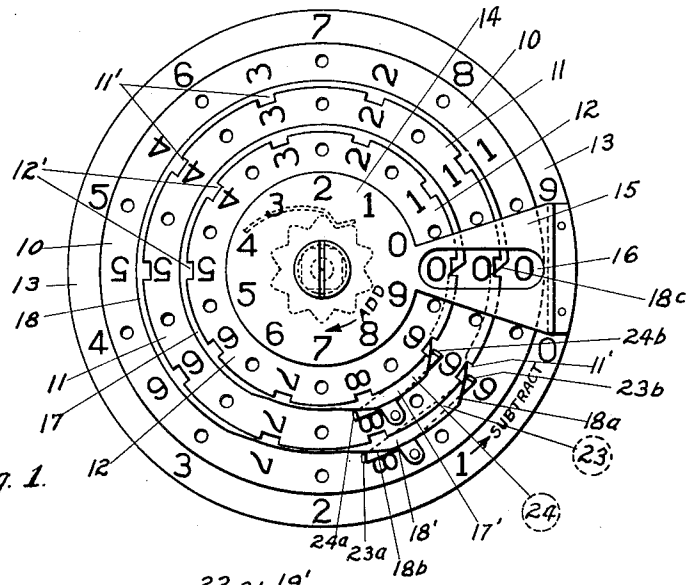



Fig. 1.

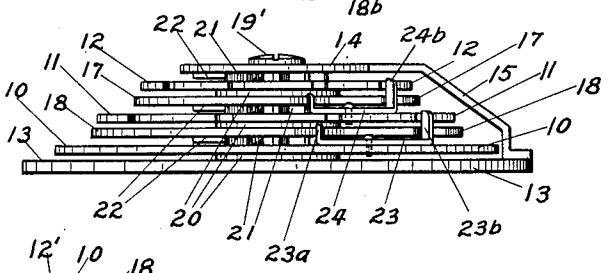


Fig. 2.

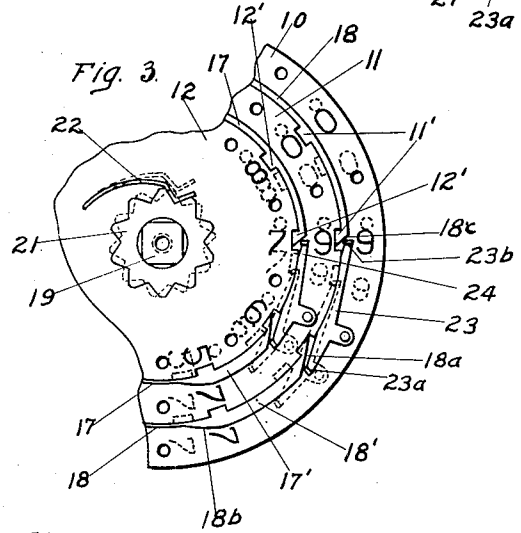


Fig. 3.

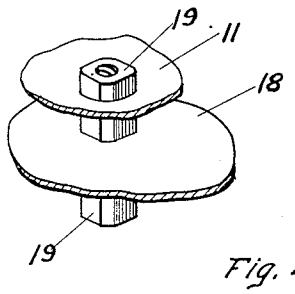


Fig. 4.

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# UNITED STATES PATENT OFFICE.

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## ADDING AND SUBTRACTING MACHINE.

1,243,224. Specification of Letters Patent. Patented Oct. 16, 1917.

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*To all whom it may concern:*

Be it known that I, FRED W. RODOLF, a citizen of the United States, residing in the city of Portland, county of Multnomah, and State of Oregon, have invented certain new and useful Improvements in Adding and Subtracting Machines, of which the following is a specification.

My invention relates to adding and subtracting machines, and more particularly to a small portable, keyless device by means of which columns of figures can be quickly and accurately added, and also by means of which subtractions from a given total can be quickly and accurately made by simply reversing the operation of the machine.

Among the salient objects of the invention are,—to provide a device of the character referred to which is direct and positive in its operation and incapable of error if correctly manipulated; to provide a device of the character referred to having a series of movable dials or counter members adapted to be positively moved by hand, or preferably by using the point of a pencil or other convenient instrument, there being a "units" dial, a "tens" dial, a "hundredths" dial, and so on to any desired capacity, these being arranged, preferably, one above the other in pyramidal form; to provide in a device of the character referred to positive mechanical connections by means of which transfers are made from one dial to the next adjacent dial; and in general, to provide a very simple, practical and efficient adding and subtracting machine which can be cheaply manufactured and which can be held in one hand and manipulated by the other.

In order that others may thoroughly understand my invention, I have illustrated one practical embodiment thereof on the accompanying sheet of drawings, which I will now describe.

Figure 1 is a top plan view of a device embodying the invention;

Fig. 2 is an edge or side view thereof;

Fig. 3 is a fragmentary top plan view with the top and bottom index plates or dials omitted, and showing in dotted lines shifted positions of the counter dials; and

Fig. 4 is an enlarged view showing a detail of construction.

For purposes of illustration I have shown only a units, tens and hundredths combination of dials or counter disks, and these I have designated, respectively, 10, 11 and 12, mounted one above the other and each being successively smaller, whereby to leave an exposed edge margin around each to receive the numerals 1 to 0. A subtracting index plate or dial 13 is provided at the bottom of the dials for use in making subtractions, and a top or adding index dial or plate 14 is provided for use when making additions, said index plates or dials being stationary and preferably being connected by an arm or stop member 15, having a sight opening, as 16, therein, which constitutes a reading position. The top or adding index dial 14 is provided around its edge with the numerals 1 to 0 arranged in the order shown and dividing the dial into ten equal segments. The units, tens and hundredths dials or counter members 10, 11 and 12 are also thus divided by the numerals 1 to 0, arranged in the same order, and in radial alinement with each other when the parts are in their normal or zero position, but not in alinement with the numerals on the index dials. The movable counter dials 10, 11 and 12, it will be noted, are provided with small holes arranged between the numerals thereon, these holes standing in radial alinement with the numerals on the index dials when the parts are at rest, as shown in Fig. 1. The lower or subtracting index dial 13, it will be noted, is also provided around its outer margin with the numerals 1 to 0, equally spaced, but arranged in the reversed order from that of the top or adding index, and also to those of the counter dials, but in radial alinement with the numerals of the adding index dial and with the holes in the counter dials. The connecting arm or member 15 between the stationary index dials is tapered and preferably covers one of the segmental spaces, as between two rows of holes, the holes resting along the straight opposite edges of said member 15, as the parts come to adjusted positions, while the numerals on said counter dials, it will be noted, are in register with the sight opening 16 in said member 15.

Arranged immediately beneath the counter dials 11 and 12, these being the tens and hundredths dials, are two fixed cam disks, as 17 and 18, having formed therein the cam portions 17′ and 18′, standing in fixed radial relationship, as shown. The parts are

secured together by means of a middle binding post, as 19, of square construction, with its corners rounded, whereby the movable counter dials 10, 11 and 12, having round holes therein, can be turned upon said post, while the cam disks 17 and 18, having square holes therethrough, are held stationary with the post 19. A screw 19′ is inserted into the upper end of said post to bind the top or adding index plate thereto. This construction is clearly shown in Fig. 4.

In order to reduce frictional contact between the counter dials and the other parts, suitable washers, as 20, are placed upon the post 19, between said dials, as indicated, Fig. 2. As a means for yieldingly holding the counter dials in their various positions, each is provided with a notched disk, as 12, rigid therewith, and having ten notches therein, one for each numeral, as shown in Fig. 3. Into these notches is adapted to fit the end of a spring member 22, said spring member operating to properly place or position the counter dials during their movements. In Fig. 3, I have shown in dotted lines the dial 12 in a partially turned position, with the spring 22 about to pass over the point of one of the teeth forming the notches in the member 21. It will be readily understood that as soon as the dial 12 has been moved sufficiently to permit the end of the spring 22 to pass over the point, said spring then operates to move the dial forwardly until the end of the spring is seated snugly in the notch, thus insuring that the dials are properly positioned so that their numerals register properly with the sight opening 16, and also so as to put the dials with their transfer levers, hereinafter referred to, in proper relationship with the cam disks.

I will next describe the mechanism by means of which transfers are made from one counter dial to the next adjacent dial. Pivotally mounted upon and carried by the counter dials 10 and 11, are pawl like levers 23 and 24, each having upturned fingers as $23^a$ and $23^b$, and $24^a$ and $24^b$, the fingers $23^a$ and $24^a$ being shorter and adapted to engage and be moved by the cam members 17 and 18, while the fingers $23^b$ and $24^b$ are adapted to be moved into and out of operating engagement with notches, as 11′ and 12′, around the edges of the dials 11 and 12. The cam members 17 and 18 are enough larger than the counter dials 11 and 12 that the fingers $23^b$ and $24^b$ are held normally out of engagement with these notches 11′ and 12′, as the counter dials on which the levers 23 and 24 are mounted are moved, excepting at the proper positions where said cam plates are formed so as to guide said fingers into and out of the proper notches of the adjacent dial in order to move it in making a transfer from one counter dial to the next adjacent counter dial, whether it be adding or subtracting.

As this construction and operation can be best understood by a description of the operation, I will now describe the operation in making additions and also in making subtractions.

Assuming that the parts are in their normal or zero positions, as shown in Fig. 1, we will add the numbers 253 and 546 together, for an illustration. If the pencil is used for manipulating the counter dials, the end of the pencil is inserted in the hole in the hundredths dial 12 which is radially opposite the index numeral 2 of the top or adding index dial 14. For the adding operation, these counter dials are moved clockwise. The hundredths dial is therefore moved until the pencil stops against the edge of the member 15, which puts the numeral 2 on the hundredths dial in the sight opening 16. The pencil is next inserted in the hole in the tens dial which is radially opposite the numeral 5 of the adding index dial 14, and this dial is turned clockwise until the pencil stops against the edge of the arm 15, as before, bringing the numeral 5 of the tens dial into the sight opening. The pencil is next inserted in the hole in the units dial, which is opposite the numeral 3 of the index dial, and the units dial is turned likewise to the stop, thus putting the number 253 in register with the sight opening 16. In like manner the number 546 is then put into the machine by inserting the end of the pencil in the hole in the hundredths dial which is radially opposite the index numeral 5, and this hundredths dial is turned clockwise until the pencil stops at the arm 15. This results in moving the numeral 7 (the total of 2 and 5) of the hundredths dial into the sight opening. The pencil is then inserted into the hole which is radially opposite the index numeral 4 in the tens dial, and this dial is so moved, bringing its numeral 9 (sum of 5 and 4) into the sight opening. The pencil is next inserted into the hole which is radially opposite the index numeral 6, in the units dial, and the units dial is so moved to the stop as before, which brings its numeral 9 (the sum of 3 and 6) into the sight opening. Thus we have the total of the numbers 253 and 546, or 799 in the sight opening, as indicated in Fig. 3. Now if we add 1 to this number, we will get a demonstration of a double transfer, that is, a transfer from the units dial to the tens dial, and from the tens dial to the hundredths dial. In order to thus add 1 to the number 799, the pencil is inserted into the hole in the units dial which is radially opposite the index numeral 1, and the units dial is turned until the pencil stops against the edge of the arm 15, as before. In doing this, the transfer is automatically made

from the units to the tens dial, and from the tens dial to the hundredths dial, and the total of 800 immediately appears in the sight opening as the pencil stops at the arm 15. These transfers are accomplished by a direct and positive mechanical connection between the adjacent dials, without the use of springs. These connections will now be described.

In manipulating the units and tens dials, as just described, the transfer levers 23 and 24, mounted thereupon, have been carried around with their respective dials nine-tenths of a full revolution, or over nine of the segmental sections into which the dials are divided, and to the relative positions shown in Fig. 3, being held out of operating engagement with the notches in the counter dials by the cam plates 18 and 17. The next movement of the units dial to add 1 to the total of 799, as described, carries its transfer lever 23 forwardly until its finger $23^a$ engages and is moved outwardly by the inclined surface $18^a$ of the fixed cam 18′, which action moves the finger $23^b$ at the opposite end of said lever 23, into the notch of the tens dial and thereby carries the tens dial with the units dial until the finger $23^b$ of the lever 23, reaches and engages with the inclined surface $18^a$ of cam 18′, by which it is caused to move out of engagement with the notch in the tens dial. By this movement, therefore, the tens dial has been carried substantially through one segmental division forwardly, which forward movement is completed by the operation of the positioning spring 22, acting on the notched member 21, fixed to the dial. Inasmuch as the tens dial, with its transfer lever 24, occupied the same radial position, the movement of the tens dial by the units dial, operated in a like manner through the transfer lever 24, to turn the hundredths dial forwardly one segmental section. Just after a transfer has been made, the parts rest in the positions shown in Fig. 1, that is, the transfer levers are over the cams 17′ and 18′. Further forward or clockwise movement of the dials carrying these transfer levers would not operate to move adjacent dials, but would move the dial and its transfer lever independently of any other dial, the cam plate 17 or 18, as the case may be, operating to keep the levers free from the notches in the dials. A backward movement, however, of either the units or tens dial, as in subtracting, would also turn back the connected dial, as I will now describe. If, for example, we wish to subtract 1 from the 800, assuming that it is 800 in the sight opening, instead of 000, the operation is just the reverse to that of the adding operation. The pencil would be inserted in the hole in the units dial which is radially opposite the index numeral 1 on the lower, or subtracting dial 13, and the units dial would be moved in a direction opposite the movement of the hands of a clock. As the units dial with its transfer lever is thus moved backwardly, the finger $23^a$ of the lever 23 engages and is moved by the cam surface $18^b$, causing the finger $23^b$ to move inwardly so that it engages the notch in the tens dial and moves the tens dial with it back one segmental section, putting the numerals 99 in the sight opening 16 on the units and tens dial. The tens dial with its lever 24 would have operated in the same manner to engage and move the hundredths dial back one section, and assuming that 800 was in the sight opening 16, the remainder 799 will be put there instead by simply turning the units dial 10 back one section. This would leave the levers in the relative positions shown in Fig. 3 with the total 799 in the sight opening. Any further subtracting movement of the units dial would cause the finger $23^b$ of the transfer lever 23 to engage and be moved outwardly by the cam surface $18^c$, as in Fig. 3, so as not to engage the tens dial notch, and as the fingers $23^a$ and $24^a$ on the short ends of the transfer levers 23 and 24 are shorter than the fingers at the long ends of said levers, said fingers $23^a$ and $24^a$ do not engage the counter dial above each, but pass under the notches therein. Therefore the units dial would be free to move nine-tenths of the revolution before its lever again engages and turns the tens dial with it.

If it is desired to subtract the number 546 from this total of 799, it is quickly accomplished as follows: The end of the pencil is inserted in the hole in the hundredths dial which is radially opposite the numeral 5 on the lower or subtracting index 13, and that dial is turned in a direction opposite the movement of the hands of a clock until the pencil strikes the edge of the arm or member 15. The pencil is next inserted in the hole in the tens dial which is radially opposite the numeral 4 on the subtracting index, and this tens dial is turned in the same direction until the pencil stops against the member 15. The pencil is next inserted in the hole of the units dial which is radially opposite the numeral 6 on the subtracting dial and this dial is turned to the stop, whereby there is put into the sight opening the remainder 253. The subtracting operation is exactly the same as the adding operation, except that the dials are turned in the opposite direction, and the lower or subtracting index 13 is used as the guide instead of the top or adding index. The transfers are made automatically and as the sum, or as the remainder, requires, and when the last numeral has been put into the device by the movement of a dial, the total, or the remainder, is shown at once in the sight opening 16.

If it is desired so to do, the column of numbers can be added on the machine in the same manner that they are added mentally, that is, by adding the units column first, the tens column next and the hundredths column next, and so on and whenever ten is reached in any column, the transfer is made. For example, commencing at the bottom, or at the top, of a column of figures, all of the numerals of the units column can be put into the machine by manipulating the units dial. After all of the units column has been put into the machine, all of the tens column is put into the machine without regard to carrying any amount from the units column. When the tens column is all put into the machine by manipulating the tens dial, then the hundredths column is put into the machine by manipulating the hundredths dial in the same manner. The total will be the same as if the numbers were put into the machine as they are put into an ordinary adding machine by manipulating the keys, or as before described.

No mental work need be done other than what is required to manipulate the machine. The transfers are automatically taken care of and are accurately made at the time they occur, and the tens or hundreds, as the case may be, is carried forward mechanically during the manipulation of the machine.

I am aware that changes can be made in the embodiment here shown and described without departing from the spirit of the invention, and I do not, therefore, limit the invention to the showings made for purposes of illustration, except as I may be limited by a broad interpretation of the hereto appended claims.

I claim,—

1. In an adding and subtracting machine of the character referred to, two disk counter dials of different diameters mounted concentrically one above the other, a transfer member mounted upon the lower dial outside the periphery of the upper dial and moving therewith and adapted to be positively moved into and out of operating engagement with the peripheral edge of the upper dial for moving it therewith, and a fixed cam disk of intermediate diameter interposed between said dials and normally holding said transfer member out of engagement with said upper dial as it moves with the lower dial, said cam disk being adapted at one place to positively move said transfer member into and out of engagement with said upper dial for moving the latter a step, substantially as described.

2. In an adding machine, two counter dials of different diameters, concentrically mounted, a cam disk mounted therebetween and being of an intermediate diameter, one of said counter dials having its edges adapted to be engaged by a transfer member, a transfer member carried by the other counter dial and normally held out of engagement with said first counter dial by said cam disk, and a cam portion on said cam disk for operating said transfer member.

3. An adding and subtracting machine comprising in combination a bottom index dial and a top index dial having index characters arranged in reversed order circumferentially thereof, counter dials concentrically disposed between said index dials and movable circumferentially in both directions, pivotally mounted transfer levers carried by some of said counter dials and adapted each to engage an adjacent counter dial and move it with the dial upon which said transfer member is mounted, and cam members for rocking said pivoted transfer members into and out of transfer engagement with the adjacent counter dials, substantially as described.

Signed at Portland, Multnomah county, Oregon, this 6th day of February, 1914.

FRED W. RODOLF.

In presence of—

F. A. BULLINGTON,

R. B. FRENCH.