(Model.)

J. L. RICHARDSON.

CALCULATOR.

No. 315,553. Patented Apr. 14, 1885.

Fig. 1.

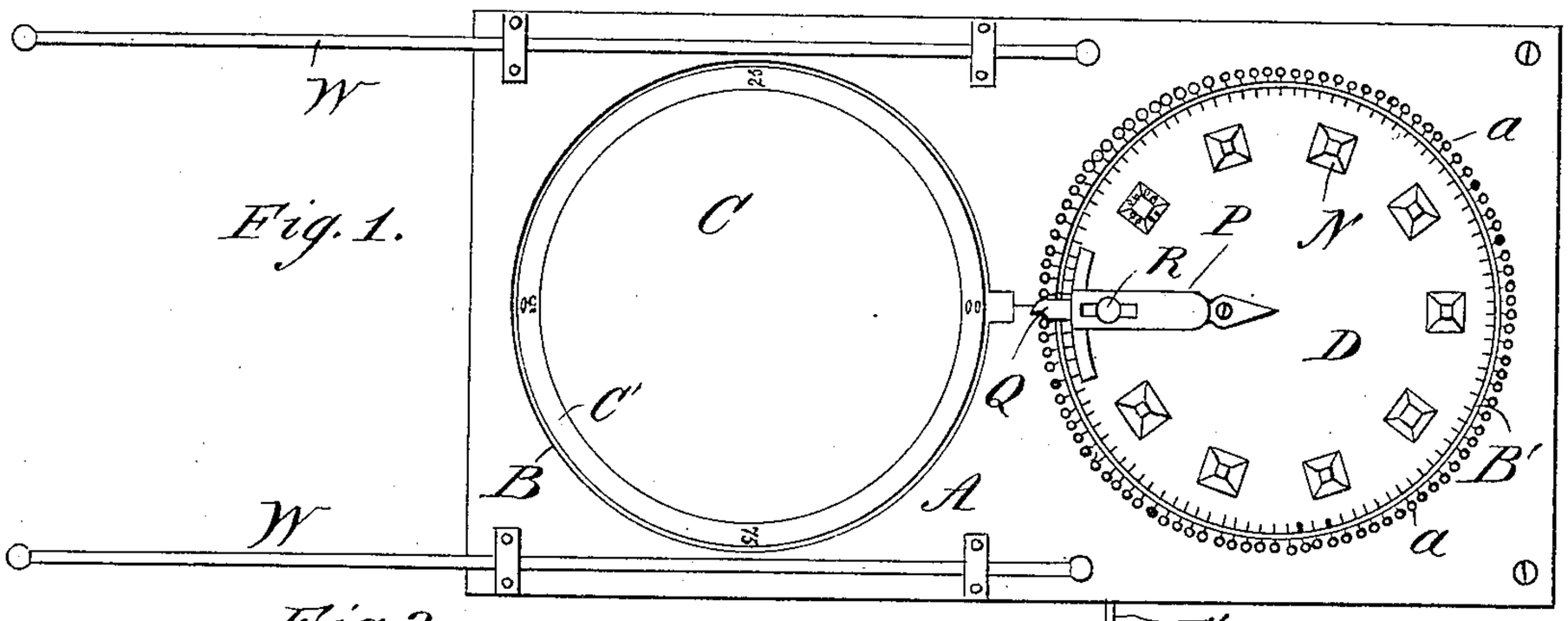


Fig. 2.

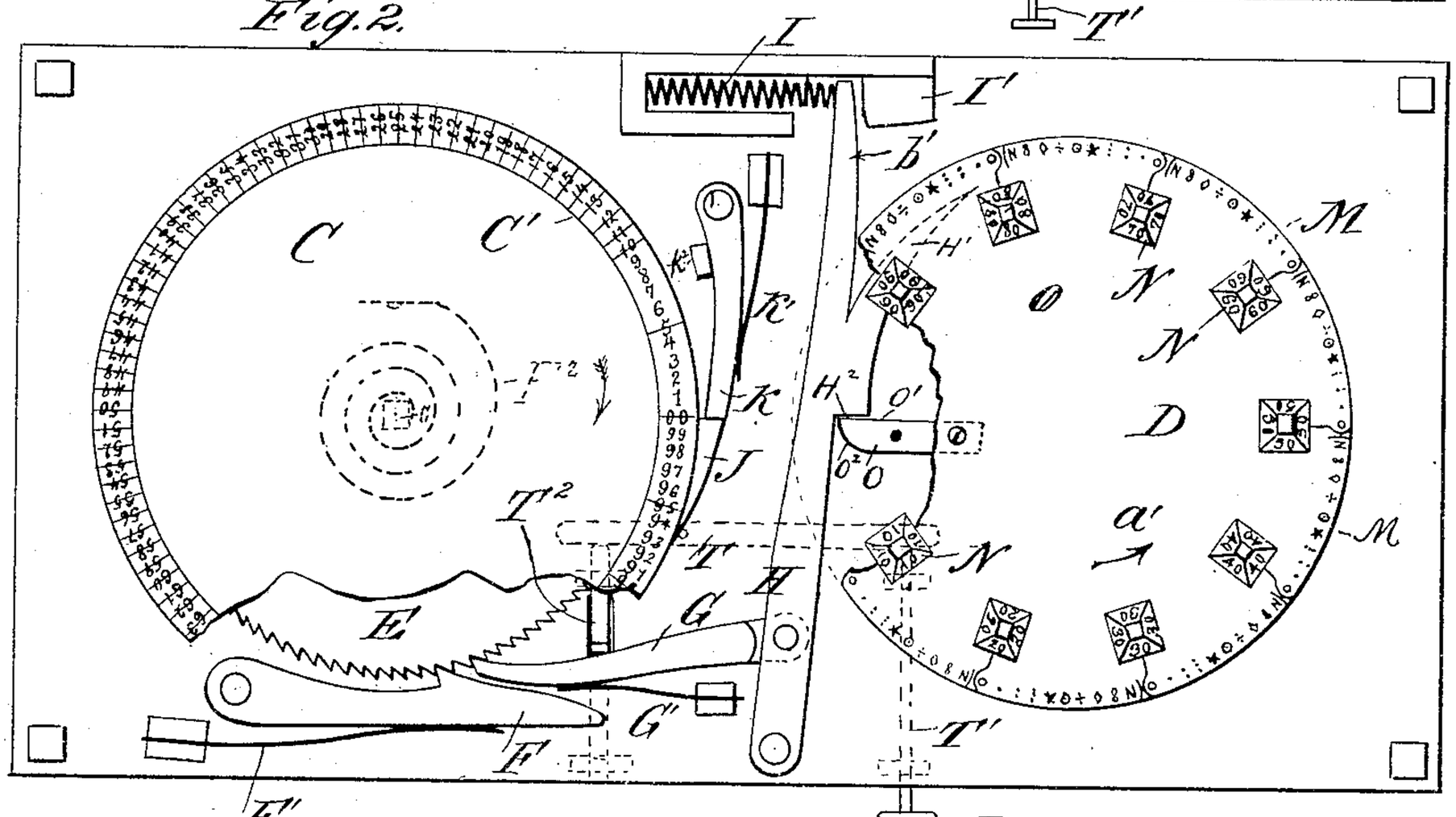


Fig. 3.

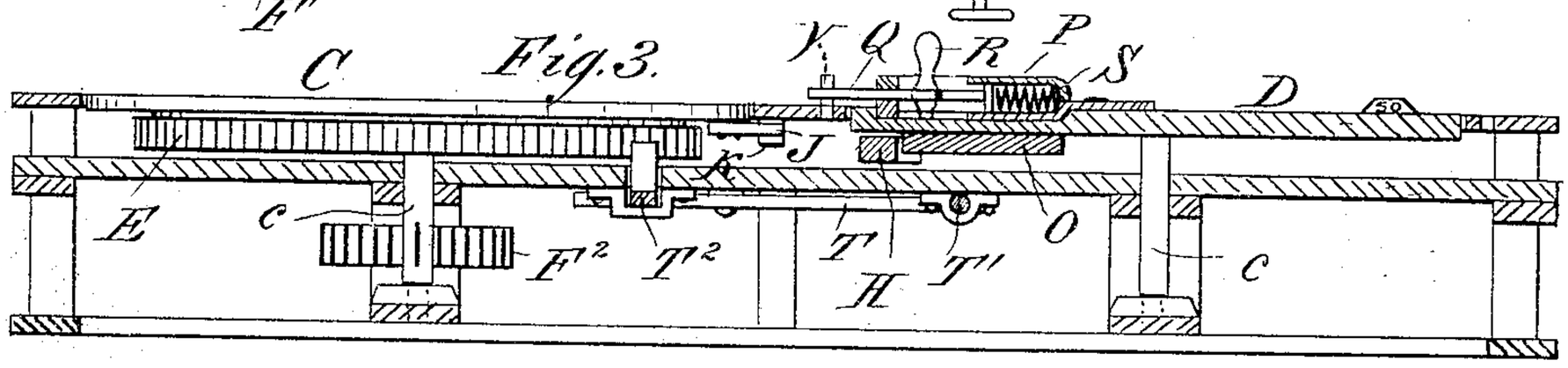
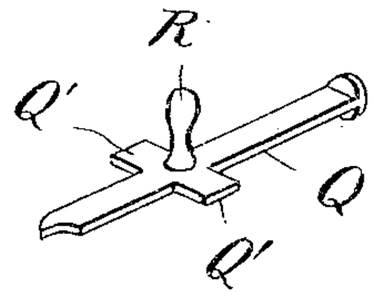


Fig. 4.



WITNESSES:

Donn Twitchell.

C. Sedgwick

INVENTOR:

J. L. Richardson

BY Munn & Co.

ATTORNEYS.

UNITED STATES PATENT OFFICE.

JOHN L. RICHARDSON, OF TUSCOLA, MICHIGAN.

CALCULATOR.

SPECIFICATION forming part of Letters Patent No. 315,553, dated April 14, 1885.

Application filed February 7, 1884. (Model.)

To all whom it may concern:

Be it known that I, JOHN L. RICHARDSON, of Tuscola, in the county of Tuscola and State of Michigan, have invented a new and Improved Adding-Machine, of which the following is a full, clear, and exact description.

The object of my invention is to provide a new and improved machine for adding numbers, which machine is very simple, gives reliable results, and can be operated very easily and rapidly.

Reference is to be had to the accompanying drawings, forming part of this specification, in which similar letters of reference indicate corresponding parts in all the figures.

Figure 1 is a plan view of my improved adding-machine. Fig. 2 is a plan view of the same, the top plate being removed and parts broken away. Fig. 3 is a longitudinal sectional elevation. Fig. 4 is a perspective view of the sliding bolt.

The top plate, A, of the machine is provided with two circular apertures, B and B′, the edge of the latter of which is divided into one hundred equal parts, a short radial line being drawn at each subdivision, and an aperture, *a*, being formed in the top plate, A, at the end of each of such short radial lines, so as to surround the edge of the aperture B′ with a ring of one hundred small apertures, *a*. In the apertures B and B′ the disks C and D are held to revolve, each disk being firmly fastened on the upper end of a central spindle, *c*, which is suitably journaled in the frame supporting the top plate, A. The disk C has an annular space, C′, formed on it along its periphery, which annular space is preferably of a light color, and divided into one hundred equal spaces by radial lines numbered consecutively with the numerals 1 to 99, inclusive, in dark color, the one hundredth radial being marked with two ciphers, 0 0.

Below the disk C, and made fast on the same spindle *c*, is a ratchet-wheel, E, with one hundred cogs, corresponding to the one hundred radial lines on disk C. A spiral spring, F^2, has one end secured to the frame of the machine, and the other end secured on the spindle *c* of disk C, for the purpose of throwing the disk C back to its starting-point when a piece of work has been finished and another is to be begun. A hook-pawl, F, engaging with the ratchet-wheel E, is pressed against the edge of the ratchet-wheel by a spring, F′, to hold what the ratchet-wheel gains by the action of the pawl G. The pawl G is pivoted to a lever, H, which lever is pivoted to the front edge of the machine-frame, and extends across, between and below the disks C D, to the opposite side of the machine-frame, the pawl G being pressed against the ratchet-wheel E by a spring, G′. On the free end of the lever H, at the back edge of the machine-frame, a spring, I, acts, which spring is held in a suitable casing. Opposite the spring I is a check-stud, I′, with which the free end of the lever H comes in contact when pressed in the direction of disk D by the spring I, and is there held in the proper position for its curved arm H′ to be acted on by the projection O, fastened to the under side of the disk D, and explained further on. On its side toward the disk D the lever H is provided with a curved arm, H′, having a shoulder, H^2, cut at a right angle with the lever H, and on a line with the end of pawl K, both the shoulder of H′ and the end of pawl K coinciding with an imaginary line from the center of disk C to the center of disk D, and constituting the starting-points of the respective disks at the beginning of every operation in adding figures, and their respective resting places when thrown backward—*i. e.*, C opposite the direction in which it is moved by lever H and pawl G, and disk D opposite the direction of its arrow *a*′. A check-block, J, having a curved outer edge, is secured to or formed on the periphery of the disk C. The end of this block J is on a line with the 0 0 (zeros) on the disk C, as shown in Fig. 2, and when the 0 0 are in alignment with the shoulder H^2 of arm H′ the pawl K will rest against the end of the check-block, which prevents the backward movement of the disk. Neither disk can go any farther than its resting place in its back direction, just explained; but either can make a complete revolution in its forward or opposite direction. The curved outer edge of check-block J, when the disk C has nearly completed its revolution in the forward direction, comes in contact with the pawl K and crowds it outward against the spring K′ until said check-block J passes the

end of pawl K, when said pawl K flies back to its place. The backward movement of the disk D, above referred to, is prevented by the shoulder H^2 and a projection, O, to be hereinafter described.

How the disk D makes a complete revolution will be seen in the following explanation: A projection, O, having a straight edge, O′, and beveled at O^2, is so fastened to the under side of disk D that the straight edge O′ coincides with the one-hundredth radial line of disk D, (as indicated by its dial,) while its outer end extends just far enough outward to allow the edge aforesaid to fit against the shoulder H^2 of curved arm H′ when the disk D is turned backward, thus stopping the disk when its one-hundredth radial line or zero-point is in line with the resting or starting point of the disk C, explained above. When the disk D is revolved in its forward direction, (direction of arrow *a*′,) the outer beveled end, O^2, of this projection O comes in contact with the extreme end of curved arm H′, sliding along its curved edge, and pressing said arm gradually toward disk C, impelling lever H and pawl G just far enough toward the ratchet E to move it the space of one tooth at the moment the projection or cam O passes the point of the shoulder H^2 of curved arm H′, at which moment, being relieved the from pressure of the cam O, lever H is instantly thrown back by the spring I against the check-stud I′, where it remains until again moved by the projection or cam O. At the same moment the locking-pawl F secures what may be gained by the ratchet-wheel E, and the pawl G, following the lever H, drops back one tooth. The disk C is thus moved the distance of one of its radial spaces by each revolution of the disk D from its starting-point. The disk C is provided with a check-block, J, mentioned above, which check is firmly fastened to the under side of its circumference. One end of this check J projects outwardly beyond the circumference of the disk, to come in direct contact with the end of the pawl K when the disk C is revolved backward, thus preventing further movement of the disk C in that direction. The projecting end of this check is on a line with the one hundredth radial line 0 0 of disk C. The pawl K is held in place by a spring, K′, against a block, K^2, on its opposite side, and its function is simply to stop and hold disk C at its starting-point, as when its ratchet E is being freed from the pawls F and G it is driven backward by the spring F^2, which has been wound by the forward movement of said disk C. A lever, T, is pivoted on the under side of the center plate, to one end of which lever is pivoted a pin or bar, T^2, and connected with or bearing against the other end of the lever T is a push-pin, T′. By pressing the push-pin T′ inwardly the pin T^2 is forced against the pawl G, the pawl G against the pawl F, removing them from the ratchet E, which being thus set free the disk C is immediately thrown back to its starting-point by spring F^2, and when the pawls F and G are relieved from the pressure of the lever T they drop into the ratchet again by force of their respective springs G′ and E′.

A check-pin, V, is used in operating the machine. (See Fig. 3.) Its purpose is to bring the one hundredth radial line of disk D (its zero) into coincidence with the short radial line of any desired aperture *a*. This is done by setting the check-pin in such aperture *a* and turning the disk D by its knob R until the curved point of its bolt Q, to be presently described, comes in contact with the check-pin, and the disk is thereby stopped.

Permanently secured to the top of disk D, directly over and coincident with its one hundredth radial line, is a bolt, Q, with curved point to fit against the check-pin V. The point of this bolt, when the bolt is in its normal position, projects far enough beyond the periphery of disk D to contact with the check-pin V, when the pin is set in one of the apertures *a* and the disk put in motion; but the bolt Q is so arranged on the disk with a spring, S, against its inner end that by pressing inwardly toward the center of the disk on the upright knob R of the bolt the point of the bolt will be drawn back within the periphery of the disk, so as to pass the check-pin without coming in contact with it, while the pin stands in any aperture *a*, if desired; and the pressure being withdrawn from the knob the bolt will be thrown out again to its normal position by its spring S. This bolt Q cannot be moved laterally on the disk from its radial line. It is preferably confined on the disx D by means of a casing, P, and has side lugs, Q′, to prevent its rocking when the hand is pressing on the knob, and to prevent the spring S pushing the bolt too far outward. Two sliding-bars, W, are held on the upper surface of the top plate, A, or frame of machine, which bars can be made to project from one end thereof, to serve as a book-rest on which to lay books or papers containing the figures to be added. The outer edge of disk D is divided into one hundred equal spaces by one hundred short radial lines, which lines, by turning disk D, may be made to coincide with those of the top plate, A. Its outer edge is also divided into ten equal compartments or sections, M, to constitute a dial. The first of these sections begins at the one hundredth radial line of disk D at the bolt Q, and extends to the ninth radial, counting in the direction of the arrow *a*′; the second section begins at the tenth radial and ends at the nineteenth; the third at the twentieth radial, ending at the twenty-ninth; the fourth beginning at the thirtieth radial and ending at the thirty-ninth; and so on, the remaining sections beginning, respectively, at the fortieth, fiftieth, sixtieth, seventieth, eightieth, and nintieth, and ending at the forty-ninth, fifty-ninth, sixty-ninth, seventy-ninth, eighty-ninth, and ninety-ninth radial lines, leaving the whole or a part of one radial space between each of said sections, so that they are

isolated as respects each other. These sections may be marked on the disk, or made of other material and superimposed thereon. Short radial lines are marked on these sections coinciding with those of the disk, which lines are numbered on the respective sections M from 0 to 9 by means of characters intended to represent the figures 0 1 2 3 4 5 6 7 8 9 on the first section; on the second and each succeeding sections the 0, which is indicated on the dial by a small projection, is intended to represent the number of the radial line at the beginning of the section on which it stands, which number is also shown in large figures on the large projections N, the other characters on the section representing the digits belonging to such large number.

The characters used are as follows, viz: one dot for the digit 1, two dots for the digit 2, three dots for the digit 3, star for 4, circle with a dot in it for 5, sign of division for 6, diamond for 7, digit eight for 8, capital N for 9.

Looking at the disk D, in whatever position it may stand, if we wish to set the check-pin V in the forty-seventh aperture from the bolt Q, (zero-point,) we readily see the sections by the large figures 40 on the projection N. We then set the pin in the apertures opposite the diamond mark, (7,) and so on for any number wanted. The object of using these characters in place of digits or other numerals is to avoid the difficulty experienced in reading inverted figures quickly, and to avoid the liability to mistake the figure 6 for 9 and 9 for 6 when inverted, as constantly happens in the revolutions of the disk. These characters are readily recognized, and are not liable to be mistaken one for another, whether inverted or partly so. The object of these sections is to more quickly limit the eye to the spot in which the digit wanted is to be found, thus preventing mistakes, it being found in practice that the operator in rapid work is liable to mistake 75 for 85 on a continuous dial, the two 5's mentioned being equidistant from 80 on either side and changing hands relatively as the disk turns around. On each of nine of these sections, beginning with the second, is a conical or pyramidal projection, preferably pyramidal and truncated, on the inclined sides of which is marked or printed in conspicuous figures the number of the radial line at the beginning of such sections, counting as before explained.

The object of marking the sections by means of these projections is twofold: first, the figures thereon are more conspicuous than they would be on a horizontal surface; second, they are not seen inverted in the revolution of the disk, as they would be if printed on the horizontal surface of the disk, and one side of such projection showing its numbers is always plainly visible to the operator, whatever may be the position of the disk. The first section needs no projection, being next to the bolt Q it is readily recognized by its position. These projections are found to be very useful in expediting the work of adding and in diminishing the liability to mistakes, for the reason above given.

Explanation of operation: In explaining the operation of the machine it should be understood that the operator sits at the side of the machine, preferably with the disk D on his right hand; that his book or paper, with the figures to be added, lies before him on the book-rest and over the disk C; that he follows the column with the index-finger of the left hand as a marker, setting the check-pin V and revolving the disk D with the right hand, and that a permanent mark, X, is made on the top plate coinciding with the 0 0, or zero-point of disk C, when that disk is at its starting-point, which mark indicates the result on disk C when the operation is completed; that disk D moves in the direction of its arrow a' continually while adding, never being turned in the opposite or backward direction until the addition of the columns being added is done. Suppose, for example, these figures—viz., $\frac{2174}{8916}$ are to be added, the disks are first brought to their starting-points, if not already there, disk D by its knob R and disk C by pressing the push-pin T'. The units and tens are taken first. In the present example the check-pin is pressed into the sixty-first aperture a from the starting-point of disk D, in the direction of the arrow a', the sectional dial showing the desired aperture at a glance; the pin is left in this aperture and the disk D turned by its knob R until the point of the bolt Q strikes the check-pin. The zero-point of disk D is now at the sixty-first aperture from the starting-point, and is left in this position, while the check-pin is withdrawn from the sixty-first aperture and inserted in the aperature a, which is in line with 74 on the dial, being seventy-four apertures from the zero-point of the disk, which zero-point stands at sixty-first from the starting-point; then the bolt is again brought to the check-pin, as before, and thus the seventy-four are added. Observe that the moment the zero-point of disk D passed the one hundredth aperture—its starting-point—the projection O passed the shoulder H^2 of the curved arm H', and disk C at the same moment had been moved one radial space of its dial, leaving the figure 1 against the mark on the top plate, but the disk D continued on to reach the check-pin where last set, as above described. It is now seen from the disk C that there are one hundred in the numbers just added; but there are more, and to find how many more the check-pin is left in the same place and the disk D thrown back to its starting-point, when, looking at the dial of D, the check-pin V will be found to stand in the thirty-fifth aperture a from the starting-point of the disk, and this shows the amount over one hundred in the numbers added, $61 + 74 = 135$. The amount of an operation is thus taken from both dials when

it is more or less than even hundreds. When less than one hundred, from the disk D.

In the operation just explained it will be noticed that the disk D represented units and C hundreds.

In adding the remaining figures of the example the disk D is to represent hundreds and C the hundreds of these hundreds. In other words, if the example were in dollars and cents, D represents cents and C dollars in the operation just explained; but in adding the remaining figures of the example D is to represent a dollar and C a hundred dollars by each radial line. The disks being again set at their starting-point the 100 or dollars already obtained on the disk C is transferred to the disk D by setting the check-pin in the first aperture, *a*, from starting-point of disk D and bringing the bolt Q to the pin. This dollar is now carried in with the dollars yet to be added. This is the carrying process in all operations. The 35 from disk D being set down in its appropriate place, thus $\begin{array}{r} 2174 \\ 8961 \\ \hline 35 \end{array}$ the 89 and 21 are added by a similar operation as were 61 and 74. The result on C will be 1, now $100, and the result on D when turned back will be 11—*i. e.*, $11.00, total of last operation $111.00; total of both, $111.35. Sums may be added one column at a time—*i. e.*, units first, then tens, and so on, if desired, on the principle explained for two columns, with one exception—viz., in carrying for single columns the result of both disks must be taken and the last figure of that result set down under the column added, and the other figure of the result carried, as above explained—*e. g.*, suppose the result of the units-column, as shown by both disk, is 197, the seven is set down under the column and the 19 carried. These being of the same order as the tens-column next to be added, are thus carried into it. In this manner, whether adding one or two columns, we proceed from right to left with any number of columns, obtaining a correct total of all the columns.

In the operation for adding two columns—*i. e.*, units and tens, &c.—explained above, it appears that the check-pin V must be set twice and the disk D turned to it twice to add $\begin{array}{r} 75 \\ 75. \end{array}$ It is apparent to the accountant at a glance, whenever he meets with these figure in a column which he is adding, that they make one hundred and fifty. If, therefore, the one hundred and fifty can be added at one setting of the check-pin and one uninterrupted turning of the disk, the addition is expedited. By means of the sliding property of bolt Q this can be done—*e. g.*, set the check-pin in the fiftieth aperature *a* from the point of the bolt, (zero-point,) seize the knob R, pressing the bolt Q back against its spring S, turning the disk at the same time. The point of the bolt, now drawn back toward the periphery of the disk I, passes the check-pin V without striking it. When being relieved from pressure, it is thrown out to its normal position by spring S, and when it again reaches the check-pin V it comes in contact with it and stops the disk. It will be seen that in this operation the disk D made one and a half revolution from the point from which it started, equivalent to adding one hundred and fifty. The same operation can be performed with two or more numbers, the amount of which is apparent from inspection, with great expedition and ease. Suppose the operator meets with these numbers, viz: $\begin{array}{r} 90 \\ 90 \\ 90 \\ 90 \\ \hline 360 \end{array}$ He simply sets the check-pin at the sixtieth aperture from the bolt, and passing it three times stops at it in the last whirl or turn of the disk, and it is added because three revolutions and sixty one-hundredths of a revolution have been made.

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

1. In an adding-machine, the combination, with the disks C D, of the projection O, the lever H, the pawl G, pivoted on the lever H and adapted to act on the disk C, and of the top plate provided with apertures around the disk D, substantially as herein shown and described.

2. In an adding-machine, the combination, with a top plate provided with two circular apertures, B and B′, of which the latter is surrounded by one hundred small apertures, *a*, of the disks C D, divided into one hundred parts, the ratchet-wheel E, connected with the disk C, and provided with one hundred teeth, the lever H, adapted to be operated from the disk D, the pawl G, pivoted on the lever H and adapted to act on the ratchet-wheel E, and of the locking-pawl F, acting on the ratchet-wheel E, substantially as herein shown and described.

3. In an adding-machine, the combination, with the top plate, A, provided with two apertures, B B′, of which the latter is surrounded by one hundred small apertures, *a*, of the disks C D, each divided into one hundred parts, the projection O on the disk D, the lever H, the pawl G, pivoted to the same, the locking-pawl F, the ratchet-wheel E, united with the disk C, the spring I, acting on the lever H, and of the stop I′, substantially as herein shown and described.

4. The combination, with the disk D, provided on its face with a series of indicative characters, of the polygonal-faced projections N, secured to the disk adjacent to the said characters, and provided on their faces with characters indicative of the order of the characters to which they are adjacent on the disk, substantially as set forth.

5. In an adding-machine, the apertured top

plate provided with a series of apertures, *a*, around the aperture, a disk, D, within said aperture, provided with a series of indicative characters corresponding in number with the apertures *a*, and a series of polygonal-faced projections on said disk, and characters on said faces indicative of the order of those on the disk D adjoining said projections.

6. In an adding-machine, the combination, with the top plate having a circular aperture around which a series of apertures, *a*, is formed, the disk D within the said circular aperture, the pin V, adapted to be inserted in the apertures *a*, sliding bolt Q, its handle R, casing P, and spring S, said bolt having one longitudinal edge in alignment with the zero character on the disk, and extending into the circle described by the series of apertures.

7. In an adding-machine, the combination, with the top plate having circular apertures B B′, the latter being surrounded by a series of apertures, *a*, of the disks C D, the former being provided with ratchet-teeth and the latter with mechanism for moving the former the space of one tooth in every revolution, spring F^2, for returning disk C to its normal position, and a lever or rod for releasing said ratchet mechanism, the check-block J on the periphery of disk C, provided with a curved outer edge and an end in alignment with the 0 0 mark of the said disk C, and the pawl K on the top plate in the path of the check-block J, sustantially as set forth.

8. In an adding-machine, the combination, with the top plate provided with the apertures B B′, of which the latter is surrounded by one hundred apertures, *a*, of means for operating the disk C from the disk D, the ratchet-wheel E, connected with the disk C, the spring F^2, connected with the disk C, the pawl G, the locking-pawl F, the pivoted lever T, the push-pin T′, and the pin T^2, for acting on the pawl G, substantially as herein shown and described.

9. In an adding-machine, the combination, with a top plate having two apertures, B and B′, of which the latter is surrounded by one hundred apertures, of the disks C and D, means for operating the former disk from the latter, which latter disk, D, is divided into ten sections, each containing the numerals from 0 to 9, inclusive, and of the truncated pyramids arranged on the disk, each pyramid having numerals produced on all four sides, substantially as herein shown and described.

JOHN L. RICHARDSON.

Witnesses:
P. B. RICHARDSON,
H. R. CARLETON.