

# W. W. HOPKINS. Calculating-Machine.

No. 203,151.

Patented April 30, 1878.

Fig. 1.

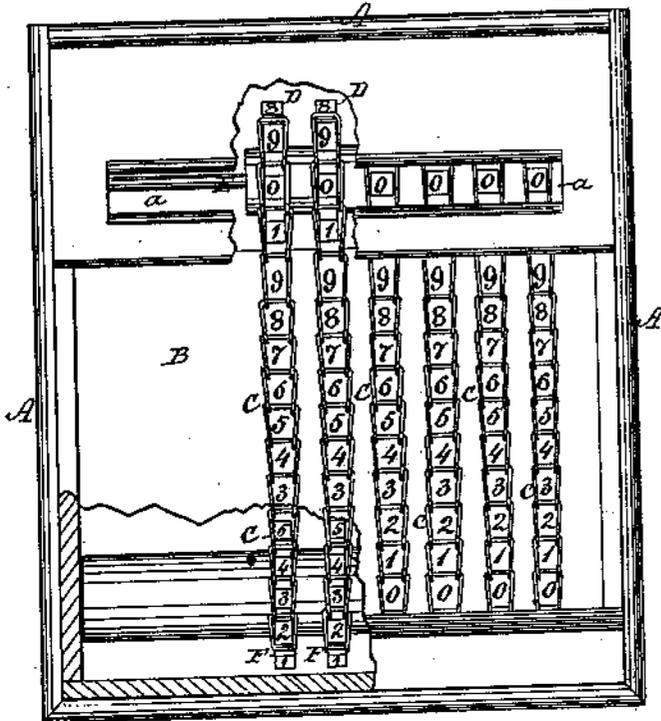
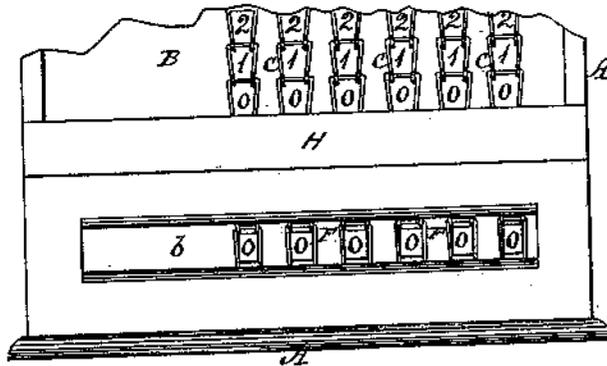


Fig. 2.



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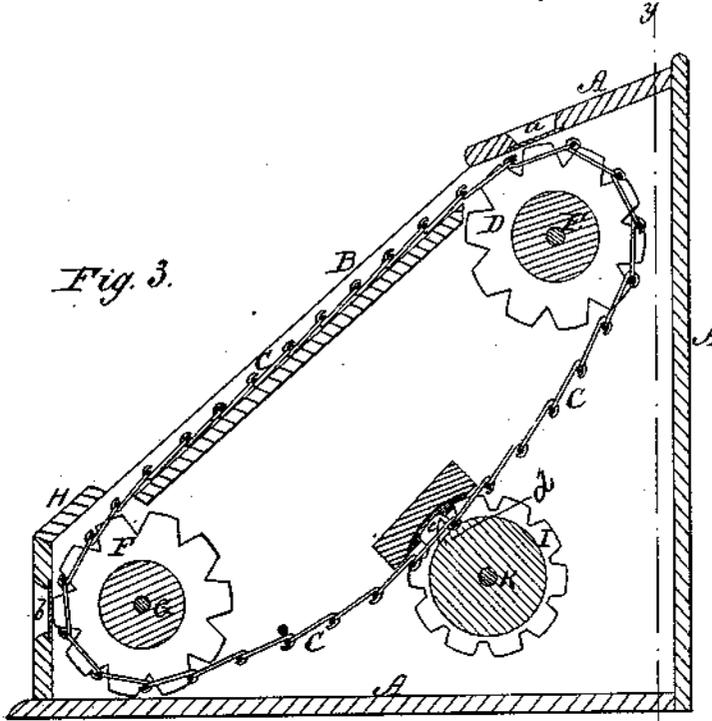


Fig. 3.

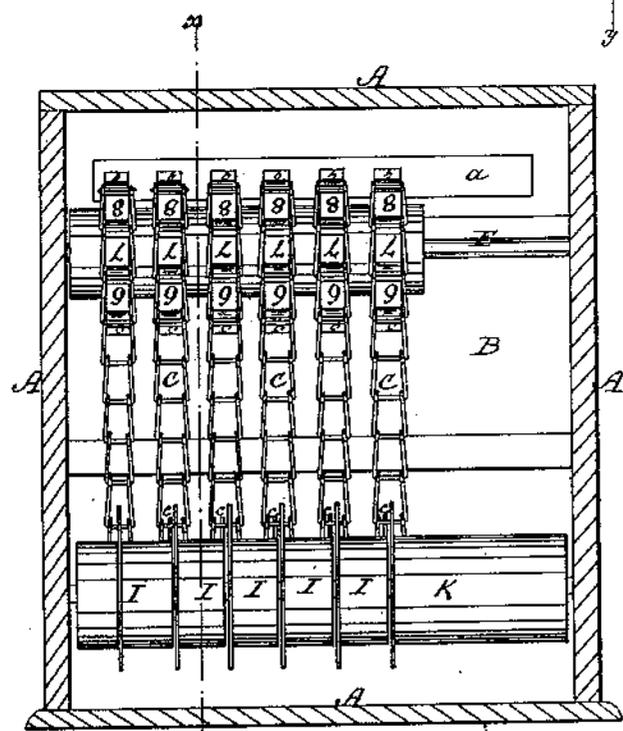


Fig. 4.

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## IMPROVEMENT IN CALCULATING-MACHINES.

Specification forming part of Letters Patent No. 203,151, dated April 30, 1878; application filed March 14, 1878.

*To all whom it may concern:*

Be it known that I, WILLIAM W. HOPKINS, of Thorntown, in the county of Boone and State of Indiana, have invented a new and Improved Calculating-Machine; and I do hereby declare that the following is a full, clear, and exact description of the same.

This invention is an improvement in the class of machines for use in adding and subtracting numbers, and in other mathematical operations.

The elements of the machine are, first, three series of notched wheels, mounted loose, and side by side, on three separate but parallel horizontal shafts, and each of the wheels on two of the shafts being inscribed on its periphery with the nine digits and the cipher (0); second, a corresponding series of endless chains having large links, and applied to the said notched wheels, so as to travel when the latter rotate, and vice versa; third, a case or box in which the wheel-shafts have their bearings, and having the nine digits and the cipher (0) inscribed in parallel rows on one of its sides, which I designate the "counting-table."

The arrangement of the aforesaid elements is such that the chains travel over the inscribed side of the box on lines coincident with the rows of digits. The several chains and rows of digits correspond to the units, hundreds, thousands, &c., columns of the figures to be added or subtracted, &c.

The machine is operated by moving the chains successively downward the length of the distance each number to be added, &c., is located on the counting-table from the front edge thereof. When each chain has been moved downward for each number to be added or subtracted, &c., the sum or other numerical answer sought can be read on the lower series of notched wheels.

In the accompanying drawing, forming part of this specification, Figure 1 is a plan top view of the machine, with part of the box or case broken away. Fig. 2 is an elevation of the front of the box. Fig. 3 is a sectional elevation, taken on line *xx* of Fig. 4. Fig. 4 is a sectional rear elevation on line *yy*, Fig. 3.

The box or case A may have various forms; but I prefer to incline the top B at an angle

of about forty degrees, to facilitate the operation of the chains C. Said top B is composed of the narrow upper part, having a transverse opening or slot, *a*, therein, and the board or table, on which are parallel rows of the nine digits and the cipher, the latter being placed at the bottom, and the digits succeeding in numerical order.

The narrow front of the box A has a transverse slot, *b*, similar to the top part. A series of notched wheels, D, is mounted loose on a shaft, E, which is parallel and contiguous to the aforesaid upper slot *a*, and a similar series of wheels, F, is similarly mounted on a shaft, G, which is parallel to the lower slot *b*. Each wheel in both upper and lower series is inscribed with the nine digits and the cipher, (0,) arranged in regular numerical order on the periphery thereof; but the order is reversed—that is to say, the digits on the wheels D of the upper series read numerically in one direction, and the digits on the wheels F of the lower series in the other direction, with reference to the table B. The endless chains C pass around the coincident wheels D and F of the parallel shafts, and the latter are so arranged at top and bottom of the inclined table B that the visible portions of the chains extend across and lie in the same plane with the latter. The chains are composed of large links, through which the figures on the counting-table are plainly visible. A stop or rest bar, H, is located at the lower edge of the table B, for a purpose hereinafter explained.

To carry ten between the units and tens column, or tens and hundreds, and so on, I employ a third series of notched wheels, I, which are mounted loose on a shaft, K, placed at a point intermediate of the shafts E and G, but parallel thereto. Each of these carrying-wheels has on one side a series of peripheral teeth, *c*, that engage with the links of its chain, and a single tooth, *d*, which projects from the other side of the wheel, and at each revolution of the latter takes into one of the links of the chain that passes around the next wheel on the right, and moves it the length of one link on the table B—that is to say, the tooth *c* of the wheel around which the units-chain

passes takes into and moves the chain, the tooth of the tens-wheel into the hundreds-chain, and so on.

By this arrangement and connection of parts the mathematical operation of carrying ten is performed automatically.

To put the machine in condition for operation, draw the chains C downward until the cipher (0) appears through the slot *a* on all the upper wheels D. Then, to add numbers, proceed as follows: Use the right-hand chain for all the figures in the units-column of numbers to be added. Then use the second chain from the right-hand side for the tens-column, the third chain for the hundreds-column, the fourth chain for thousands, and so on. The sum of the numbers added will appear on the lower series of wheels F through the slot *b*—that is to say, suppose the numbers to be added are 13 and 12; first place a hook, pencil, or other suitable instrument in that link of the right-hand chain, through which the figure 3 appears on the table B, and draw said chain down until the movement is arrested by the stop-bar E. Then place the point of the pencil or other instrument in the link of the same chain through which the figure 2 appears, and draw the chain down, as before. The sum of these numbers, to wit, 5, will then appear through the slot *b* on the first wheel F of the lower series. Next proceed in the same manner to add the tens (1 and 1) by twice drawing down the second chain the length of one link; and the sum of the tens, to wit, 2, will appear through the slot *b* on the second wheel of the series, and alongside the 5 on the first wheel, so that 25 will thus be indicated as the sum of 12 and 13.

To subtract, adjust the machine so that the minuend will appear at the upper slot, use the chains the same as in adding, place the pointer on the figures of the table which represent the subtrahend, and draw the chains down to the rest-bar. The remainder will appear at the upper slot where the minuend was.

To multiply, use the multiplicand the same as four numbers to be added. The product will appear at the lower slot.

To divide requires a different operation for each prime factor. Thus, to divide by 2 place dividend at upper slot and divide by short division, pulling the chain down the number of links the divisor is contained in the dividend. The quotient will appear where dividend was.

To count interest, multiply principle by number of days, and divide by 6 for 6 per cent., or divide by 3 for 12 per cent., &c.

In place of the chains I may employ ordinary tapes or belts of transparent material, having suitable marks to indicate spaces corresponding to the distance between the digits on the counting-table. In brief, while I prefer the chains, it is practicable to employ other devices in place of them.

My improved machine is distinguished by simplicity and cheapness of construction and convenience of operation.

What I claim is—

1. In a calculating-machine, the combination of a board or table inscribed with the nine digits, two series of wheels inscribed with the digits and the cipher, and a series of endless chains, or equivalents, passing around said wheels, in the manner described, to operate as specified.

2. In a calculating-machine, the combination of the endless chains composed of open links, as specified, the notched wheels D and F, and their parallel shafts, the inclined counting-table, and the box or case provided with slots *a* and *b*, all constructed and arranged as shown and described.

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Witnesses:

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FRANK W. MAHAN.