A. W. DAVIES.

COMPUTING MACHINE.

No. 65,883. Patented June 18, 1867.

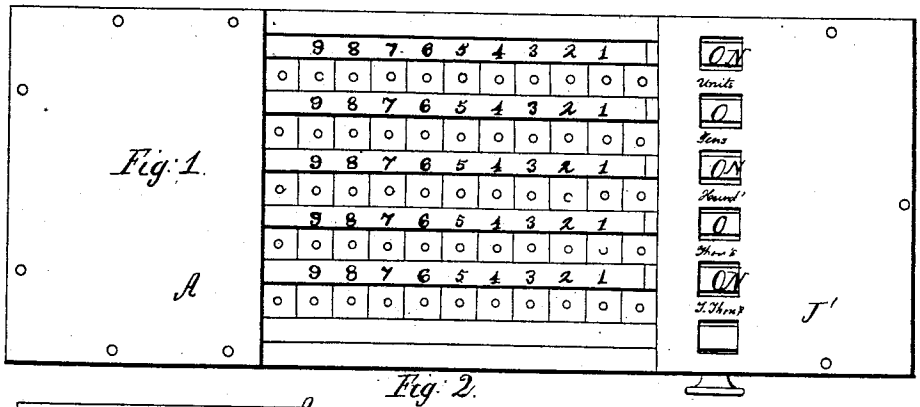


Fig. 1.

Fig. 2.

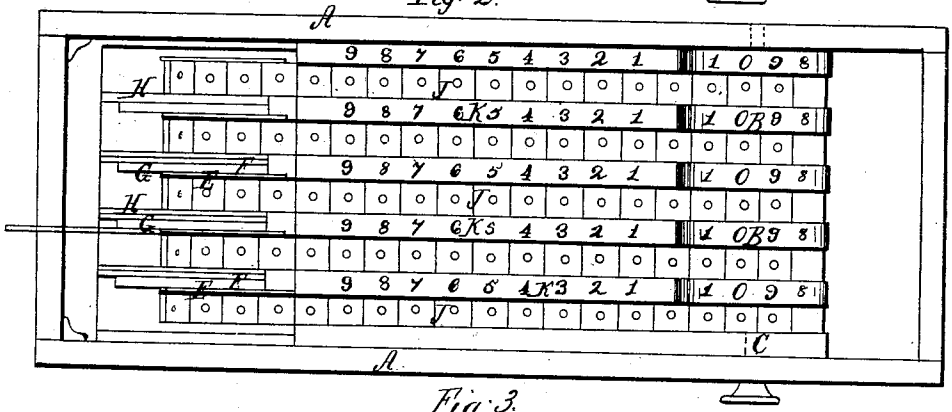


Fig. 3.

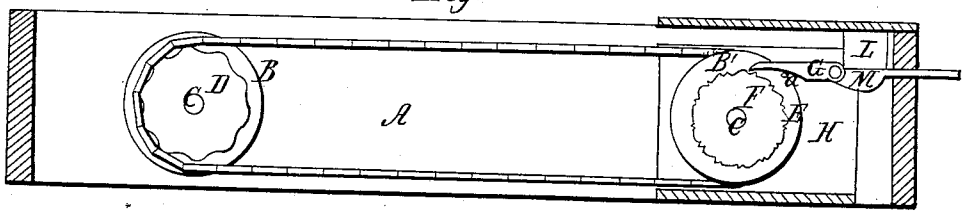


Fig. 6.

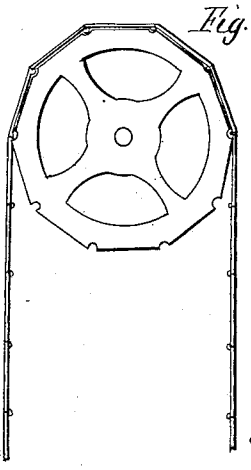


Fig. 4.

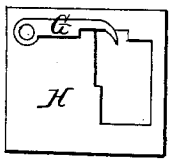
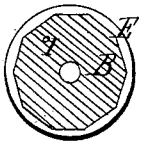


Fig. 5.



Witnesses;

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A. W. DAVIES, OF CLEVELAND, OHIO.

Letters Patent No. 65,883, *dated June* 18, 1867.

IMPROVEMENT IN COMPUTING MACHINES.

The Schedule referred to in these Letters Patent and making part of the same.

TO ALL WHOM IT MAY CONCERN:

Be it known that I, A. W. DAVIES, of Cleveland, in the county of Cuyahoga, and State of Ohio, have invented certain new and useful improvements in Computing Machines; and I do hereby declare that the following is a full and complete description of the construction and operation of the same, reference being had to the accompanying drawings, making a part of this specification, in which—

Figure 1 is a top view of the machine.

Figure 2 is a view of the top with the covers detached.

Figure 3 is a longitudinal section.

Figures 4, 5, and 6 are detached sections to which reference will be made.

Like letters of reference refer to like parts in the views.

In a case, A, fig. 1, is arranged a system of wheels, B B′, fig. 3, five at each end, in the order as represented. Wheels B are denominated the figure-wheels, and wheels B′, fig. 5, the master-wheel. These several wheels are placed upon shaft C, having their bearings in the sides of the case, and upon which shafts the wheels rotate, as will hereafter be shown. It will be seen that on the periphery of wheels B are arranged nine digits and a cipher, and to the sides of the same a shoulder or auxiliary wheel, D, fig. 3, having a corrugated periphery, whereas wheels B′ are provided with ten sides and a thin flange, E. To this flange is connected a ratchet or notched wheel, F, in which the pawls G are seen to engage. This pawl is pivoted to a cam, H, of which fig. 4 is a detached view, and when in position, as shown in fig. 2, it is given a reciprocating movement, in grooves provided for that purpose, by the pin *a*, which is made to enter the irregular opening seen in the cam, as and for a purpose hereafter shown. J are endless chains passing around the wheels B B′ and over the figure-board K, as shown in fig. 2. These chains are constructed in sections of nine links each, corresponding with the figures on the board, with an additional link of other metal as the cipher, and by which the sections are distinguished. These chains are five in number, thus corresponding with the rows of figures on the board, which are counted from the top downwards, as units, tens, hundreds, thousands, and tens of thousands, as indicated by the lettering between the opening in the right-hand section of the cover or stop-plate J′. To the dependent arm L, fig. 3, is pivoted a lever, M, one end of which is projected through the case, the other terminates in a point or nib, *a*, which is made to pass under the pawl, and by which it is disengaged from the wheel, for a purpose hereafter described.

The simple mechanical movements of the machine are as follows: On moving the chains to the right by inserting some pointed implement in the links will cause the wheels to rotate. The shape of the faces of the wheels being such as to prevent the chains from slipping over them, at the same time insists on a true and regular movement. The first or unit-wheel, in the series of master-wheels, is not furnished with a notched wheel and pawl, but with a pin only, which operates the cam with which it is associated, as the next number in the series of wheels and cams. As this wheel rotates and the pin comes around it strikes the cam and forces it forward. At the same time the pawl attached to the cam, and engaged in the notches of the wheel next in order, causes the wheel of tens and the chain of tens to move the distance of one link, and thus adds one to the number in the order and time of carrying. As the wheel continues to rotate the pin is carried around to the opposite side, and in so doing forces the cam back, by striking on the opposite side of the opening in the cam, in which the pin is at all times confined. Each cam and wheel is operated in the same way and in the same order and time that the nature of the computation may demand, the carrying of figures from column to column or from row to row.

Having thus described the construction and general movement of the machine, the special manner of manipulating the same for computing is as follows, viz: In order to set the machine for computing, the ciphers on the figure-wheels, above referred to, must appear in the openings N in the stop-plate J′, and which is done by inserting some pointed implement in the brass link in the chain of units, and moving it to the right until it reaches the edge of the stop-plate, and so on downward through the whole series of chains, as designated by the plate, thus moving each chain to the right, until the brass links which stand for ciphers in the order of rotation range along the front edge of the plate, as shown in fig. 1, and which figure shows the machine ready for practical exercises.

For the first example, please take 1, 8, 6, 9, of the figure-board of units to add together. Insert a peg in

the link 1 of the chain of units and move it to the right—the figure 1 will appear in the opening; next insert the peg in the figure 8 in the chain, and 9 will appear in the opening; next in 6 of the chain, now the chains of tens will move at the same time carrying 1, which will be seen in the opening of tens, and 5 in the opening of units, making 15 as the result thus far; next insert the peg in the last figure, 9, moving it to the right as before. In this move another figure will be carried, changing the 1 to 2 in the opening of tens. The product of the addition will be read in the two openings as $\frac{4}{2}$=24.

Again, take the following, if you please, 438 and 706. First, bring all the ciphers to the openings, and the brass links to the stop-plate, as before, then insert the peg under figure 4 in the chain of hundreds, and move to the right, next under figure 3 in the chain of tens, and move to the right, and under figure 8 in the chain of units; the result will appear $\frac{8}{3}$ Proceed with the next amount by inserting the peg in figure 7 in the chain of hundreds, and move to the right; now the chain of thousands will advance one figure; the cipher is omitted in the chain of tens. Next insert the peg under figure 6 in the chain of units and move to the right; now the chain of tens will advance one figure. The result will be read in the openings which will be read from the bottom upward, 1144.

Proceed in the same way with any given number or numbers, observing always to bring the brass links to the plate and the ciphers to appear in the openings before commencing a new computation, keeping in mind that the chain must never be moved to the left. The lever M, above described, disengages the pawl G between the third and fourth chains, by depressing the projecting end while moving the brass links on the chain of hundreds. This obviates the necessity of going through the series of chains (when setting the machine) when the first, second, and third chains only have been used.

The peculiar advantages of this machine are, viz: The amounts to be added are conveyed to the machine in the order of rows in which they are read; hence, an addition can be done verbally. It obviates the necessity of reversing the figures, and does not require the figures in columns, although it can add by columns. The movement in operating this machine is natural and in one direction only, which insures greater accuracy. The result is always before the eye of the operator, who can see the work as it progresses. It is simple in its mechanism and operation, which insures to it certainty and reliability.

Fig. 6 represents a form of wheel and chain which can be introduced instead of the wheel and chain above described. The construction of this chain is such that the joints of which, on falling into the notches in the wheel, will prevent all possible slipping of the chain on the wheel; hence, it will be safer and more reliable than the one now used. Multiplication can be performed by this machine by simply repeating the multiplicand the number of times indicated by the multiplier. Thus, 23×24; move the ten-chain from 2 to the right, then 4 on the unit-chain; this repeat three times. Then 2 on the hundred-chain and 4 on the ten-chain, omitting the unit-chain; this repeat twice, and 552 appears in the opening—the result.

The machine may be constructed for computing fractions, board-measure, weights, &c., by having the first or unit-wheel of the series made with a corresponding number of faces, according to the fractions. Thus, in board-measure, the said unit-wheel should have twelve faces, every revolution indicating one foot; and in weights, sixteen faces, in which case every revolution indicates one pound. Other instances may be noted as carrying out the same principle of operation.

What I claim as my improvement, and desire to secure by Letters Patent, is—

1. The series of reciprocating cams H and pawls G, in combination with the ratchet-wheels F and pin *a*, arranged and operating conjointly with the endless chain J, substantially as and for the purpose set forth.

2. The lever M and pawl G, as arranged in relation to each other, and the ratchet-wheel for disengaging or breaking the connection of one chain from the other, for the purpose set forth.

3. The endless belt or chain, composed of sections corresponding to the faces or sides of the master-wheels, and so arranged as to operate conjointly with the figure-wheels, substantially as and for the purpose specified.

A. W. DAVIES.

Witnesses:

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