

No. 635,670.

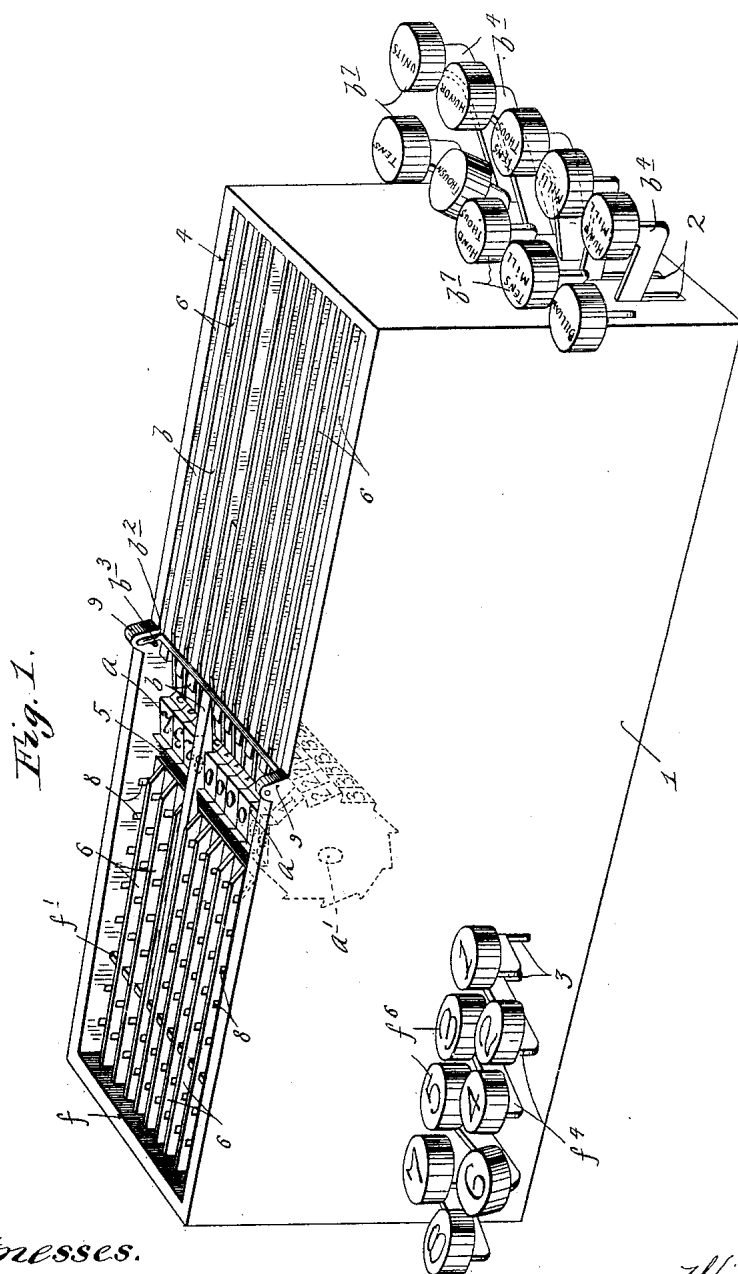
Patented Oct. 24, 1899.

W. H. DAVIS.
ADDING MACHINE.

(Application filed Apr. 1, 1898.)

(No Model.)

3 Sheets—Sheet 1.



Witnesses.

C. F. Kilgore

F.D. Merchant.

Inventor
William H. Davis.

William H. Davis,

By his Attorney,

By his Attorney,
Jas. F. Williamson.

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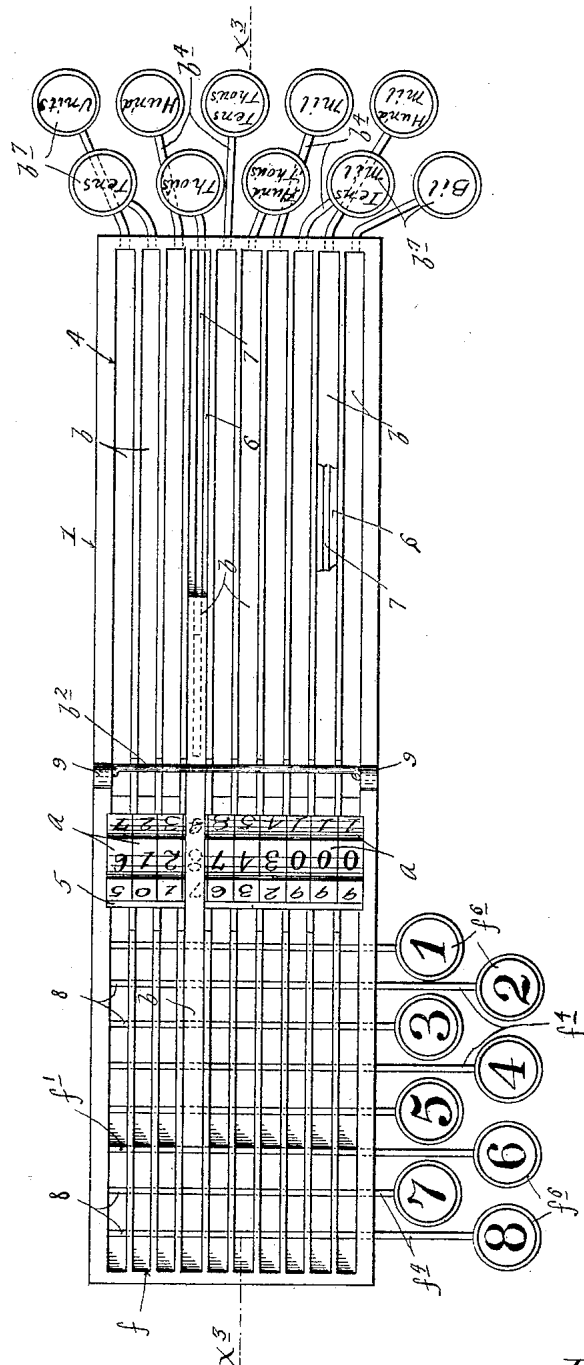
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Fig. 2.



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D. Merchant.

Inventor

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By his Attorney.

Jas. F. Williamson

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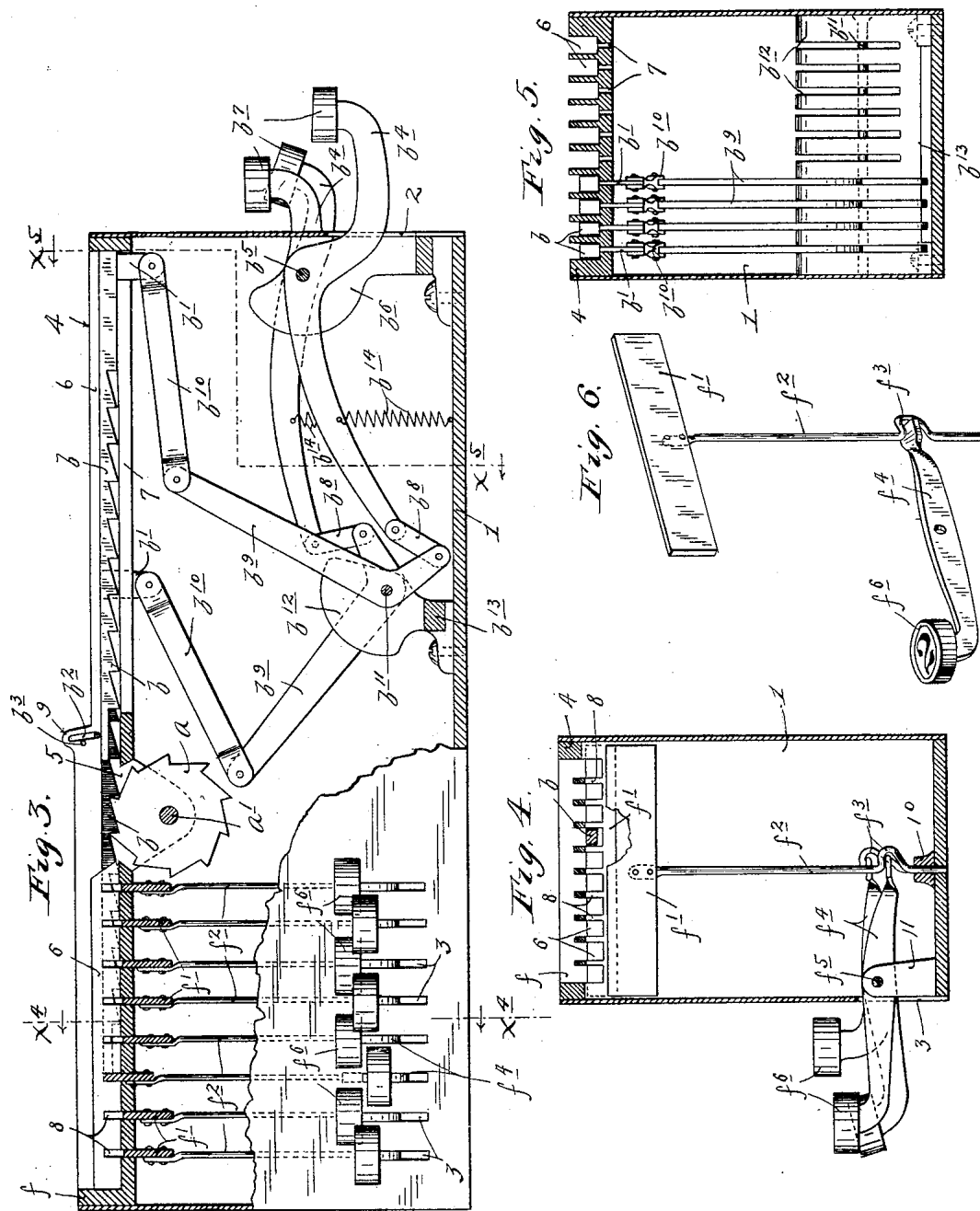
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Inventor:
William H. Davis,
By his Attorney.

Jas. F. Williamson.

UNITED STATES PATENT OFFICE.

WILLIAM H. DAVIS, OF MINNEAPOLIS, MINNESOTA.

ADDING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 635,670, dated October 24, 1899.

Application filed April 1, 1898. Serial No. 676,038. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM H. DAVIS, a citizen of the United States, residing at Minneapolis, in the county of Hennepin and State of Minnesota, have invented certain new and useful Improvements in Adding-Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to calculating-machines, and has for its primary object to provide a simple and efficient adding-machine which may be manufactured at a small cost and which may be conveniently carried from place to place.

To the ends above indicated my invention consists of the novel devices and combinations of devices hereinafter described and defined in the claims.

As introductory to the detail description which is to follow, the following brief and generic statements of the invention will be given. I employ an indicator or register which involves a series of independently-movable sections, preferably in the form of counting wheels or disks, with numerals marked on the peripheries thereof. These counting wheels or disks are moved independently, each by a differential feed device, involving, preferably, a suitable finger-operated key. The several differential feed devices are stopped or limited in their feed movements by means of a series of stops, each of which stops is common to the whole series—that is, permits like feed movements of each of the same. These stops are independently operated each by a key preferably formed with a finger-piece.

When designed as an adding-machine, the keys of the differential feed devices, considered from the right toward the left, represent units, tens, hundreds, thousands, tens of thousands, &c., and are preferably so marked, and the keys of the stop devices, which permit the number of units of movement from one to nine which the differential feed devices are to be given, represent the digits and are preferably numbered in the order indicated. In other words, the two banks of keys are arranged on the bifactored

principle, so that they coöperate to give the effect of a bank of keys of a number equal to the product of the two banks multiplied together. As is obvious, this greatly reduces the parts of the machine and simplifies the construction of the same. It also reduces the liability of errors in striking the wrong keys.

My invention in its preferred form or approximately such form is illustrated in the accompanying drawings, wherein like characters indicate like parts throughout the several views.

Figure 1 is a perspective view of the adding or calculating machine with the top plate of the same removed. Fig. 2 is a plan view of said machine, also with the top plate removed. Fig. 3 is a view, partly in left side elevation and partly in vertical longitudinal section, taken on the line $x^3 x^3$ of Fig. 2. Fig. 4 is a transverse vertical section taken on the line $x^4 x^4$ of Fig. 3. Fig. 5 is a transverse vertical section taken on the irregular line $x^5 x^5$ of Fig. 3, and Fig. 6 is a perspective view of one of the stop blades or bars and its operating-key.

The movable parts of the machine are mounted in a rectangular case 1, which is provided at one end with key-passages 2 and in one side with other key-passages 3. Near the top of this case 1 a horizontally-extended bed-plate 4 is rigidly secured. This bed-plate 4 is at its intermediate portion formed with a transverse opening 5, through which, as will presently appear, the numeral or counting wheels of the indicator are mounted to work. A series of parallel longitudinally-extended grooves or guide-channels 6 are formed in the upper face of said bed-plate 4. The forward sections of these grooves or guide-channels 6 are provided with longitudinally-extended slots 7, that cut entirely through said bed-plate, and the rear portion of the bed-plate is formed with a series of vertical transversely-extended guide-slots 8, that cut through the bottom thereof and extend some little distance upward into the runways or slots 6.

Almost any form of indicator or register may be employed. However, the indicator shown and preferred, for very important reasons, comprises a series of numeral or counting wheels or disks a , formed on their periph-

eries with ten ratchet-teeth, which teeth are marked with the digit characters "0" to "9," inclusive. These numeral-wheels *a* are mounted on a transversely-extended shaft *a'*, the ends of which are fixed in the sides of the case 1 and work through the transverse opening 5 and stand in line, one with each of the guide-channels or grooves 6. As shown, there are ten of these guide-channels 6, and hence also ten of the numeral or counting wheels *a*.

Mounted for reciprocating movements in each guideway or channel 6 is a ratchet-rack *b*, provided on its under edge with ratchet-teeth adapted for engagement with the ratchet-teeth of the coöperating numeral-wheel *a* when moved from the front toward the rear, but adapted to slip without moving said wheel when returned or moved in the reverse direction. Said racks *b* are provided with depending ears *b'*, which work downward through the slots 7. A loose retaining-bail or eccentric rod *b²*, pivoted to ears 9 on the case 1, is normally held by gravity in such position that it will prevent the racks or plungers *b* from rising out of their seats. A stop pin or projection *b³* limits the movement of said retaining-bail toward the rear. When said racks or bars *b* are moved rearward for action upon the numeral or counting wheels *a*, said bail *b²*, if engaged at all, will be forced against the stop *b³*, and will thus positively hold the said racks or bars to their work. However, under the return stroke of said racks or bars the retaining-bail *b²* will be engaged and carried away from its stop *b³*, thus permitting the said racks or bars to rise and pass freely over the teeth of said wheels *a* without causing movement of the same.

Each feed rack or bar *b* is moved from an independent key-lever through suitable connections. These keys *b⁴* are in the form of levers pivoted on a transverse rod *b⁵* and working between spacing-segments *b⁶*, secured to the forward end of the case 1. The forward ends of said keys *b⁴* project forward and outward through the key-passages 2 and are provided with finger-pieces *b⁷* at their outer ends. These finger-pieces of the keys *b⁴*, which are to actuate the numeral or counting wheels *a*, considered from right toward the left or from the lowest to the highest decimal order, are marked, respectively, "units," "tens," "hundreds," "thousands," "tens of thousands," "hundreds of thousands," "millions," "tens of millions," "hundreds of millions," "billions." The inner ends of the keys *b⁴* are connected by short links *b⁸*, each to one arm of a bell-crank *b⁹*, the upper arm of which is connected by a link *b¹⁰* to the depending lug *b⁷* of the corresponding feed rack or bar *b*. The bell-cranks *b⁹* are pivoted on a pivot-rod *b¹¹* and work between the segmental webs *b¹²* of a bearing-bracket *b¹³*, which is secured to the bottom of the case 1. It will thus be seen that each wheel *a* of the indicator or register is adapted to be variably moved by an independent dif-

ferential feed device. The arrangement is such that if any one of the said keys *b⁴* is depressed to its limit, so as to throw the rear end of the corresponding feed rack or bar against the fixed stop or transversely-extended flange *f* at the rear end of the case 1, the corresponding numeral-wheel *a* will be given nine units of movement, or, in other words, will be given nine-tenths of a complete rotation.

Mounted for vertical movements, one within each of the transverse guide-slots 8, is a series of transversely-extended stop blades or bars *f'*. Each of these stop-blades *f'* is provided with a depending vertical stem *f²*, which is mounted for vertical movement at its lower end in a perforated guide-lug 10 on the bottom of the case 1 and is provided just above its lower end with an offset or shouldered portion *f³*. Each stop-blade *f'* is operated by an independent key *f⁴*, pivoted on a rod *f⁵*, held in lugs 11, projecting from the bottom of the case 1. These keys *f⁴* work through the key-passages 3, and the inner ends of each engage with a coöperating shoulder or offset *f³* of one of the rods *f²*. The outer ends of these keys *f⁴* are provided with finger-pieces *f⁶*, which are marked with the numerals "1" to "8," inclusive, in the order in which they are arranged or connected to operate the stop-blades *f'*, which are successively farther from the counting-wheels *a*. These keys are therefore designated as "digit-keys." It will be understood that no keys need be provided for the zero character or for the numeral "9," inasmuch as no movement of the numeral or counting wheels *a* is required to record zero and inasmuch as nine units of movement is permitted by the fixed stop-flange *f*.

It will of course be understood that some suitable carrying mechanism must be employed in connection with the numeral or counting wheels of the indicator or register; but as this feature does not relate to my present invention and is a matter of common knowledge I have not specifically illustrated the same.

From the foregoing it is clear that when one of the stop-blades *f'*—for example, the stop-blade which is operated by the depression of the digit-key *f⁴*, which stands for the numeral "6"—is thrown upward into the paths or guideways 6, as shown in Figs. 1 and 3, the said stop-blade becomes common to all of the feed racks or bars *b* and will permit six units of movement of any one of the said racks or bars. For example, if the digit-key, which is marked "6" and indicates that many units of movement, is depressed, as just described, then the depression of the key *b⁴*, which indicates units, will cause six units of movement of the numeral or counting wheel which records units, while, on the other hand, if the key *b⁴*, which is marked "thousands," is depressed the numeral or counting wheel which records thousands will be given six units of movement, and the sum of six thousand will

thus be added on the indicator or register. As a concrete example, suppose the sum of "259,701" is to be added or recorded on the indicator or register. This will be accomplished as follows: First, strike the two-unit digit-key and immediately thereafter strike the feed-key indicating hundreds of thousands; second, strike the digit-key indicating five units and follow by striking the feed-key indicating tens of thousands; third, without striking any of the digit-keys strike the feed-key indicating thousands; fourth, strike the digit-key indicating seven units and follow by striking the feed-key indicating hundreds; fifth, skip the feed-key indicating tens, and, sixth, strike the digit-key indicating one unit, and then follow by striking the feed-key indicating units. As is evident, to register the sum of "9,999," for example, it would only require that the feed-keys indicating thousands, hundreds, tens, and units be struck in succession without the use of any of the digit-keys. To strike any other succession of numbers—such, for example, as "666"—it would require, first, that the digit-key indicating six units be struck and held down, while the feed-keys indicating hundreds, tens, and units are struck in succession.

The stop blades or bars f' will normally be held down by the action of gravity. The differential feed racks or bars b are normally held retracted or thrown forward by any suitable spring devices—as, for example, by the springs b^{14} , connecting the inner ends of the keys b^4 to the bottom of the case 1.

From the foregoing it is thought to have been conclusively shown that by my invention I have greatly simplified the construction of calculating-machines of this general character. For example, machines capable of performing the work of which the machine above described is capable, as hitherto constructed, would necessarily involve a bank of keys of one hundred in number. In my machine above described the work of one hundred keys is accomplished by two banks, one consisting of ten keys and the other of eight keys or a total of eighteen keys. Of course the number of feed-keys may be varied at will according to the capacity of machine desired. As is evident the addition of two more feed-keys would have the same effect in increasing the capacity of my machine above described as would the addition of twenty keys to an ordinary calculating-machine involving one hundred keys.

It is thought that the liability of accidents in incorrectly striking the keys is reduced approximately in the ratio of one hundred to eighteen. It will also be understood that all of the problems in multiplication and division capable of being performed on other add-

ing-machines may also be accomplished by the use of my improved machine above described.

It will be further understood that I do not limit myself to the details of construction above set forth, but, on the contrary, that many modifications may be made within the broad scope of my invention.

What I claim, and desire to secure by Letters Patent of the United States, is as follows:

1. The combination with an indicator or counter, of differential feeding mechanism operating on the same, stop mechanism for limiting the actions of said feeding mechanism, and two banks or classes of depressible finger-keys, one bank actuating said stop mechanism, and the other actuating said feeding mechanism.

2. The combination with the ratchet-like numeral or counting wheels of the indicator or register, of the corresponding series of reciprocating ratchet-racks, the corresponding series of key-levers and connections to said racks, the series of stop blades or bars spaced apart and working transversely into and out of the paths of said racks, and the corresponding series of digit-keys, for operating said stop blades or bars, substantially as described.

3. The combination with the ratchet-like numeral or counting wheels of the indicator or register, of the corresponding series of reciprocating ratchet-racks adapted to move vertically at their free ends, key mechanism for reciprocating said racks, an eccentric stop holding said racks to their work and permitting them to rise on the return strokes, and stops for variably intercepting said racks, substantially as described.

4. The combination with the series of ratchet-like numeral or counting wheels a , of the corresponding series of reciprocating racks b and key connections for reciprocating the same, the eccentric bail b^2 and coöperating stop b^3 , and means for variably intercepting said feed-racks, said parts operating substantially as described.

5. The combination with the series of numeral or counting wheels a , of the corresponding series of reciprocating ratchet-racks b , the corresponding series of keys b^4 with connections to said racks b , the series of vertically-movable transversely-extended stop-blades f' with depending stems $f^2 f^3$, and the digit-keys f^4 for operating said stop-blades f' , substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM H. DAVIS.

Witnesses:

LILLIAN C. ELMORE,
F. D. MERCHANT.