

No. 641,363.

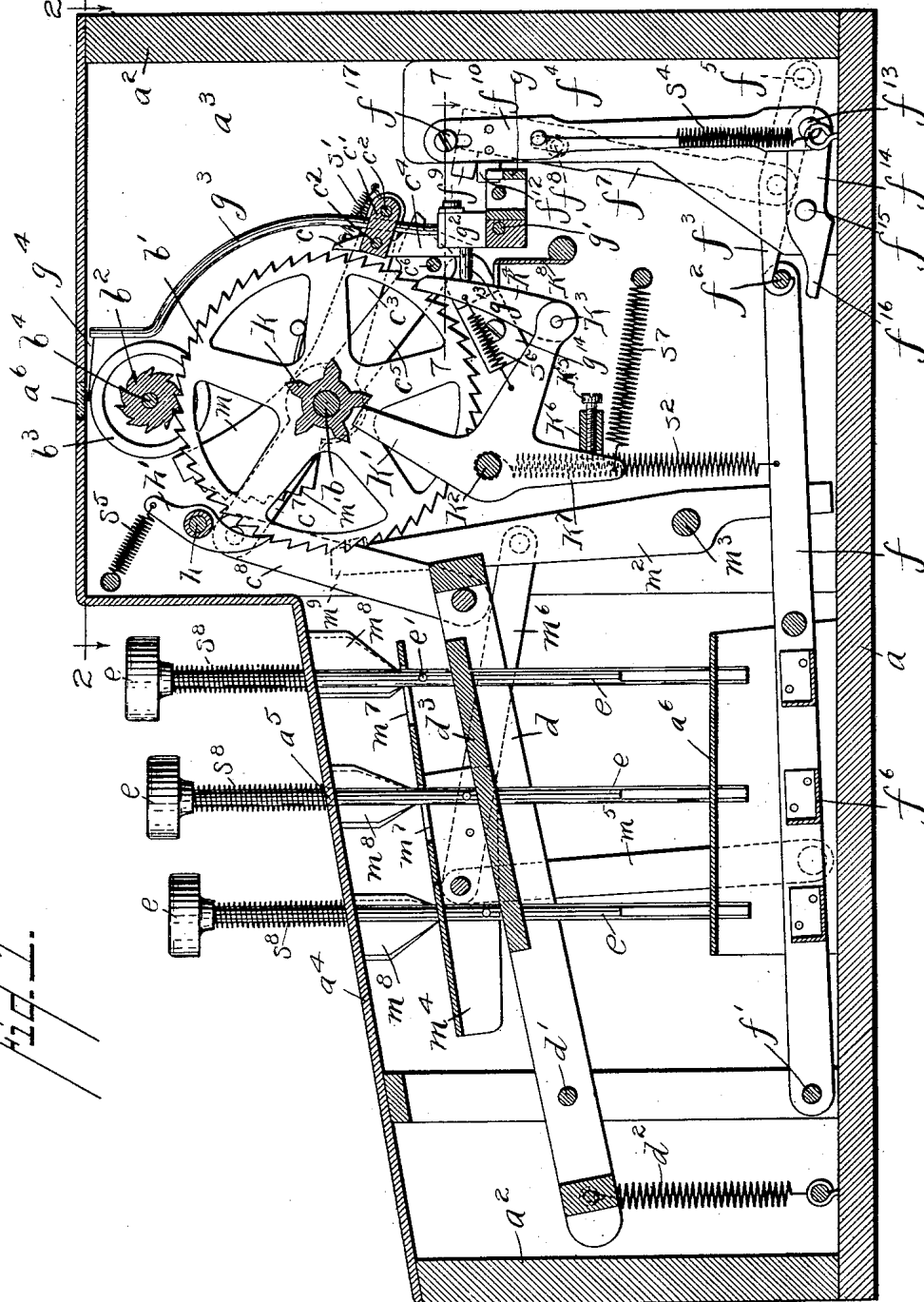
Patented Jan. 16, 1900.

J. E. BLACKER.
ADDING MACHINE.

(Application filed Dec. 1, 1898.)

(No Model.)

5 Sheets—Sheet 1.



WITNESSES.
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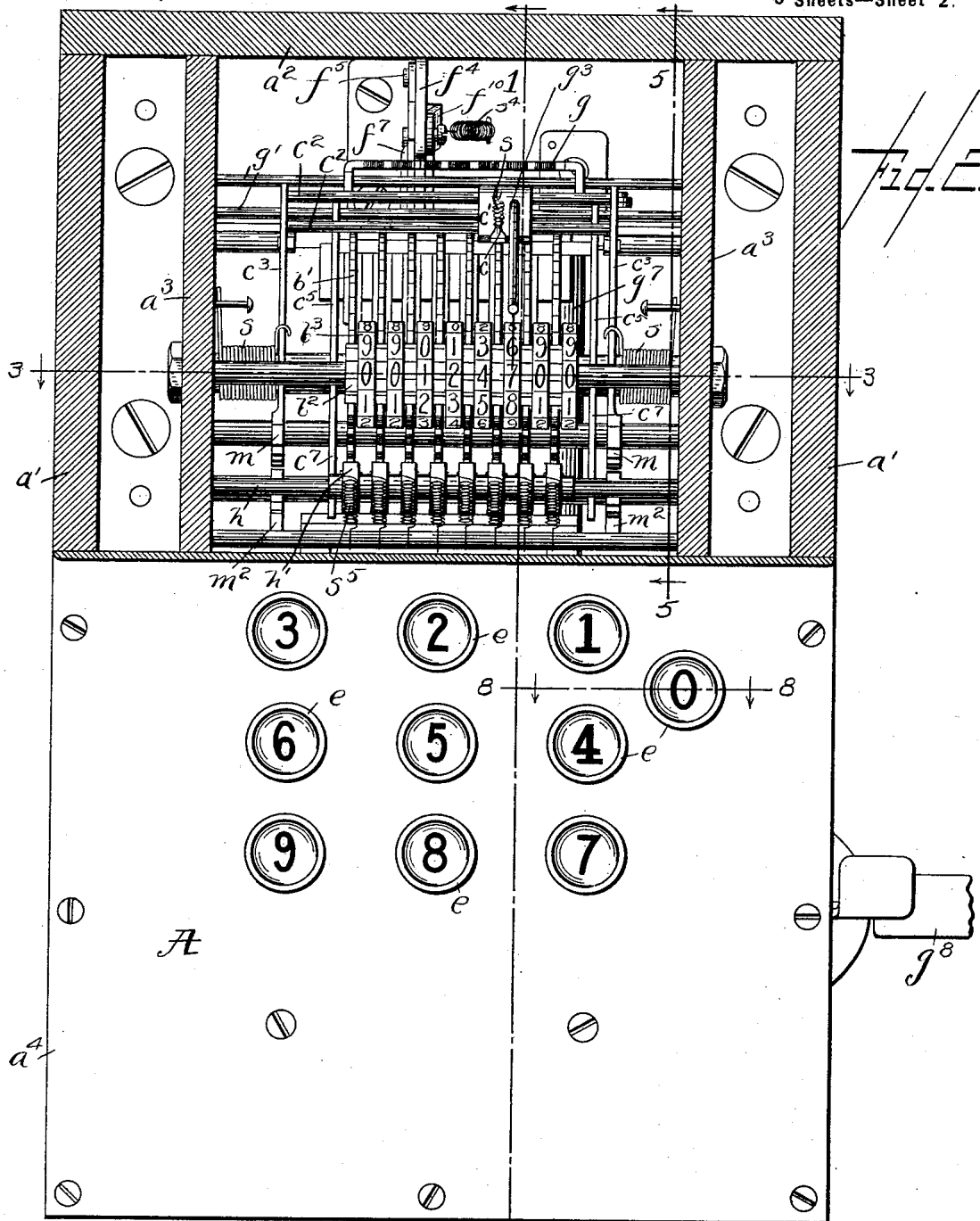
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5 Sheets—Sheet 2.



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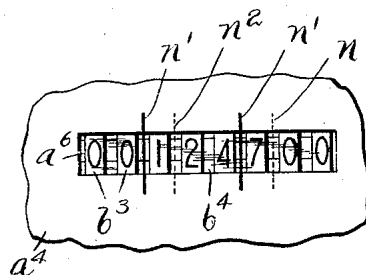
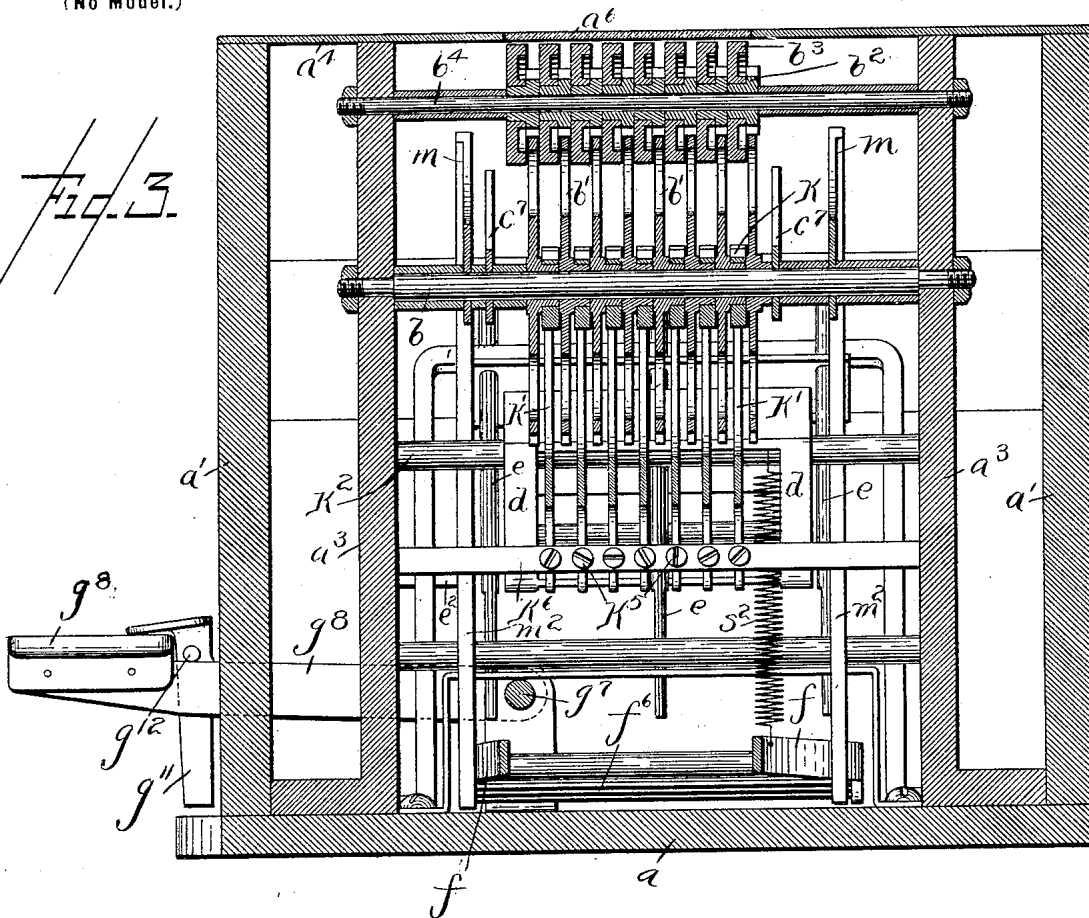
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(Application filed Dec. 1, 1898.)

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5 Sheets—Sheet 3.



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5 Sheets—Sheet 5.

Fig. 7

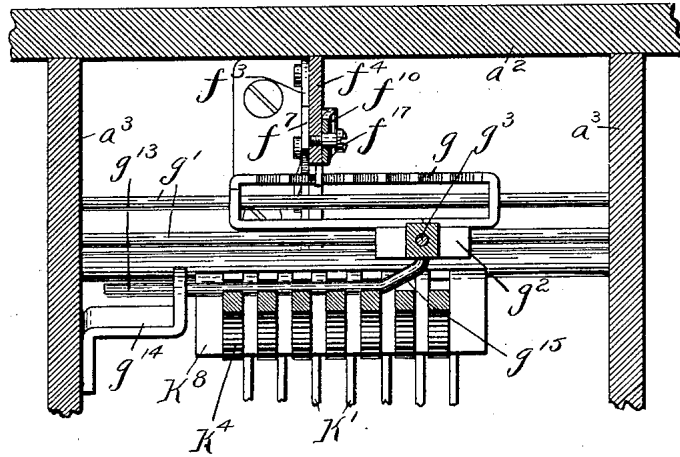
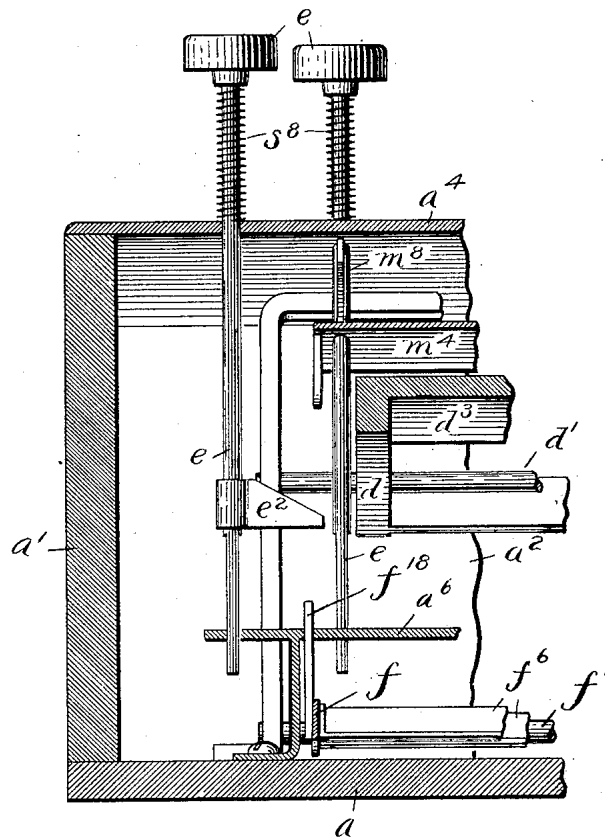


Fig. 8



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UNITED STATES PATENT OFFICE.

JAMES E. BLACKER, OF BOSTON, MASSACHUSETTS.

ADDING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 641,363, dated January 16, 1900.

Application filed December 1, 1898. Serial No. 697,966. (No model.)

To all whom it may concern:

Be it known that I, JAMES E. BLACKER, of Boston, county of Suffolk, State of Massachusetts, have invented an Improvement in Adding-Machines, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawing representing like parts.

My invention is a computing-machine for adding numbers, and has for its object the provision of a device of this kind which will add numbers of any amount by putting down successively each entire number of the series which is to be added. There have been a great many machines of this kind invented already, and I am aware that the field is not a new one; but so far as I am informed most of these machines are impractical, complicated, difficult to keep in order, and exceedingly expensive. Accordingly it has been my aim to remove these various objections and provide an instrument which is exceedingly simple, as well as accurate, and which is comparatively inexpensive and has a minimum of parts.

My improved machine employs but ten keys, corresponding to the Arabic digits. It has, moreover, a number of other valuable and novel features, among which may be mentioned the provision of a pawl apparatus which effectually locks the number-wheels against accidental movement farther than intended, a carrying mechanism which cannot carry excepting at the right time and to the right amount, a locking device or stop which positively and automatically regulates the throw of the keys, a shifting device for carrying the number-actuator to the next column, and special means for recording in the dollar-columns only, (where amounts are being added in dollars and cents, for example,) and, furthermore, the mechanism taken as an entirety is novel.

The details of the preferred construction of my invention will be pointed out in the following description, and the invention will be more particularly defined in the appended claims.

In the drawings, in which I have shown a preferred embodiment of my invention, Figure 1 is a longitudinal vertical section taken on the line 1 1, Fig. 2. Fig. 2 is a horizontal

section taken on the line 2 2, Fig. 1. Fig. 3 is a transverse vertical section on the line 3 3, Fig. 2. Fig. 4 is a broken detail, in top plan, showing the sight-aperture and ledger-lines. Fig. 5 is a broken detail, in vertical section, taken on the line 5 5, Fig. 2. Fig. 6 is a fragmentary view showing parts of the operating mechanism in rear elevation. Fig. 7 is a horizontal sectional detail inwardly from the line 7 7, Fig. 1. Fig. 8 is a vertical section taken on the line 8 8, Fig. 2.

Within a suitable cabinet or case A, comprising a base *a*, sides *a'*, ends *a''*, partitions or bearing-blocks *a'''*, and top *a''''*, is mounted a transverse shaft *b*, journaled in the blocks *a'''* and carrying a plurality of ratchet-wheels *b'*, respectively in mesh with special small ratchet-wheels *b''*, secured adjacent the counters *b'''* on a transverse shaft *b''''*, parallel to the shaft *b*, and similarly mounted in the end blocks *a'''*.

The ratchet-wheels *b'* are separately and preferably successively operated by a pawl *c*, pivoted in a block *c'*, mounted to slide freely laterally on a support, herein shown as two rods *c''* of a cradle *c'''*, normally held downward by springs *s*, Fig. 2, said pawl being pivoted within the block *c'* on the inner rod *c''* and having a depending cam portion *c''''*.

A spring *s'* is preferably provided for normally retracting the pawl *c* out of engagement with the teeth of the ratchet-wheels *b'*, and in order to positively engage the pawl with said ratchet-teeth and insure that it shall hold into said teeth and prevent the wheels being carried too far by their momentum I provide an actuator *c''''*, pivoted on the shaft *b* and projecting beneath the cradle *c'''*, said actuator having at its rear end a rod *c''''''*, extending across the machine behind all the ratchet-wheels in position to engage the cam portion *c''''* of the cam wherever the pawl may be.

The actuator *c''''* has opposite arms *c''''''*, extending forward and pivotally connected by means of links *c''''''''* to an operating-frame *d*, pivoted at *d'* to the case and normally held upward, as shown in Fig. 1, by a spring *d''*. This operating-frame carries a board or plate *d'''*, through which the operating-keys *e* pass, said keys having pins *e'* projecting laterally to engage said plate, and thereby depress the

operating-frame whenever the keys are depressed. The keys e pass through suitable perforations a^5 in the top a^4 in usual manner and through a guide-plate a^6 at their lower ends. In line with the keys e I provide a shifting frame f , pivoted at f' to the case and extending rearwardly in engagement at f^2 with a lever f^3 , pivoted thereto and at f^5 to a stationary stand f^4 . The frame f is normally held up by a spring s^2 and has boxes or ledges f^6 to receive the lower ends of the keys when the latter are depressed, so as to communicate proper motion to the shifting mechanism mounted on the stand f^4 .

At the rear of the machine a ratchet bar or plate g is mounted to slide on transverse rods g' , said ratchet-bar carrying a post g^2 , in which is fixed an upwardly-projecting arm g^3 , which passes through the pawl-block c' and is thence curved in an arc concentric to the shaft b in order that the pawl-block may freely move up and down thereon in its motions necessary for actuating the ratchet-wheels, said arm g^3 having at its free end an indicating-finger g^4 , visible through the sight-aperture a^6 , for indicating to the operator the travel of the computing mechanism. Pivotally connected with the post g^2 by a link g^5 is a crank g^6 , extending from a horizontal rock-shaft g^7 , normally held by a spring s^3 under a tendency to move the rack-bar g to the right, Fig. 6, and provided at its forward end with a shifting-lever g^8 , carrying a finger-rest, by means of which the actuating-pawl c , ratchet-plate g , and connected parts are shifted back to the units number-wheel when desired for adding a new number after having been shifted forward in adding a preceding number. At g^9 I pivot an auxiliary shifting bar or lever g^{10} , having a leg g^{11} for limiting its motion for a purpose to be described, said bar being moved upwardly with the lever g^8 by the engagement of the latter with a pin g^{12} therein.

The automatic shifting mechanism is of the escapement kind and is best shown in Figs. 1, 5, and 6, where it will be seen that on one side of the stand f^4 I mount a dog f^7 , slidably pivoted at f^8 to said stand and carrying a tooth f^9 at its upper end to be depressed in front of the teeth of the ratchet-plate g , and on the opposite side of the stand f^4 I loosely pivot a reciprocating dog f^{10} , normally held downward by a spring s^4 , said dog having a tooth f^{12} to engage the teeth of the ratchet-plate g at proper times and pivoted at its lower end at f^{13} to a trip f^{14} , pivotally mounted at f^{15} to be engaged at its front end f^{16} by the frame f , so as to lift the dog f^{10} whenever the dog f^7 is depressed thereby.

It will be observed that the forward ends of the tripping-levers f^3 f^{16} are separated sufficiently to permit the dog f^7 to be definitely depressed, so as to engage the ratchet-plate g before the dog f^{10} is actuated to disengage said plate, and also it will be noted, viewing Fig. 6, that the pin f^{17} , on which the upper

end of the dog f^{10} is pivoted, projects therefrom, so as to permit the spring s^4 to pull the upper end of said dog out, as indicated in dotted lines in Fig. 6, the result being that when said dog is thereafter depressed it will be certain to engage the teeth of the ratchet-plate g on their inclined sides, so as to produce the required step-by-step movement of the said ratchet-plate and through it of the pawl c , as desired.

On a bar h , at some suitable location, herein shown as the upper front part of the case, I mount click-pawls h' , held in engagement with the ratchet-wheels b' by springs s^5 for preventing accidental backward movement of the ratchet-wheels.

For carrying tens from one number-wheel to the next I provide a carrying mechanism, herein shown as comprising a plurality of cam projections k , one for each ratchet-wheel, to engage a tappet, shown as a bell-crank lever k' mounted on a shaft k^2 , there being one of these sets of mechanism for each ratchet-wheel b' , except the last, said bell-crank on its other arm carrying, pivoted thereto at k^3 , a pawl k^4 , held in continuous engagement with its ratchet-wheel by a spring s^6 . The bell-crank or tappet lever k' is given a carrying movement by a spring s^7 , limited in its extent of movement by an adjusting-screw k^5 , these several adjusting-screws for the several levers being mounted in a stationary cross-bar k^6 in front of the depending arms k^7 of the levers k' . A guide-plate k^8 is fixed behind the pawls k^4 to maintain them in proper alinement with the ratchet-wheels b' , and also preferably a rod g^{13} extends from the post g^2 just back of the several pawls k^4 , so as to prevent them from accidentally moving the ratchet-wheels more than one notch at a time, said rod sliding at its free end in a bracket g^{14} and being deflected at g^{15} , Fig. 7, for convenience of securing it to the post g^2 .

As herein shown, the special ratchet b^2 of each number-wheel has ten teeth and the actuating ratchet-wheel b' has fifty teeth, and it therefore follows that there are five cam projections k in order that the carrying mechanism should be operated once for every rotation of the number-wheel.

I have already emphasized the fact that I provide special mechanism in connection with the pawl c whereby the latter is caused to lock its ratchet-wheel in positive position when it has moved it forward the distance desired. As a still further precaution, however, and to guard against the possibility of the cradle c^3 being thrown by its momentum slightly farther than it should be thrown, I have extended said cradle forwardly and provided it with opposite notched ends m , whose notches m' are accurately spaced to correspond with the exact distance which the pawl should be moved for the successive numbers indicated by the keys, the notches of these ends m being brought into engagement with a stop m^2 , pivoted at m^3 and moved by a plate m^4 , car-

ried on swinging struts m^5 and connected to said stop by links m^6 . The plate m^4 is provided with a set of similar openings m^7 , one for each key, in which operate cams m^8 , carried by the keys, said cams being so positioned and shaped that as the respective keys are depressed against the action of their springs s^8 the corresponding cams will shift the plate m^4 to a further or less degree, and thereby bring either the upper end m^9 or the projecting shoulder m^{10} of the post m^2 into position beneath the particular notch m' of the plate or end m corresponding to the number of the key depressed. By reason of this feature of my invention, taken in connection with the positively held or locked pawl c , it is absolutely impossible that a number-wheel should be shifted farther than proper.

Referring to Fig. 4, in which I have shown the sight-aperture closed with glass or mica, it will be seen that I rule the latter in ledger form, so as to indicate to the operator the dollars and cents columns, preferably by a red line at n , and the thousands and millions periods by other lines n' , preferably black, and the thousands-of-dollars period by another line n^2 , which may be red or blue or have other distinguishing characteristic. This feature of my invention coöperates with the feature thereof before alluded to, and shown in Fig. 6, in which I employ an auxiliary lever g^{10} for shifting back the pawl, said lever having a leg g^{11} , which strikes the base of the machine when the index-finger g^4 has been shifted back to the units dollars-wheel, (see 7, Fig. 4,) when, for instance, it is desired only to add dollars and not add cents. It will be understood that the length of the leg g^{11} may be varied when for any reason it is desired to add other columns exclusively, as in certain forms of mathematical operations.

The zero-key, it will be observed, simply operates to depress the shifting frame, a projection f^{18} from the frame being engaged by an arm e^2 thereof for this purpose, thereby simply shifting the pawl c from one wheel to the next higher wheel.

From the above description it will be evident that my machine is positive and accurate in its operation and not complicated in its operating mechanism.

Let us suppose that it is desired to add the numbers six hundred and twenty-seven and three hundred and eighty. The operator (it being supposed that the wheels are all turned to zero) depresses the key 7, then the key 2, and then the key 6, thereby bringing the number "627" into view on the number-wheels at the sight-aperture. He then depresses the shifting-lever g^8 so as to bring the pawl c back to the first ratchet-wheel, (or if he is adding simply dollars he depresses the auxiliary lever g^{10} , so as to bring the pawl back to the third ratchet-wheel,) and then depresses in succession the keys 0, 8, and 3, the depression of the 0 key simply shifting the pawl to the left one wheel, leaving the 7 undisturbed.

The depression of the 8 key raised the pawl c a distance of eight notches, thereby turning the wheel which previously registered "2" forward, so that it registered "0" and at the same time retracting the pawl k^4 and permitting its tappet-arm k' to escape from one of the cam projections k , so that its spring s^7 could cause it to move the next higher ratchet-wheel b' forward one notch, and thereby carry the ten, changing the "6" of said next number-wheel to "7." The depression of the key 3 likewise shifted its number-wheel forward three places, and inasmuch as it had just been shifted forward one place, so as to change the previous "6" to "7," the addition of these three additional steps operated its tappet, and thereby moved the fourth or next higher number-wheel forward one notch, bringing the numeral "1" into view at the sight-opening, the result being that "1" stands to the left of the black line n' or of the red line n^2 , as the case may be, at the sight-opening, and "007" is indicated at the right of said ledger-lines. In depressing the keys their pins e' come into contact with the plate d^3 , and thereby depress the frame d and swing the rear end of the actuator c^5 up into lifting and locking engagement with the pawl c , thereby locking it into the proper ratchet-wheel b' and sliding it up on the arm g^3 , while at the same time the cam m^8 of the depressed key, having come into engagement with its slot m' , shifts the stop m^2 forward, so as to engage the proper notch m' of the cradle, and thereby prevent the pawl c being thrown too far forward. As the key nearly reaches the limit of its downward movement it engages the frame f , and thereby depresses the dog f^7 into holding engagement in front of the adjacent tooth of the ratchet-plate g , at the same time lifting the dog f^{10} out of engagement therewith and permitting its spring s^4 to pull it laterally slightly, ready to descend on the inclined side of said tooth and positively stop the next tooth of the ratchet-plate the moment that the released key permits the dog f^7 to be raised from blocking the forward movement of the ratchet-plate under the impulse of its spring s^3 . As the ratchet-plate g is shifted toward the left, Fig. 2, (or right, Fig. 6,) its arm g^3 shifts the pawl c correspondingly.

In order that I might engage the wheels b^2 directly with the ratchet-wheels b' , I have provided them with specially-formed teeth having forwardly-projecting tongue-like ends which prevent slipping, as will be evident viewing Fig. 1, although I wish it understood that I am not restricted in this respect.

It will be understood that while I have herein shown and described definite and preferred mechanism in detail my invention is not limited thereto, inasmuch as very many changes in form and arrangement and in the combinations and construction may be resorted to without departing from the spirit and scope of my invention.

Having described my invention, what I

claim, and desire to secure by Letters Patent, is—

1. In a machine of the kind described, number-wheels, means to rotate them including
5 a pawl and ratchet-wheel, operating-keys, means for positively locking said pawl and ratchet-wheel together during rotation of the latter, an independent stop cooperating with a plurality of said keys, and means for moving
10 said stop to different extents according to the place a wheel is to be stopped for positively stopping rotation of said number-wheels beyond given points, substantially as described.

2. In a machine of the kind described, a plurality of operating-keys, a plurality of number-wheels, mechanism actuated by said keys for rotating said wheels, and a single stop mechanism separate from the actuating
20 means engaging said wheels, connected with and operated by all of said keys for positively stopping rotation of said number-wheels beyond certain given points, said several keys automatically changing to different extents
25 the position of said stop mechanism for permitting a varying rotation of the number-wheels according to the key operated, substantially as described.

3. In a machine of the kind described, a plurality of operating-keys, a plurality of number-wheels, mechanism actuated by said keys for operating said wheels, and stop mechanism connected with said keys for positively
30 stopping rotation of said number-wheels beyond certain given points, cooperating cam devices operated by said keys for automatically changing the position of said stop mechanism, to change the stopping-point of movement of the number-wheels to correspond with
35 the key operated, substantially as described.

4. In a machine of the kind described, a plurality of operating-keys, a plurality of number-wheels, mechanism actuated by said keys for operating said wheels, a stop for positively
45 stopping rotation of the number-wheels beyond points desired, a slotted plate connected with and to move said stop, and cams actuated by said keys and engaging said plate, for changing the position of said stop, substantially as described.

5. In a machine of the kind described, number-wheels, ratchet-wheels operating the same, a pawl to engage the ratchet-wheels, a lever for engaging said pawl, and means for
55 operating said lever, said pawl being normally out of engagement with said ratchet-wheels, and said lever moving it into positive locking engagement therewith, to operate said number-wheels, substantially as described.

6. In a machine of the kind described, number-wheels, ratchet-wheels operating the same, a pawl to engage the ratchet-wheels, a lever for engaging said pawl, and means for operating said lever, said pawl being normally out
60 of engagement with said ratchet-wheels, and said lever moving it into positive locking en-

gagement therewith, to operate said number-wheels, and means for shifting said pawl laterally step by step from one ratchet-wheel to the next, substantially as described.

7. In a machine of the kind described, a plurality of number-wheels, a plurality of ratchet-wheels therefor, a pawl to operate said ratchet-wheels, and means to shift said pawl laterally from one ratchet-wheel to the next, said means
75 including a laterally-movable ratchet-plate, independent dogs for alternately engaging the teeth of said ratchet, and means to reciprocate said dogs, substantially as described.

8. In a machine of the kind described, a plurality of number-wheels, a plurality of ratchet-wheels therefor, a pawl to operate said ratchet-wheels, and means to shift said pawl laterally from one ratchet-wheel to the next, said means including a laterally-movable ratchet-
85 plate, independent dogs for alternately engaging the teeth of said ratchet, means to reciprocate said dogs, and means for shifting one of said dogs sidewise when out of engagement with said ratchet-plate, substantially as
90 described.

9. In a machine of the kind described, a plurality of number-wheels, a plurality of ratchet-wheels therefor, a pawl to operate said ratchet-wheels, and means to shift said pawl laterally
95 from one ratchet-wheel to the next, said means including a laterally-movable ratchet-plate, independent dogs for alternately engaging the teeth of said ratchet, and means to reciprocate said dogs, one of said dogs being loosely
100 mounted with room for lateral movement relatively to the ratchet-plate, and a spring automatically moving said dog laterally when the dog is out of engagement with the ratchet-plate, substantially as described.

10. In a machine of the kind described, a plurality of number-wheels, a plurality of ratchet-wheels for operating them, a cam projection rotating with each ratchet-wheel, a tappet to be actuated by each cam projection,
11 a pawl operated by said tappet and in engagement with the next ratchet-wheel, means for actuating said ratchet-wheels one at a time, and a sliding rod for preventing the overcarrying of any of said pawls on wheels higher
115 than the wheel being operated, substantially as described.

11. In a machine of the kind described, a plurality of counters, mechanism to actuate said counters successively, means to restore
12 or shift back said mechanism to the first counter, and auxiliary means for restoring said mechanism to another predetermined counter when desired, said auxiliary means having mechanism to stop it before said
125 actuating mechanism has been restored to its original position, substantially as described.

12. In a machine of the kind described, a plurality of counters, mechanism to actuate said counters successively, and a lever for
13 shifting said mechanism back again, said lever having means to stop it before said actu-

ating mechanism has been restored to its original position, substantially as described.

13. In a machine of the kind described, a plurality of number-wheels, a sight-opening
5 for viewing said wheels, an indicator between said sight-opening and said wheels for showing the wheel operated, means to move said indicator to the successive number-wheels as the respective wheels are operated, and station-
10 ary marks for indicating at said sight-

opening particular numerical positions, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JAMES E. BLACKER.

Witnesses:

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GEO. W. GREGORY.