(No Model.) 5 Sheets—Sheet 1.

# C. C. CLIFFORD.

## ADDING MACHINE.

No. 602,154. Patented Apr. 12, 1898.

Fig. 1

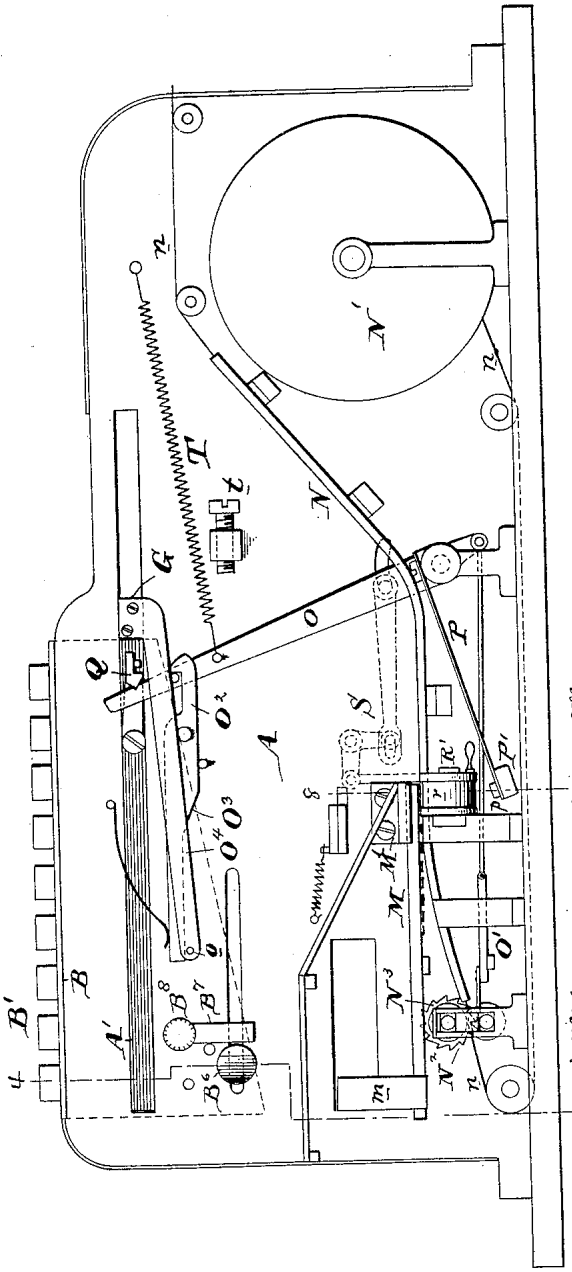
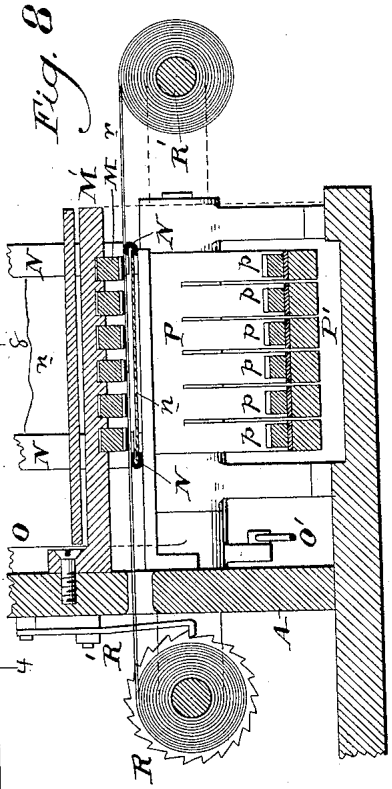


Fig. 8



Witnesses.
Henry Drury
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(No Model.) 5 Sheets—Sheet 2.

# C. C. CLIFFORD.

## ADDING MACHINE.

No. 602,154. Patented Apr. 12, 1898.

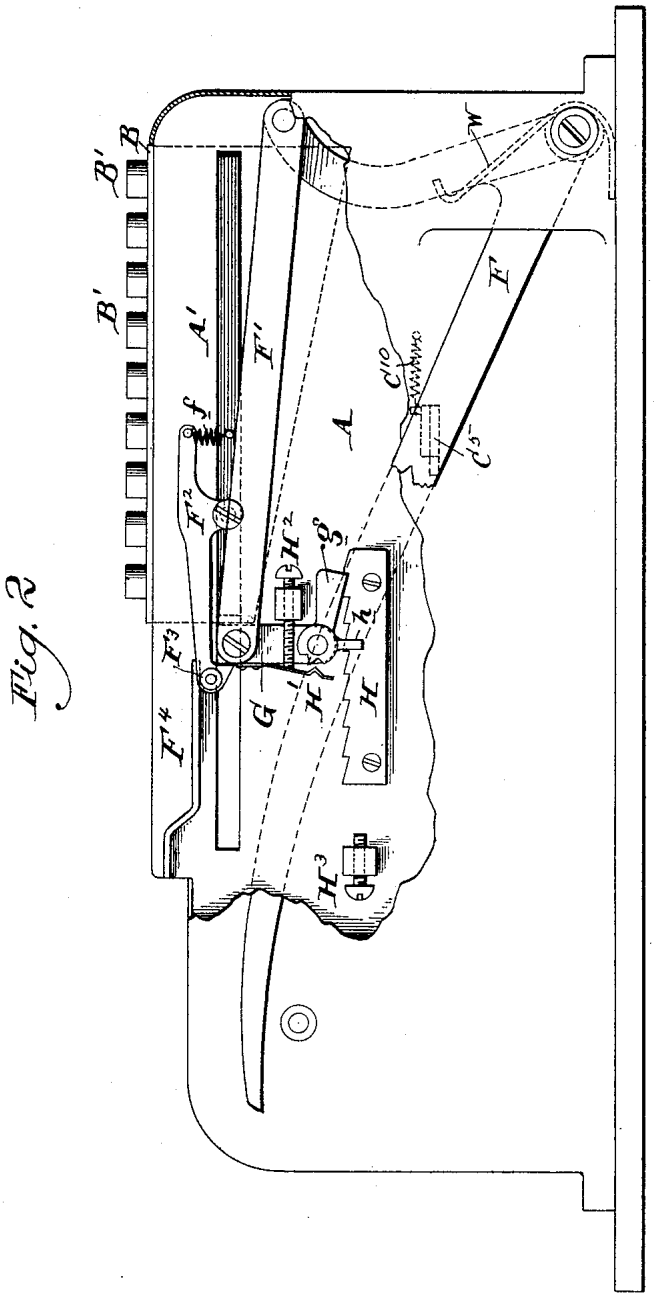

Fig. 2

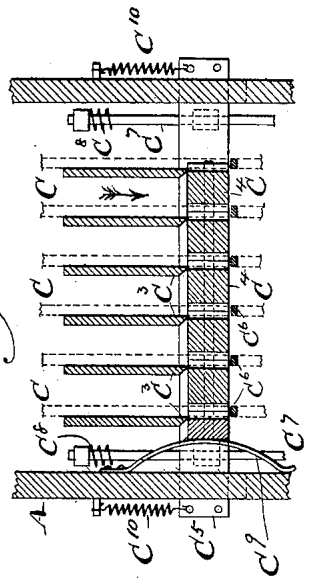

Fig. 10

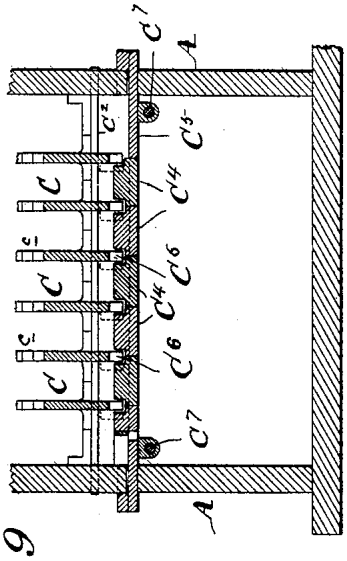

Fig. 9

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(No Model.) 5 Sheets—Sheet 3.

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## ADDING MACHINE.

No. 602,154. Patented Apr. 12, 1898.

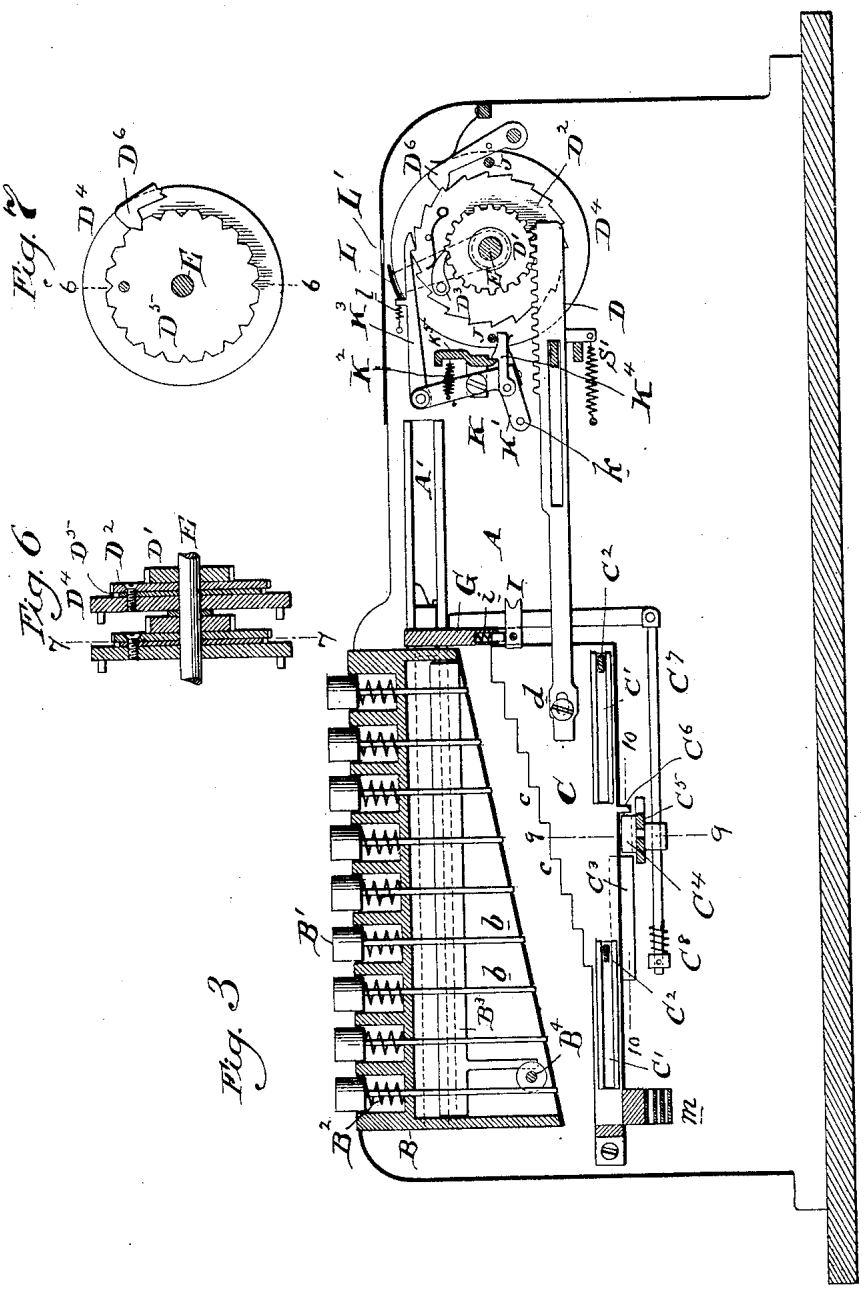

Fig. 3

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(No Model.) 5 Sheets—Sheet 4.

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## ADDING MACHINE.

No. 602,154. Patented Apr. 12, 1898.

Fig. 3.

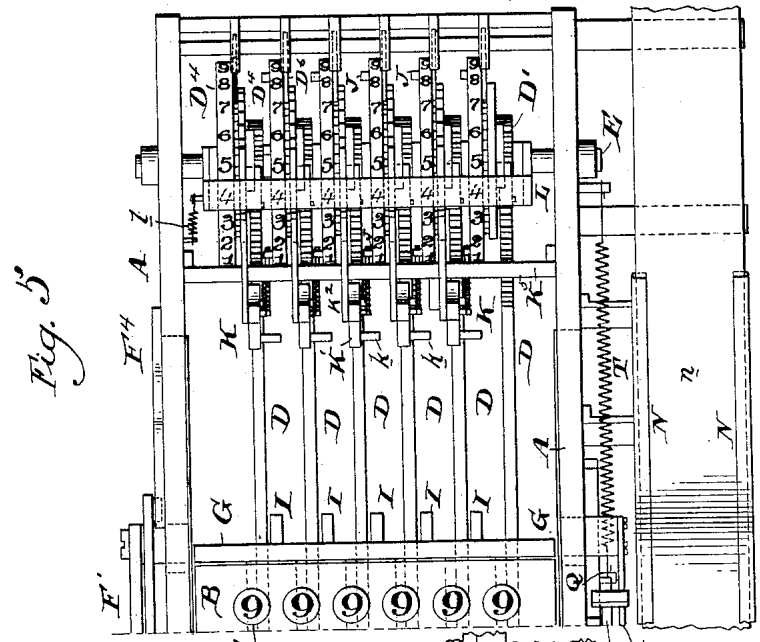
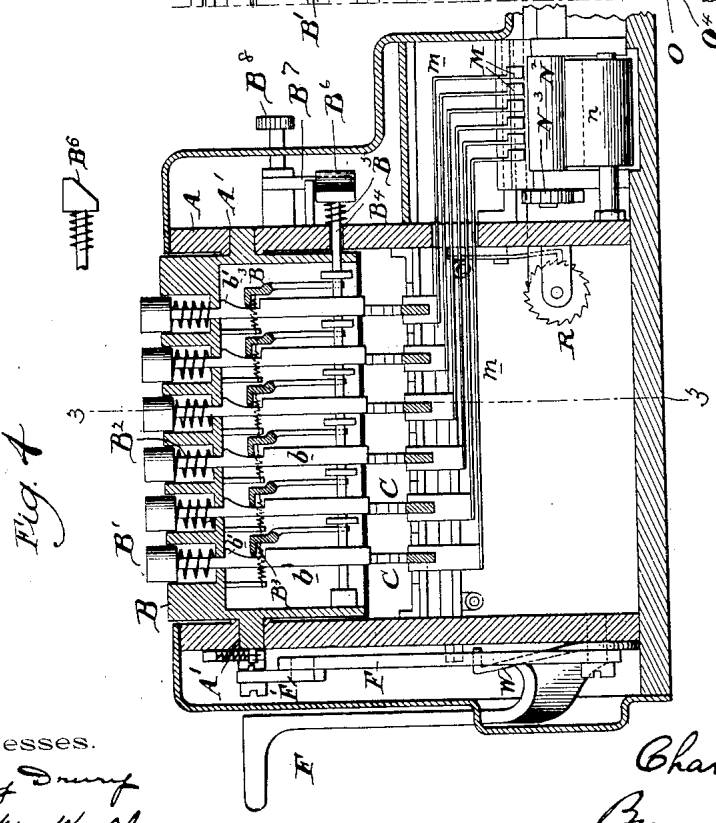


Fig. 4.



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(No Model.) 5 Sheets—Sheet 5.

# C. C. CLIFFORD.

## ADDING MACHINE.

No. 602,154. Patented Apr. 12, 1898.

Fig. 11.

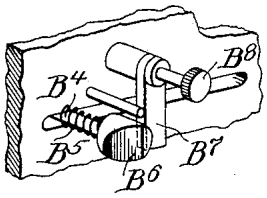
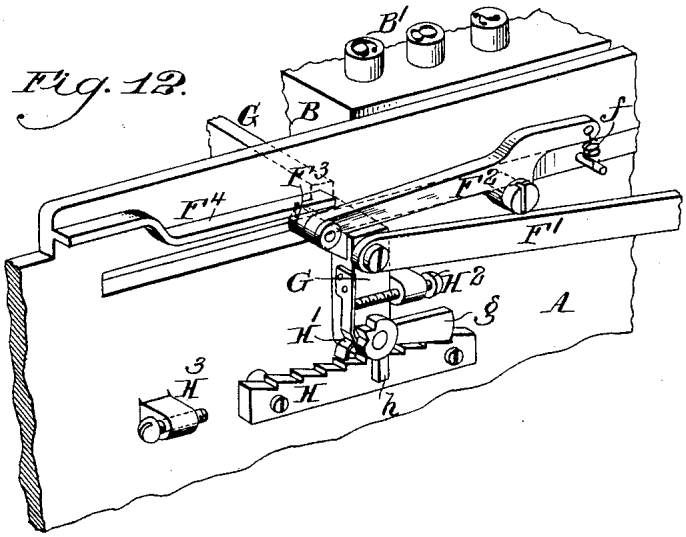



Fig. 12.




Witnesses.
Henry Dumy
R. M. Kelly.

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Charles C Clifford.
By A. Wilkinson
Attorney.

# UNITED STATES PATENT OFFICE.

CHARLES C. CLIFFORD, OF PHILADELPHIA, PENNSYLVANIA.

## ADDING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 602,154, dated April 12, 1898.

Application filed April 23, 1897. Serial No. 633,432. (No model.)

*To all whom it may concern:*

Be it known that I, CHARLES C. CLIFFORD, of Philadelphia, county of Philadelphia, State of Pennsylvania, have invented an Improvement in Adding-Machines, of which the following is a specification.

My invention has reference to automatic adding machines or registers; and it consists in certain improvements which are fully set forth in the following specification and shown in the accompanying drawings, which form a part thereof.

The object of my invention is to provide a suitable construction which shall have automatic capacity for adding together any number of rows of figures, so that at a glance the total amount may be ascertained. In connection with said machine I provide a suitable printing or recording device which shall have capacity for printing upon a slip of paper the successive rows of figures which have been added, so that the said printed slip will be a visual record of the amounts added and of the keys struck, while the register will indicate the sum total of said amounts. The printed slip, while not essential to the operation of the machine, may be considered as a check upon the operator, as it would indicate any mistakes which he might have made in striking the keys. Under certain manipulation my improvements may be also made to multiply.

In carrying out my invention I provide a series of sets of keys, each set corresponding from one to nine, and, if desired, keys corresponding to zero may also be employed. There may be any desired number of sets or rows of keys, so that the machine may be capable of adding very large amounts; but it is thought that in ordinary use six sets of keys will be sufficient, as that will be capable of registering amounts equal to nine thousand nine hundred and ninety-nine dollars and ninety-nine cents or under, and if the cent-keys are used as dollars then said number of keys would be capable of adding amounts as high as nine hundred and ninety-nine thousand nine hundred and ninety-nine dollars. The keys are so arranged that they operate in connection with a step-bar to produce a relative movement upon a series of registering wheels or dials arranged side by side, so that the amount in units corresponding to any key of a series depressed will move the dial or wheel corresponding to said set of keys a corresponding amount. In connection with this mechanism I combine automatic devices adapted to come into play after the operation of the dials or registering-wheels to cause a further rotation of any registering wheel or dial to the extent of one unit on its face wherever the amounts added upon the dial of the next lower order cause the said dial to move its registering-surface under the sight-aperture to bring into view or cause to pass under said sight-aperture the zero thereon. My invention furthermore comprehends mechanism for automatically releasing the keys after the amounts have been registered. In connection with the sight-aperture and the dials I employ a shield, which in case of the failure of the devices above referred to for carrying amounts from one dial to the next either from breakage or the natural operation of the machine remains closed so that the amount cannot be read. This prevents any possible reading of a wrong amount and insures the machine being exceedingly accurate. The registering devices may be operated through a suitable hand-lever or movable part, the action of which causes a relative movement on all of the keys and on all of the racks.

The recording mechanism of my improved adding-machine comprises a series of type-bars, each having printing-type corresponding from zero to nine and adapted to move parallel side by side over a strip of paper and between which and the type a printing-tape is arranged. Below the strip of paper is arranged the impression-hammers, which upon rising impart a blow to produce the printing action. The type-bars are connected with the step-bars under the control of the keys, so that their position over the paper and printing-hammers corresponds to the requisite movement of the said step-bars. The type are set during the initial operation of the registering-wheels, and the printing operation takes place automatically during the completion of the registering operation, so that the printing is automatically performed and gives an absolute record of the several amounts which are added.

In connection with the printing devices I provide automatic means for causing all of the step-bars whose keys below the highest number struck have not been depressed to move forward one space to bring the zeros of the type into printing position, so that when a numeral is not printed a zero is always printed. While this latter is not essential, it is nevertheless desirable, in that the zero should be properly interposed between the numerals to prevent any necessity of special observation of the spacing in reading any row of figures.

My invention also comprehends various details of construction which, together with the important features of the machine, will be better understood by reference to the accompanying drawings, in which—

Figure 1 is a side elevation of my improved machine with a portion of the casing broken away and more particularly showing the recording mechanism. Fig. 2 is a side elevation of the machine upon the opposite side of Fig. 1, with a portion of the casing broken away. Fig. 3 is a sectional elevation of my improved machine, taken on line 3 3 of Fig. 4. Fig. 4 is a transverse section of my improved machine on line 4 4 of Fig. 1. Fig. 5 is a plan view of the registering portion of my improved machine with the outer casing removed. Fig. 6 is a sectional elevation through a portion of the registering-wheels on line 6 6 of Fig. 7. Fig. 7 is a transverse section on line 7 7 of Fig. 6. Fig. 8 is a transverse section on line 8 8 of Fig. 1 through the recording devices on an enlarged scale. Fig. 9 is a cross-section on line 9 9 of Fig. 3. Fig. 10 is a sectional plan view on line 10 10 of Fig. 3. Fig. 11 is a perspective view of the releasing-pawl mechanism, and Fig. 12 is a perspective view of the releasing devices between the keyboard and transferring-frame.

A is the main frame of the machine and may be of any suitable construction. As shown, it is provided with horizontal guide-slots A′, in which a keyboard B is adapted to reciprocate. The keyboard is provided with a series of sets of keys B′, having shanks *b*, extending downward and of different lengths and suitably guided in the keyboard. Springs $B^2$ cause the keys to rise normally. Spring-pivoted locking-bars $B^3$ are also carried by the keyboard and are adapted to lock the keys in their depressed position by catching over the teeth *b*′. There is one of the locking-bars for each set of keys and each set of keys comprise at least nine keys, corresponding to the numerals "1" to "9." If desired, there may be an additional set of keys corresponding to the zeros. Each of the locking-bars may operate independently of the others, so as to lock any key of one set without disturbing the locking action when depressing any key of another set. All of the keys may be released by the action of a transversely-reciprocating rod $B^4$, having projections which simultaneously operate all of the locking-bars to release all of the keys which have been depressed and previously locked in said depressed position. This rod $B^4$ is normally kept out of operation by a spring $B^5$, interposed between the main frame A and a head $B^6$. When the keyboard B is moved to the right, Figs. 1 and 3, the head $B^6$ throws the pawl $B^7$ upward and passes beneath it without being operated to release the keys, and when said keyboard is moved backward to the left the outer face of the head $B^6$, being inclined, acts as a cam against the inner side of the pawl $B^7$ and pushes the rod $B^4$ transversely against the action of the spring $B^5$, and thereby operates all of the locking-bars to release the keys. When it is desired not to release the keys, the pawl $B^7$ is turned upward by revolving the milled head $B^8$, which extends outside of the case, Fig. 4, so as to throw the pawl out of action. The teeth *b*′ are made slightly rounded, so that if a wrong key is depressed another of the same set may be depressed and locked and at the same time automatically release the wrong key. The keyboard may be reciprocated in any suitable manner; but as shown it is connected by means of a detachable connection with a frame G, directly reciprocated by a hand-lever F and link F′, Fig. 2. The detachable connection comprises a pivoted pawl $F^2$, secured to the keyboard and adapted to catch upon the reciprocating frame G. A spring *f* acting upon this pawl tends to release its connection with the frame G when permitted by the action of the cam $F^4$. The cam $F^4$ is formed upon the main frame A and acts as a guide for a wheel or projection $F^3$ on the pawl $F^2$. As shown in Fig. 2, the cam $F^4$ holds the pawl into connection with the frame G. When the frame G is moved forward, (or to the left,) it moves the keyboard with it by the connection $F^2$; but when the roller $F^3$ reaches the point in the cam $F^4$, so that the spring *f* may cause it to move rapidly upward, the keyboard is automatically released and the frame G continues to move forward, the reason for which will be explained later on. In the return movement, under the action of the springs W, the frame G strikes the keyboard and moves it backward and at the same time causes the projection $F^3$ to pass under the lower part of the cam $F^4$ to insure the two parts B and G being once more locked together.

It is essential in a machine of this class that a full movement be given to the parts to avoid any possibility of defective registration, and to insure this action I employ the mechanism clearly illustrated in Fig. 2. The pawl *g* is carried by an arm from the frame G and operates by gravity in connection with the rack H, secured to the main frame. When the movement to the left begins, the spring H′ moves away from the screw $H^2$ and is permitted to come into action with the pawl *g*, maintaining it in its connection with the rack. When the extreme end of the frame

G is reached, the projection *h* of the lower part of the pawl strikes the screw $H^3$ of the main frame and snaps the pawl upward, in which position it is held out of contact with the rack until the extreme end of the return stroke is secured. At this part of the stroke the spring H′ strikes the screw $H^2$ and is once more moved out of contact with the pawl, and the latter falls by gravity into connection with the rack H. While this is excellently adapted to the purpose, it is readily understood that various other means may be substituted to secure the full reciprocation of the parts at each operation.

Arranged below each set of keys is a step-bar C, the steps *c* thereof being of uniform length, but of less length than the distance between the several keys of a set. The steps are so disposed with reference to the lower parts of the shanks *b* of the keys that the key corresponding to No. 9 shall strike its step in the step-bar C when depressed in a manner to impart a longitudinal movement to said step-bar sufficient to turn the registering-dial $D^4$ a space corresponding to nine units. The relation between the next key-shank and the next step of the step-bar will produce a corresponding movement of the registering-dial equal to eight units, and so on. This is secured by permitting more or less lost motion between the lower ends of the key-shanks and the steps before the forward movement of the keyboard shall operate upon the step-bar. The step-bars C are provided with longitudinal slots C′, through which pass transverse rods $C^2$ for sustaining and guiding them. Each step-bar C is connected with a rack-bar D at *d* with provision for a small amount of lost motion, the object of which is to permit the step-bar C moving a short distance before operating the rack-bar, which movement is intended to facilitate the printing of the zeros in the recording mechanism, to be described hereinafter. The rack-bar D of each set meshes with a pinion D′, loosely journaled upon a transverse shaft E. The pinion D′ is connected with a ratchet-wheel $D^2$ by a pawl $D^3$, so that when the pinion D′ is operated by the rack-bar in the forward direction it rotates the ratchet-wheel, but in the reverse movement it moves the pinion under the pawl. The ratchet-wheel $D^2$ is connected with the registering-dial $D^4$, having upon its periphery numbers from "0" to "9," which may, if desired, be repeated. As shown, there are two sets of these numbers on each dial, so as to permit the dial to be of considerable diameter. This, however, is not essential, as it is only necessary to properly proportion the parts to employ a single set of numbers. A notched disk $D^5$ is also carried with the dial, having as many notches as there are numbers, so that a spring-actuated pawl $D^6$ presses into said notches to normally prevent accidental spinning of the dial-wheels $D^4$. The same action may be produced by any suitable friction-creating devices. The pawl $D^3$ may be assumed as being directly connected with the registering-dial $D^4$, so that the rotation of the pinion D′ operates the said dial through the pawl $D^3$. A suitable spring S′ returns the rack-bars to their normal position. There is a dial for each of the step-bars, and consequently for each set of keys. As shown, there are six sets of keys; but it is self-evident that there may be more or less of said sets of keys employed, as desired.

When performing the registering operation, it is essential, as before explained, to make a full movement of the keyboard. This is secured by the construction shown in Figs. 2 and 12, the idea being that the pawl *g*, in running over the rack H, necessitates the frame G being moved the full distance before it can be returned. In returning the screw $H^3$ pushes the pawl up out of the way and the spring H holds it in its new position until the complete return of the frame G, when the spring is brought in contact with the stationary screw $H^2$ and by being pressed away from the pawl allows it to fall again into contact with the rack, as shown.

The return movement of the frame G operates upon all of the step-bars C previously moved in registering, Fig. 3, and returns them all to their normal position, as shown, and yet, by the slotted connection *d*, permits a slight movement of any step-bar in a further registering action of the machine without moving the registering-dial—as, for instance, when printing the zero—as explained later on. A spring S′ insures a positive return of the rack-bars D and at the same time holds them against vibration or movement when the step-bar is moved forward for printing the zero, as at that time no movement must be made to the dial.

It is evident that as the dials correspond to the cents and dollars it will constantly happen that when "10" is registered upon any dial it will be necessary to carry a unit to the next dial, as is well known, and to accomplish this automatically and in connection with one or more of the dials, as the case may be, I provide a series of devices K, which I will term "transferring" devices or mechanism. This mechanism consists of a bell-crank K′, pivoted to a transverse bar $K^5$, secured to the main frame. The upper end of the crank K′ carries a pawl $K^3$, which operates in connection with the ratchet-wheel $D^2$. A spring-pressed pawl $K^4$ is connected with the bell-crank below its pivot-point and locks with the lower edge of the frame $K^5$. When in this position, a pin *k*, carried at the lower part of the bell-crank, is out of alinement with the transfer-finger I, pivoted at the lower part of the frame G and held in normal horizontal position by a spring *i*.

It will be observed that when the frame G moves forward the transfer-finger I will pass above the pin *k* of the bell-crank lever, and consequently will not operate the same. If, however, the pawl $K^4$ should be liberated by

a stud J upon the dial of the next lowest order, the spring $K^2$ will oscillate the bell-crank frame K', throwing the pin *k* upward into alinement with the transfer-finger I and at the same time move the pawl $K^3$ forward one tooth of the ratchet-wheel $D^2$. When this position is assumed, the forward movement of the frame G will cause the notched end of the transfer-finger I to receive the pin *k* and oscillate the bell-crank to the position shown in Fig. 3, with the result of turning the ratchet-wheel $D^2$ and its dial $D^4$ one point and at the same time relocking the pawl upon the frame $K^5$, where it remains until a further operation of this character is required. As the dials have twenty figures about their circumference, two pins or studs J are arranged upon each dial, and these studs on one dial operate upon the pawl $K^4$ of the transfer device corresponding to the next dial of higher order, and so on. From this it will be evident that when any dial passes the zero-point it operates the transfer device to insure one additional movement to the next dial, and such action takes place irrespective of the amount of movement given to the dials under the operation of the keys of any set corresponding to its own particular dial. The dials should only be read when the transferring device K is in the position shown in Fig. 3, and consequently if from any cause the said transferring devices should not work—such as by the breaking of one of the transferring-fingers I or when a transfer device was tripped after the transfer-fingers I were fully moved and did not have the opportunity to register—a shield L will be held under the sight-opening L' in the case to prevent the numbers on the dials being read and indicating that something is wrong with the machine or that a second movement is required to the frame G. In the latter case the next amount added gives the requisite movement. The tripping of the pawl $K^4$ is a very simple matter and is positive, and whenever this takes place the shield L is pushed forward again against the action of a spring *l* until the transfer is positively made. The transfer-fingers I are made flexible, so that when engaging the pins *k* they may follow the downward arc of said pins, or should one of the levers K' be liberated after the fingers have been fully thrown, the pin *k* of said lever may rise and press the finger I upward. In this latter case the shield L will be moved over the sight-opening and will remain there until the next movement of the transfer-frame G.

If "99" were on the dials and a number was added to it, the first movement of the frame G would turn the first dial to the proper number and set the transferring devices for the second dial, and this would necessitate a second movement of the frame G without operating any of the keys. Without the second movement the sight-openings are covered and the dials could not be read. If the addition was to continue, the second movement would not have been required as a special operation, as the next additions made would produce such a movement. The same would be the case if the numbers were "999," only in this case a further additional movement would be required, excepting in case of the addition of other numbers, where the natural movement of the frame G would accomplish the same office. If the dials cannot be read on account of the shield, the operator knows he must give the machine another forward movement.

I do not confine myself to the particular details of the transferring devices here shown, as it is evident that other forms of mechanism may be employed for obtaining the same results.

I will now refer to the recording mechanism, which may or may not be employed in connection with the registering devices, as desired.

M are a series of type-bars having type corresponding from "0" to "9" upon their under surfaces. These type-bars are guided in a suitable guide M' and connected by frames *m* with the corresponding step-bars C, so that the movement of any step-bar moves the corresponding type-bar. Arranged below the type-bars are the paper-guides N, through which the paper strip *n* passes. The said paper strip is fed through the said guides N by feeding-rollers $N^2$, and the printed slip is wound upon a roller or drum N'.

O is a pivoted lever which, by means of a pawl O' and ratchet $N^3$, operates the feed-rollers $N^2$ intermittently. A printing-tape *r* is arranged to move transversely between the type-bars and the paper-guides N and is wound from a roller R' onto a roller R, the latter being provided with a ratchet-wheel which is operated by a vertical reciprocating pawl R', moved under the action of a bell-crank and link S, connecting with the pivoted lever O. A spring-arm P, secured to the lever O, carries at its lower and free end a series of spring-fingers, weighted at P' and having impression-surfaces *p*, the said parts constituting a series of hammers which upon rising produce an impression by the type upon the paper under the inking-tape *r*. The movement of the lever O in one direction is caused by the spring T, and its stroke is limited by an adjustable screw *t*. The lever O is held against movement by a cam-pawl $O^2$, pivoted to the main frame, the said pawl being provided with a cam-surface $O^3$. The frame G is provided with an arm $O^4$, extending rearwardly and having a pin *o*, which works against the cam-surface of the pawl $O^2$, so as to trip the said pawl and liberate the lever O, that it may be pulled backward by the spring T with a sudden blow. This produces a quick action of the impression-hammer in printing and throws the pawls R' and O' into position so as to feed upon the return movement of the lever.

Q is a pivoted arm carried by the keyboard for holding the lever O against the action of

the spring T in relocking it upon the return movement of the keyboard.

The operation of this recording or printing mechanism will now be understood. When the keys are depressed and the keyboard moved, the type-bars M are moved to the requisite distance, the arm Q will have receded from the lever O, and the pin *o* will have moved along the under side of the pawl $O^2$ until it reached the cam portion $O^3$. A further movement will trip the pawl $O^2$, permitting the spring T to operate the printing-hammer. Upon the return movement of the keyboard the arm Q draws the lever O back to the position shown in Fig. 1, when it is again locked by the pawl $O^2$. In the return movement of the lever O the feeding mechanism for the paper N is operated, together with the movement of the printing-tape. Various forms of printing and feeding mechanism may be employed in lieu of those here shown.

It is evident from the foregoing description that when desired zeros should be printed, and to insure the printing of such I provide a special attachment. (Illustrated more particularly in Figs. 3, 9, and 10.) The lower parts of the step-bars C are provided with downwardly-projecting portions or pins $C^6$ and also with the cam portions $C^8$, located to the rear of said portions $C^6$ and formed of considerable length. $C^5$ is a transverse plate carrying upon its outer surface a series of blocks $C^4$, arranged end to end and pressed in one direction by the action of a spring $C^9$. These blocks are formed with notches or grooves through which the pins $C^6$ normally pass, as clearly shown in Fig. 9. The plate $C^5$ is driven in one direction by the springs $C^{10}$, and is adapted to be moved in the other direction or toward the registering-dials by rods $C^7$, provided with cushion-springs $C^8$, the said rods $C^7$ being connected to extensions from the reciprocating frame G. It will now be understood that if any of the step-bars C be moved in the direction of the arrow, Fig. 10—that is to say, toward the registering-dials—the knife-edge forward part of the plate $C^3$ will act upon the sliding blocks $C^4$ and push them sidewise against the action of the spring $C^9$, so that all of the said blocks corresponding to the keys of the lower orders are operated upon by the beveled side of the said plate $C^3$ and caused to move in such a manner as to form abutments relatively to the pins or projections $C^6$, so that when the rods $C^7$ finally move the frame $C^5$ also in the direction of the arrow, Fig. 10, the blocks which have been shifted sidewise will catch upon the projections or pins $C^6$ and move the corresponding step-bars a short distance, so as to bring the zeros of the type-bars into printing position. It will thus be seen that every one of the step-bars which have not been positively moved forward under the action of the keys and the keyboard will be caught by the blocks $C^4$ and moved the short distance necessary to bring the zeros into line; but this only applies to the step-bars corresponding to the lower order of keys—that is to say, if "500" were printed no zero would be printed in the thousand position, and likewise if the amount to be printed were "50" no zero would be printed for the columns corresponding to "100" or "1,000," and this is true whether we assume the amounts to be printed as made up of cents and dollars or of dollars alone. When the small movement is imparted to the step-bars by the blocks $C^4$ in moving the type-bars, it is permitted by the slotted connection *d*, Fig. 3, between the step-bar and the rack-bar D, to which reference has heretofore been made, the said connection permitting of the movement of the type-bar and its corresponding step-bar without moving the rack-bar D and its registering-dial. This automatic mechanism for operating the printing or type bars to insure printing the zero is not essential to the practical operation of my machine, but is desirable in that it makes the columns of the figures more natural and easier to read. Any other form of mechanism may be employed for securing the adjustment of the type-bars for the purpose of printing the zero, as above described.

I have not shown any special mechanism for resetting the various registering dials or wheels to zero, as such devices are common, and, further, because my machine may be quickly manipulated to bring the dials to zero. This latter operation is secured by adding by one manipulation the difference between the amount registered and the maximum capacity of the machine, the result being that all the dials come to zero under the sight-opening.

While I prefer the construction herein set out and illustrated, the various details making up the complete structure may be modified without departing from the principles involved. Hence I do not limit myself to the particular details illustrated.

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

1. In an adding-machine, the combination of a series of sets of keys each independently movable, a series of sliding step-bars each adapted to be operated by a set of the keys, means to move the keys relatively to the step-bars, a series of registering devices respectively operated by the step-bars, transferring devices controlled by the registering devices of one order of numbers to move the registering devices of the next higher order one point, and means acting after the direct action of the step-bars upon the registering devices to operate the transferring devices.

2. In an adding-machine, the combination of a series of sets of keys, a series of step-bars operated by the keys, means to move the keys relatively to the step-bars, a series of registering devices respectively operated by the step-bars, means to move the registering devices from the step-bars, transferring devices

controlled by the registering devices of one order of numbers to move the registering devices of the next higher order one point, means acting after the direct action of the step-bars upon the registering devices to operate the transferring devices, and a shield controlled by the transferring devices to shield the numbers of the registering devices from view in case said transferring device becomes inoperative or fails to register.

3. In an adding-machine, the combination of a series of sets of keys, a series of step-bars operated by the keys, a series of registering devices respectively operated by the step-bars, transferring devices adapted to move the registering devices one point operated by a moving part of the machine with each operation, a trip controlled by the registering devices of the next lower order to put the transferring devices into action, and means acting after the direct action of the step-bars upon the registering devices to operate the transferring devices.

4. In an adding-machine, the combination of a series of sets of keys, a series of step-bars operated by the keys, means to move the keys relatively to the step-bars, a series of registering devices respectively operated by the step-bars, transferring devices adapted to move the registering devices one point operated by a moving part of the machine with each operation, a trip controlled by the registering devices of the next lower order to put the transferring devices into action, a transfer-operating frame having operating parts for imparting motion to the transferring device, and hand-operated devices for reciprocating the transfer-operating frame.

5. In an adding-machine, the combination of a series of sets of keys, a keyboard for said keys, a series of step-bars operated by the keys, means for moving the keyboard, a series of registering devices respectively operated by the step-bars, transferring devices controlled by the registering devices of one order to move the registering devices of the next higher order one point, a transfer-operating frame having operating parts for imparting motion to the transferring device, hand-operated devices for reciprocating the transfer-operating frame, a latch to intermittently connect the keyboard and transfer-operating frame whereby the former is moved by the latter, and a trip for releasing the latch after a given movement of the keyboard is made.

6. In an adding-machine, the combination of a series of sets of keys, a keyboard for said keys, a series of step-bars operated by the keys, a series of registering devices respectively operated by the step-bars, means for moving the keyboard, and means to lock the keyboard against return movement until its full movement is completed in registering.

7. In an adding-machine, the combination of a series of sets of keys, means to move the keyboard, a keyboard for said keys, a series of step-bars operated by the keys, a series of registering devices respectively operated by the step-bars, transferring devices adapted to move the registering devices one point operated by a moving part of the machine with each operation, a trip controlled by the registering devices of the next lower order to put the transferring devices into action, a transfer-operating frame having operating parts for imparting motion to the transferring device, hand-operated devices for reciprocating the transfer-operating frame, and means to lock the transfer-operating frame against return movement until its full movement is completed in registering.

8. In an adding-machine, the combination of a series of sets of keys, means for supporting and reciprocating all of the keys, a series of step-bars operated by the keys, a series of registering devices respectively operated by the step-bars, transferring devices controlled by the registering devices of one order to move the registering devices of the next higher order one point, and means acting after the direct action of the step-bars upon the registering devices to operate the transferring devices.

9. In an adding-machine, the combination of a series of sets of keys, means for supporting and reciprocating all of the keys, a series of step-bars operated by the keys, a series of registering devices respectively operated by the step-bars, transferring devices controlled by the registering devices of one order to move the registering devices of the next higher order one point, a transfer-operating frame having operating parts for imparting motion to the transferring device, hand-operated devices for reciprocating the transfer-operating frame, and means to lock the transfer-operating frame against return movement until its full movement is completed in registering.

10. In an adding-machine, the combination of a series of sets of keys, means for supporting and reciprocating all of the keys, a series of step-bars operated by the keys, a series of registering devices respectively operated by the step-bars, transferring devices controlled by the registering devices of one order to move the registering devices of the next higher order one point, a transfer-operating frame having operating parts for imparting motion to the transferring device, hand-operated devices for reciprocating the transfer-operating frame, a shield controlled by the transferring devices to shield the numbers of the registering devices from view in case said transferring device becomes inoperative or fails to register, and means to lock the transfer-operating frame against return movement until its full movement is completed in registering.

11. In an adding-machine, the combination of a series of sets of keys, a series of registering devices respectively operated by said sets of keys, a single locking-piece for each set of keys extending longitudinally past all of the keys of a set movable by any key of a set and for locking each of said keys of a set in oper-

ative position, and a common releasing mechanism for simultaneously moving all of the locking-pieces of the several sets of keys.

12. In an adding-machine, the combination of a series of sets of keys, a reciprocating keyboard carrying said keys, a series of registering devices respectively operated by said sets of keys, a single locking-piece for each set of keys for locking the keys movable with said keyboard in operative position, a common releasing mechanism for simultaneously releasing all of the keys upon completing the registration and reciprocation of the keyboard, and hand-controlled means for throwing the common releasing mechanism out of action.

13. In an adding-machine, the combination of a series of sets of keys, a keyboard for said keys, a series of step-bars operated by the keys, a series of registering devices, connecting devices between the step-bars and respective registering devices, means for moving the keyboard, locking devices for each set of keys for locking the keys in operative position, and a common releasing mechanism for simultaneously releasing all of the keys upon completing the registration.

14. In an adding-machine, the combination of a series of sets of keys, a keyboard for said keys, a series of step-bars operated by the keys, a series of registering devices, connecting devices between the step-bars and respective registering devices, means for moving the keyboard, locking devices for each set of keys for locking the keys in operative position, a common releasing mechanism for simultaneously releasing all of the keys upon completing the registration, and means to lock the keyboard against return movement until its full movement is completed in registering.

15. In an adding-machine, the combination of a series of sets of keys, a keyboard for said keys, a series of step-bars operated by the keys, a series of registering devices, connecting devices between the step-bars and respective registering devices, means for moving the keyboard, transferring devices operated by the means for moving the keyboard and controlled by the registering devices of one order of numbers to move the registering devices of the next higher order one point, locking devices for each set of keys for locking the keys in operative position, a common releasing mechanism for simultaneously releasing all of the keys upon completing the registration, and means to lock the keyboard against return movement until its full movement is completed in registering.

16. In an adding-machine, the combination of a series of sets of keys, a series of registering devices operated by said keys, hand-operated devices for producing a reciprocation to all of the keys relatively to the registering devices, transferring devices adapted to move the registering devices one point with each operation of the registering devices, a trip controlled by the registering devices of the next lower order to put the transferring devices into action, and a reciprocating transfer-operating frame having operating parts for imparting motion to the transferring devices and movable under the action of the hand-operated devices for causing the relative reciprocation of the keys with respect to the registering devices.

17. In an adding-machine, the combination of a series of sets of keys, a series of registering devices respectively operated by said sets of keys, transferring devices adapted to move the registering devices one point operated by a moving part of the machine with each operation, a trip controlled by the registering devices of the next lower order to put the transferring devices into action, a transfer-operating frame having operating parts for imparting motion to the transferring device, and means to lock the transfer-operating frame against return movement until its full movement is completed in registering.

18. In an adding-machine, the combination of a series of sets of keys, a series of registering devices respectively operated by said sets of keys, transferring devices adapted to move the registering devices one point operated by a moving part of the machine with each operation, a trip controlled by the registering devices of the next lower order to put the transferring devices into action, a transfer-operating frame having operating parts for imparting motion to the transferring device, and a shield controlled by the transferring devices to shield the numbers of the registering devices from view in case said transferring device becomes inoperative or fails to register.

19. In an adding-machine, the combination of a series of sets of keys, means for simultaneously reciprocating all of the keys in registering, a series of registering devices respectively operated by said sets of keys, transferring devices adapted to move the registering devices one point operated by a moving part of the machine with each operation, a trip controlled by the registering devices of the next lower order to put the transferring devices into action, a reciprocating transfer-operating frame having operating parts for imparting motion to the transferring device, locking devices for each set of keys for locking the keys in operative position, and a common releasing mechanism for simultaneously releasing all of the keys upon completing the registration.

20. In an adding-machine, the combination of a series of registering devices, key mechanism for operating the registering devices, means to reciprocate the key mechanism, transferring devices for moving the registering devices one point with each complete reciprocation of the key mechanism in the operation of registering, a trip controlled by the registering devices of the next lower order to put the transferring devices into operative position, and devices under the control and

operating in conjunction with the means for reciprocation of the key mechanism for imparting motion to the transferring devices.

21. In an adding-machine, the combination of a series of registering devices, transferring devices adapted to move the registering devices one point operated by a moving part of the machine with each operation, a trip controlled by the registering devices of the next lower order to put the transferring devices into action, a transfer-operating frame having operating parts for imparting motion to the transferring device, hand-operated devices for reciprocating the transfer-operating frame, and means to lock the transfer-operating frame against return movement until its full movement is completed in registering.

22. In an adding-machine, the combination of a series of registering devices, transferring devices adapted to move the registering devices one point operated by a moving part of the machine with each operation, a trip controlled by the registering devices of the next lower order to put the transferring devices into action, a shield controlled by the transferring devices to shield the numbers of the registering devices from view in case said transferring device becomes inoperative or fails to register, a transfer-operating frame having operating parts for imparting motion to the transferring device, and hand-operated devices for reciprocating the transfer-operating frame.

23. In an adding-machine, the combination of a series of registering parts adapted to bring into view figures corresponding to the numbers added, a series of sets of keys carried in a keyboard, a series of step-bars one to each set of keys acting as connecting mechanism between the keys and the registering devices for imparting a movement to said registering devices corresponding to the key or keys operated, means for imparting a relative movement between all of the keys and step-bars in registering printing devices for printing consecutively on a strip of paper the successive amounts which have been added, and connecting mechanism between the printing devices and the keys for operating the registering devices.

24. In an adding-machine, the combination of a series of registering devices, a series of reciprocating step-bars for operating the respective registering devices, a series of sets of keys one set for each step-bar in which each key of a set is adapted to cause the step-bar of that set to be moved to a definite and different distance, and means to impart a relative movement between the keys and the step-bar.

25. In an adding-machine, the combination of a series of registering devices, a series of step-bars for operating the respective registering devices, a series of sets of keys one set for each step-bar in which each key is adapted to move the step-bar to a definite distance, means to impart a relative movement between the keys and the step-bar, transfer devices connecting the several registering devices in pairs and controlled by the registering devices of the lower order of any pair, and means operating with the action of the keys for operating the said transferring devices.

26. In a transferring device for an adding-machine, the combination of two registering-wheels, one of which is provided with a ratchet-wheel and the other with a pin or projection, a pivoted lever having a pawl engaging with the ratchet-wheel, a spring to move the lever and pawl into operative position, a latch for holding the lever and pawl out of operative position adapted to be released by the pin or projection on the other registering-wheel, means for positively moving each of the registering-wheels, and hand-controlled means for operating the pivoted lever and pawl against the action of the spring to turn the ratchet-wheel.

27. In a transferring device for an adding-machine, the combination of two registering-wheels, one of which is provided with a ratchet-wheel and the other with a pin or projection, a pivoted lever having a pawl engaging with the ratchet-wheel, a spring to move the lever and pawl into operative position, a latch for holding the lever and pawl out of operative position adapted to be released by pin or projection on the other registering-wheel, means for moving each of the registering-wheels, means for operating the pivoted lever and pawl, keys to control the movement of the registering-wheels, a keyboard, means to move the keyboard, and connecting devices between the means for moving the keyboard and the means for operating the pivoted lever whereby the latter is caused to move after the operation of the former.

28. In a transferring device for an adding-machine, the combination of two registering-wheels, one of which is provided with a ratchet-wheel and the other with a pin or projection, a pivoted lever having a pawl engaging with the ratchet-wheel, a spring to move the lever and pawl into operative position, a latch for holding the lever and pawl out of operative position adapted to be released by pin or projection on the other registering-wheel, means for moving each of the registering-wheels, means for operating the pivoted lever and pawl, a sight-opening for reading the figures on the dials, and a shield controlled by the pivoted lever for closing the sight-opening when it fails to complete its oscillation.

29. In an adding-machine, the combination of a series of sets of keys, a reciprocating keyboard for moving said keys, a series of step-bars operated by the keys, a series of registering devices respectively operated by the step-bars, transferring devices controlled by the registering devices of one order of numbers to move the registering devices of the next higher order one point, means acting after the direct action of the step-bars upon the registering devices to operate the transferring

devices and under the control of the means for reciprocating the keyboard, printing devices for printing consecutively on a strip of paper the successive amounts which have been added, and means forming a connection between the registering devices and the printing devices whereby the said parts operate simultaneously.

30. In an adding-machine, the combination of a series of sets of keys, a series of step-bars operated by the keys, a series of registering devices respectively operated by the step-bars, transferring devices adapted to move the registering devices one point operated by a moving part of the machine with each operation, a trip controlled by the registering devices of the next lower order to put the transferring devices into action, a transfer-operating frame having operating parts for imparting motion to the transferring device, hand-operated devices for reciprocating the transfer-operating frame, printing devices for printing consecutively on a strip of paper the successive amounts which have been added, and connecting devices between the step-bars and the type of the printing devices whereby the step-bars simultaneously operate the registering devices and printing devices.

31. In an adding-machine, the combination of a series of sets of keys, a keyboard for said keys, a series of step-bars operated by the keys, a series of registering devices respectively operated by the step-bars, means for moving the keyboard, means to lock the keyboard against return movement until its full movement is completed in registering, and printing devices under the control of the step-bars for printing consecutively on a strip of paper the successive amounts which have been added upon the registering devices.

32. In an adding-machine, the combination of a series of sets of keys, a keyboard for said keys, a series of step-bars operated by the keys, a series of registering devices respectively operated by the step-bars, means for moving the keyboard, means to lock the keyboard against return movement until its full movement is completed in registering, a series of type-bars respectively connected with the several step-bars, impression devices for pressing the paper against the type-bars, and means for moving the step-bars and type-bars connected therewith not operated by the keys a short distance to bring the zero-type into printing operation upon the registering of a given amount upon the registering devices.

33. In an adding-machine, the combination of a series of sets of keys, a series of step-bars operated by the keys, a series of registering devices respectively operated by the step-bars, transferring devices controlled by the registering devices of one order to move the registering devices of the next higher order one point, means acting after the direct action of the step-bars upon the registering devices to operate the transferring devices, a series of type-bars respectively connected with the several step-bars, means to feed a paper strip under the type-bars, impression devices for pressing the paper against the type-bars, and means for moving the step-bars and type-bars connected therewith not operated by the keys a short distance to bring the zero-type into printing operation upon the registering of a given amount upon the registering devices.

34. In an adding-machine, the combination of a series of sets of keys, a series of step-bars operated by the keys, a series of registering devices respectively operated by the step-bars, transferring devices adapted to move the registering devices one point operated by a moving part of the machine with each operation, a trip controlled by the registering devices of the next lower order to put the transferring devices into action, means acting after the direct action of the step-bars upon the registering devices to operate the transferring devices, a series of type-bars respectively connected with the several step-bars, means to feed a paper strip under the type-bars, impression devices for pressing the paper against the type-bars, and means for moving the step-bars and type-bars connected therewith not operated by the keys a short distance to bring the zero-type into printing operation upon the registering of a given amount upon the registering devices.

35. In an adding-machine, the combination of a series of registering parts adapted to bring into view figures corresponding to the numbers added, a series of sets of keys carried in a keyboard, connecting mechanism between the keys and the registering devices for imparting a movement to said registering devices corresponding to the key or keys operated, printing devices for printing consecutively on a strip of paper the successive amounts which have been added, connecting mechanism between the printing devices and the keys for operating the registering devices, and means controlled by the registering mechanism for bringing into printing position the zero-type corresponding to the keys of the lower order of the series of sets of keys when no key of such set has been operated.

36. In an adding-machine, the combination of a series of sets of keys, a keyboard for said keys, a series of step-bars operated by the keys, a series of registering devices, connecting devices between the step-bars and respective registering devices, means for moving the keyboard, transferring devices operated by the means for moving the keyboard and controlled by the registering devices of one order of numbers to move the registering devices of the next higher order one point, locking devices for each set of keys for locking the keys in operative position, a common releasing mechanism for simultaneously releasing all of the keys upon completing the registration, means to lock the keyboard against return movement until its full movement is

completed in registering, type-bars moved by the step-bars, a paper-guide arranged adjacent to the type-bars, means to feed the paper intermittently, an impression device or hammer for pressing the paper toward the type, spring-actuated devices for operating the impression device, a lock controlling the spring-actuated devices, and devices under the control of the means for moving the keyboard for operating the lock to release the spring-actuated device whereby the printing operation takes place simultaneously with the registering operation.

37. In an adding-machine, the combination of a series of registering devices, transferring devices adapted to move the registering devices one point operated by a moving part of the machine with each operation, a trip controlled by the registering devices of the next lower order to put the transferring devices into action, a transfer-operating frame having operating parts for imparting motion to the transferring device, hand-operated devices for reciprocating the transfer-operating frame, a series of type-bars respectively connected with the registering devices so as to be moved simultaneously therewith, impression devices for the type-bars, and connecting devices between the impression devices and transfer-operating devices whereby the printing is performed when the registration has been completed.

38. In an adding-machine, the combination of a series of sets of keys adapted to be depressed, a lock for each set of keys and common to all of the keys of a set adapted to lock any key depressed and hold it in its depressed condition and automatically release it upon depressing any other key of the set, registering devices, reciprocating hand-operated connecting means whereby the keys depressed are adapted to operate the registering devices, and a common releasing device for all of the locks of the several sets of keys controlled by the hand-operated connecting means whereby all of the keys may be simultaneously released.

39. In an adding-machine, the combination of a series of registering-wheels, a series of sets of keys for operating the several registering-wheels one set being adapted to control a single registering-wheel, transferring devices adapted to act upon the registering-wheels and be thrown into operative condition by the action of the registering-wheel of the next lower order, and hand-power devices for operating the transferring devices to positively move them in performing the act of registration as in carrying the maximum amount of one registering-wheel to the next registering-wheel of a higher order.

In testimony of which invention I hereunto set my hand.

CHAS. C. CLIFFORD.

Witnesses:
R. M. HUNTER,
J. W. KENWORTHY.