No. 627,571. Patented June 27, 1899.

C. C. CLIFFORD.

ADDING MACHINE.

(Application filed Apr. 28, 1898.)

(No Model.) 6 Sheets—Sheet 1.

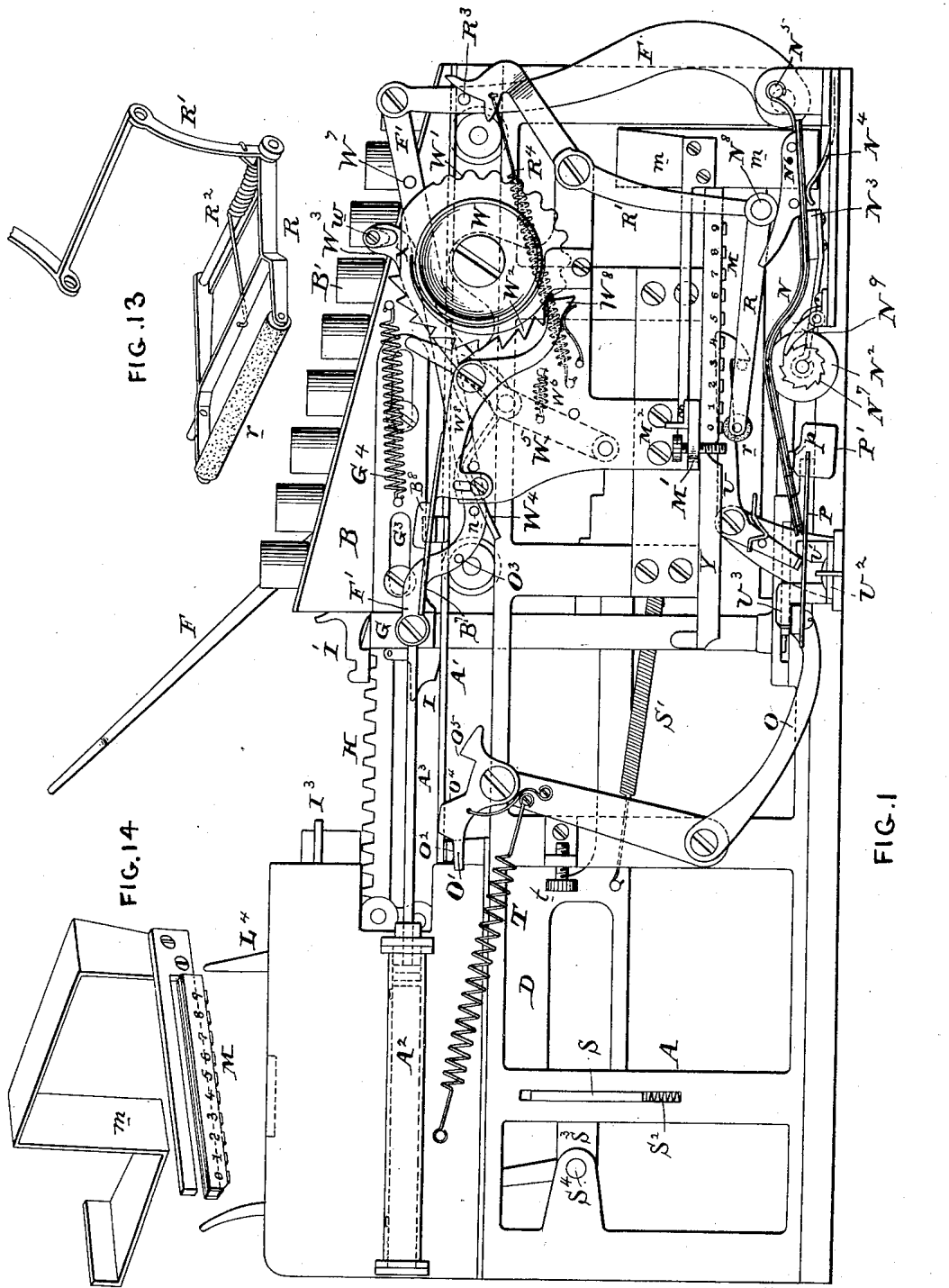

FIG. 1

FIG. 14

FIG. 13

WITNESSES:

Henry Drury

R. M. Kelly

INVENTOR:

Charles C. Clifford

By his atty

No. 627,571. Patented June 27, 1899.

C. C. CLIFFORD.

ADDING MACHINE.

(Application filed Apr. 28, 1898.)

(No Model.) 6 Sheets—Sheet 2.

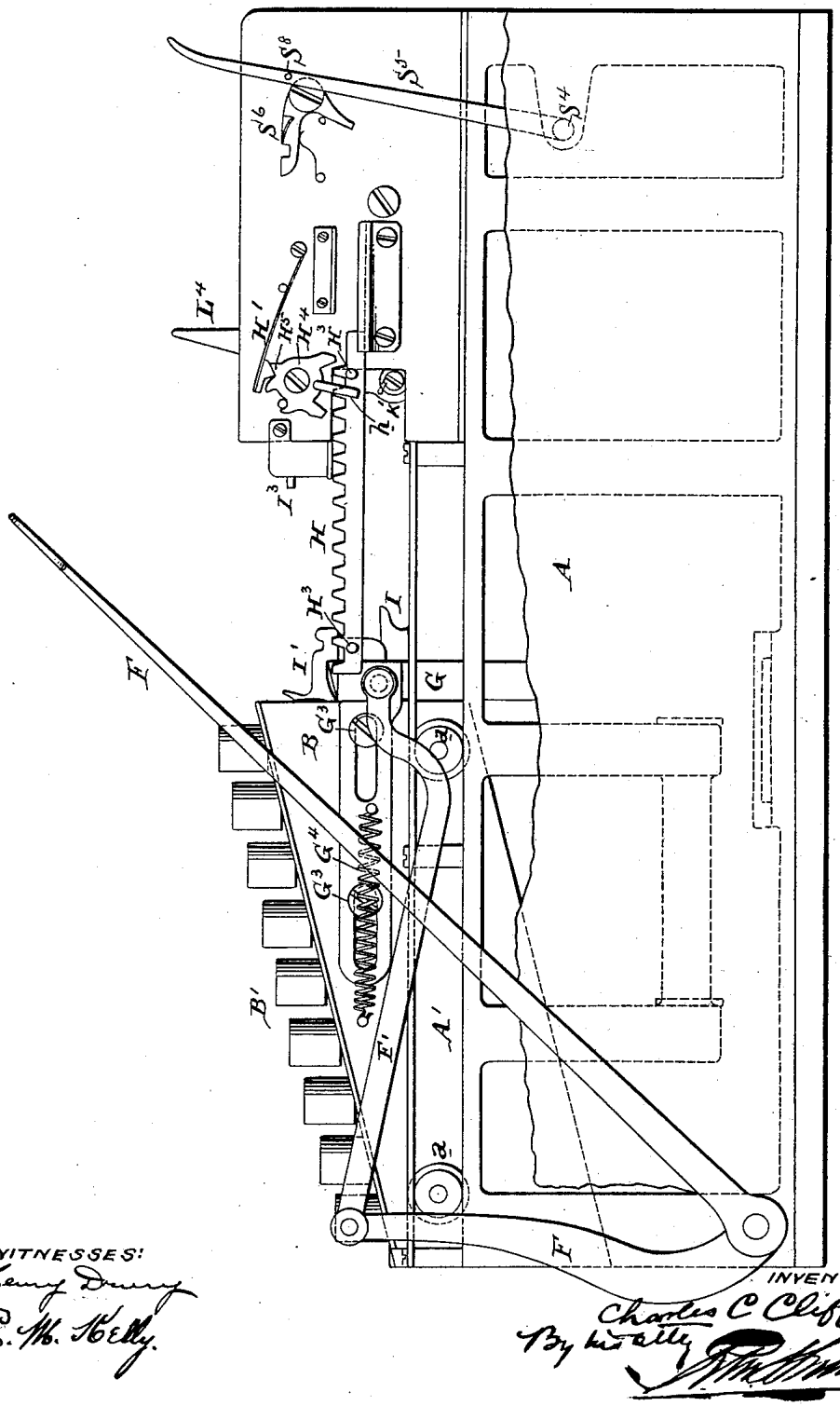

FIG. 2

WITNESSES:
Henry Drury
R. M. Kelly.

INVENTOR:
Charles C. Clifford
By his Atty
[illegible]

No. 627,571. Patented June 27, 1899.

C. C. CLIFFORD.

ADDING MACHINE.

(Application filed Apr. 28, 1898.)

(No Model.) 6 Sheets—Sheet 3.

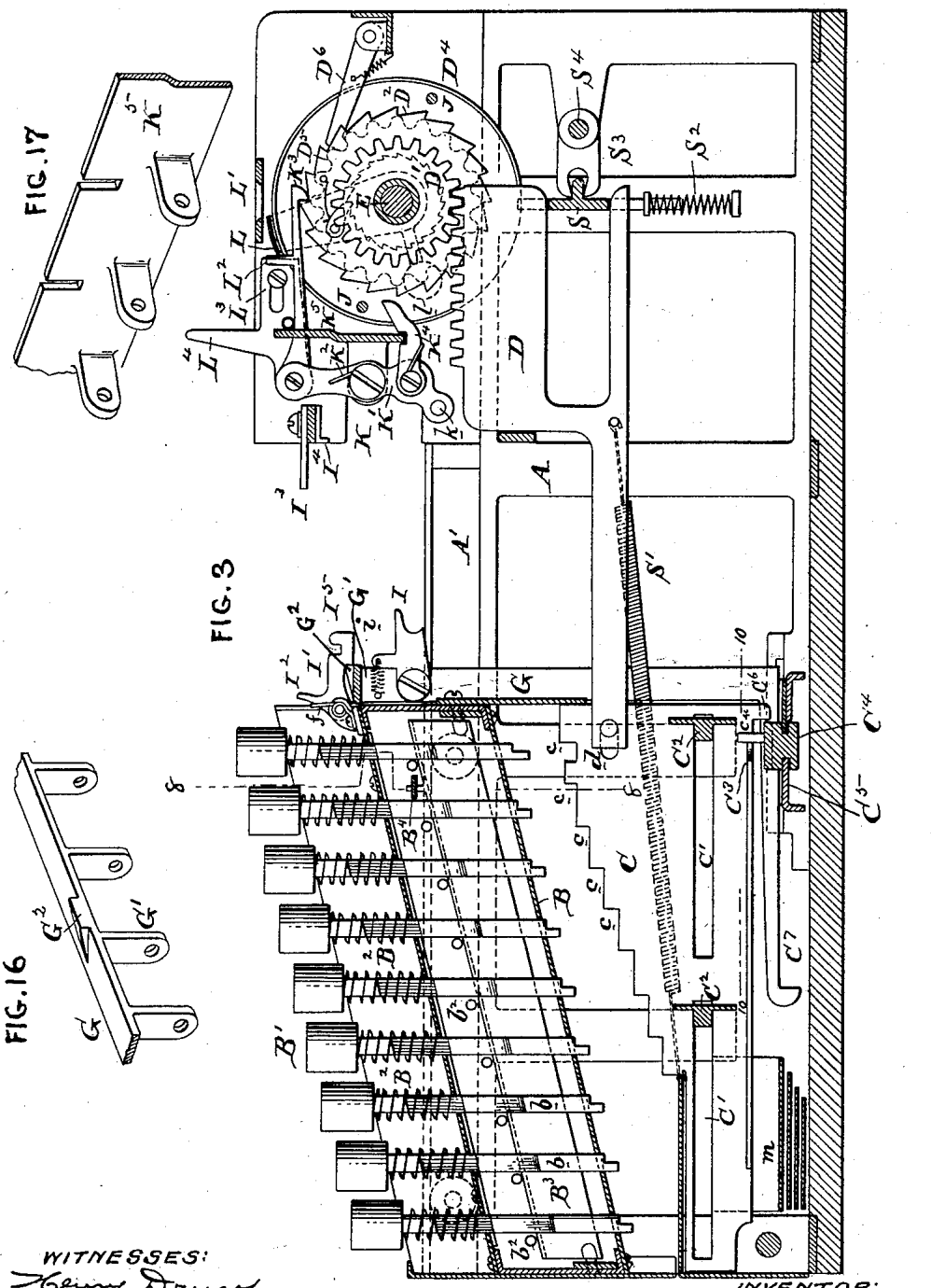

FIG. 17

FIG. 3

FIG. 16

WITNESSES:

Henry Drury

R. M. Kelly.

INVENTOR:

Charles C. Clifford

By his Atty

No. 627,571. Patented June 27, 1899.

C. C. CLIFFORD.

ADDING MACHINE.

(Application filed Apr. 28, 1898.)

(No Model.) 6 Sheets—Sheet 4.

FIG. 4

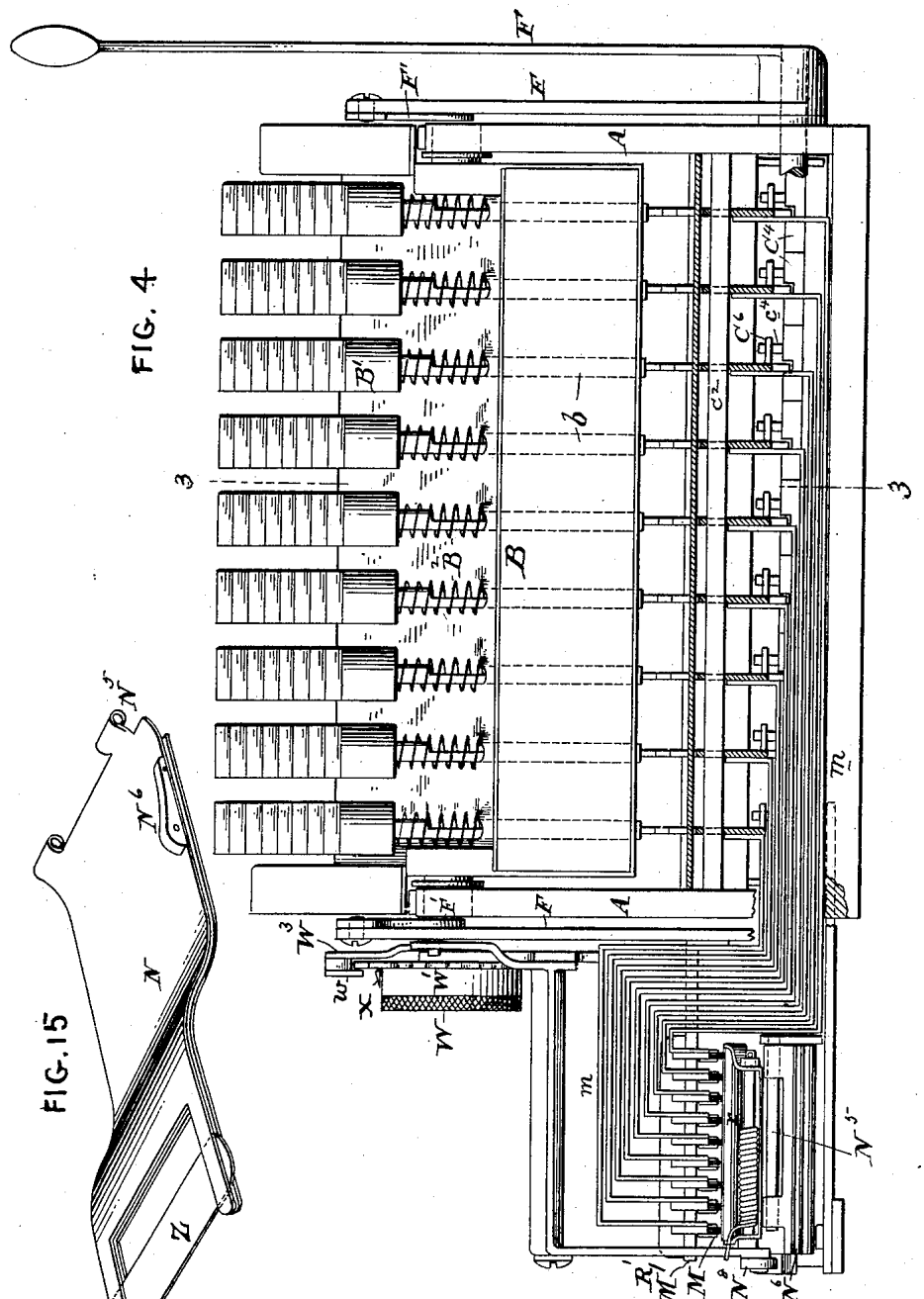

FIG. 15

WITNESSES:
Henry Drury
R. M. Kelly

INVENTOR:
Charles C. Clifford
By his Atty
J. M. Clarke

No. 627,571. Patented June 27, 1899.

C. C. CLIFFORD.

ADDING MACHINE.

(Application filed Apr. 28, 1898.)

(No Model.) 6 Sheets—Sheet 5.

FIG. 12

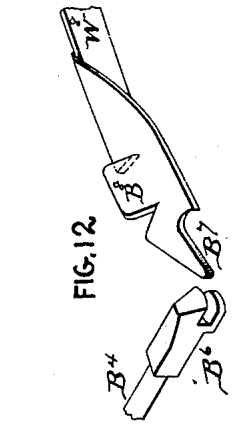

FIG. 5

WITNESSES:

Harry Drury

R. M. Kelly

INVENTOR:

Charles C. Clifford

By his atty

No. 627,571. Patented June 27, 1899.

C. C. CLIFFORD.

ADDING MACHINE.

(Application filed Apr. 28, 1898.)

(No Model.) 6 Sheets—Sheet 6.

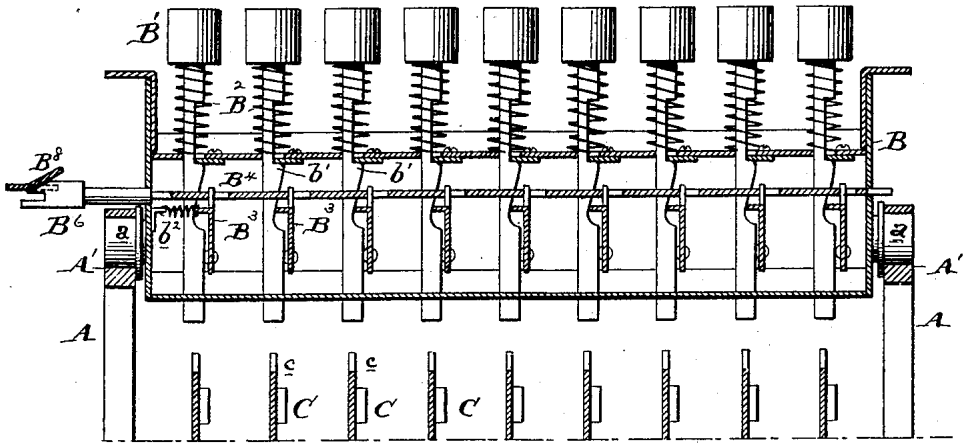

FIG 8

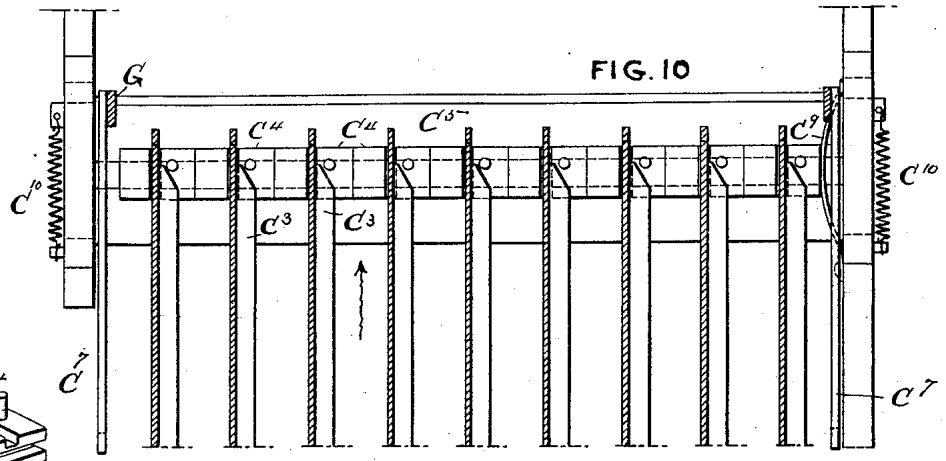

FIG. 10

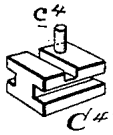

FIG. 11

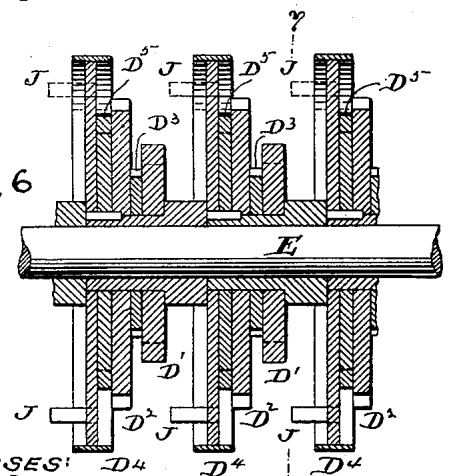

FIG. 6

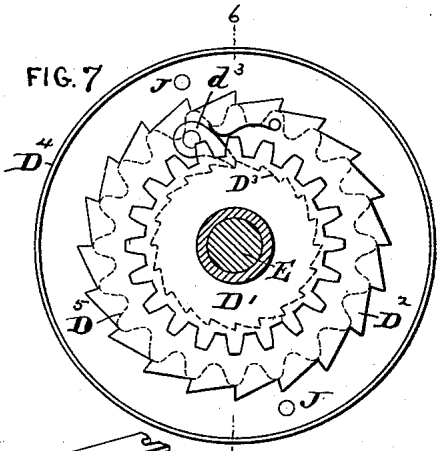

FIG. 7

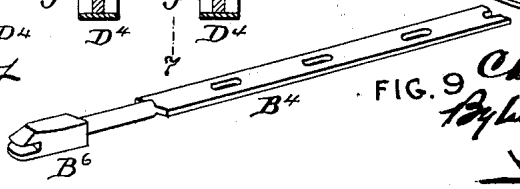

FIG. 9

WITNESSES:

Henry Drury

R. M. Kelly.

INVENTOR:

Charles C. Clifford

By Lucius Ally

UNITED STATES PATENT OFFICE.

CHARLES C. CLIFFORD, OF ALLENTOWN, PENNSYLVANIA.

ADDING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 627,571, dated June 27, 1899.

Application filed April 28, 1898. Serial No. 679,064. (No model.)

To all whom it may concern:

Be it known that I, CHARLES C. CLIFFORD, of Allentown, Lehigh county, 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 of certain improvements, which are fully set forth in the following specification and are shown in the accompanying drawings, which form a part thereof.

This application is particularly directed to improvements upon the structure set out in Letters Patent No. 602,154, dated April 12, 1898, granted to me, the machine therein set out being a suitable construction of adding-machine and register having automatic capacity for adding any number of rows of figures, so that at a glance the total amount may be ascertained. In connection therewith is provided a suitable printing or recording device for printing upon a slip or sheet of paper the successive rows of added figures, thus affording a visual record of the amounts added and the keys struck, while the register indicates 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 indicates any mistakes which he might have made in striking the keys. Under certain manipulation the machine may also be made to multiply.

My improvements comprehend certain features for automatically controlling the key-locking mechanism to release and unlock the keys only after a given number of relative reciprocations between the keyboard and registering devices for use in employing the machine for multiplying. These further comprehend, in a machine, of this class means for throwing the printing or registering devices out of action, so that the printing may be accomplished when the registering devices are not being operated—as, for example, when it is desired to carry forward a sum total to a new page. My improvements also provide for putting the printing devices out of action when required. I also provide suitable cushioning devices to prevent too great a jar upon the forward-and-return movement of the keyboard and transfer-frame. Aside from these features my improvements include numerous specific details of construction pointed out hereinafter.

I have shown the keys, dials, and type adapted to the ordinary numbers, and, while this is specially useful in computing in the metric system or in money denominations of the United States and Canada, it will be readily understood that the keys, dials, and type may be formed with other marks to correspond to the money values of the country in which the apparatus may be used. It is also to be understood that in so adapting the machine more or less keys may be used in a set, and more or less sets may likewise be employed.

My invention will be better understood by reference to the drawings, in which—

Figure 1 is a side elevation of my improved machine with the casing removed 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 an end view of my improved machine with a portion of the frame broken away. Fig. 5 is a plan view 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. 3. Fig. 9 is a perspective view of the key-releasing bar. Fig. 10 is a sectional plan view on line 10 10 of Fig. 3. Fig. 11 is a perspective view of one of the locking-blocks for the step-bars. Fig. 12 is a perspective view of the key-releasing devices. Fig. 13 is a perspective view of the inking device. Fig. 14 is a perspective view of one of the type-bars. Fig. 15 is a perspective view of the paper-guide. Fig. 16 is a perspective view of a portion of the transfer-frame, and Fig. 17 is a perspective view of a portion of the registering-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 on rollers *a*. The keyboard is provided with a series of sets of keys B′, having shanks *b* extending downward and suitably guided

in the keyboard. Springs B^2 cause the keys to rise normally. Spring-actuated 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 comprises 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 slots 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 held in position to be operated by the action of the locking-bars and their springs b^2, Figs. 3 and 8. The keyboard is moved forward by a hand-lever mechanism F through links F' and returned by the action of the springs S', referred to later. When the keyboard B is moved by pressing upon the lever F, the beveled head B^6 passes under the spring-cam B^7 on the end of the pivoted lever W^8 and is not forced inward; but upon the reverse movement of the carriage the notch in the end of the head B^6 receives the cam edge B^7 and the head is forced laterally, carrying with it the bar B^4 and thereby releasing all of the depressed keys. Just as soon as the head passes the cam B^7 it moves outward again under the action of the springs b^2 and locking-bars B^3 and the inclined edge wedges under the inclined leaf B^8, Figs. 1, 5, and 8, and lifts the cam edge B^7, so that the head will not be operated upon the next forward movement of the carriage. Normally the locking-bars will automatically release the locked keys with each complete reciprocation; but when adding duplicate numbers or when multiplying, the locking-bars should not be operated for a given number of reciprocations of the carriage, and to secure this result I provide special means, (shown in Figs. 1, 3, 4, and 5,) and which I will now describe.

W is a dial having upon its face numbers "1" to "9." It also has nine long ratchet-teeth W^2, corresponding to the numbers, and nine shallow teeth W', arranged about the dial. The dial is movable by hand and also by a pawl w, carried by the arm W^3, hinged to the lever W^5. The lever W^5 is moved toward the dial by a spring W^6 and in the other direction by the pin W^7 on the link F' striking its free end. In this manner the pawl w is reciprocated with each reciprocation of the carriage B and keyboard and operates the dial W by striking the teeth W^2, successively imparting a step-by-step movement. When the carriage B is in its normal position, a pin n on the link F' presses upon the extension W^4 of the pivoted arm W^3 and holds the pawl w clear of the teeth W', so that the dial W may be turned and set. The moment the carriage moves forward the pawl w is permitted to drop down into operative position. Now, assuming that it is required to add a given number five times, (which is equivalent to multiplying it by five,) I turn the dial W until the figure "5" comes in line with the pointer X, Fig. 5. The carriage B may now be reciprocated five times before the depressed keys are released. The reason of this is that when the dial is turned the teeth W' operate on the heel of the pivoted lever W^8 and raise the cam B^7 out of the path of the head B^6. As the pawl w moves the dial one tooth W^2 with each reciprocation of the carriage B, it follows that the carriage B may be reciprocated five times without releasing the depressed keys; but when five teeth have been moved the lever W will pass off the teeth W' and oscillate, and thereby the cam B^7 will be restored to operative position and on the next reciprocation will cause the locking-bars to release the keys. Thus, if one hundred and twenty-five is to be multiplied by five, the dial W is set for "5" and the keys B' are depressed corresponding to "125." The lever F is then depressed five times, and this will cause the registering-dials to record five times one hundred and twenty-five, or "625." It is also to be remembered that this is equivalent to adding five successive numbers of one hundred and twenty-five. If, however, it is desired to add two thousand and ninety to one hundred and twenty-five, the keys B' corresponding to "125" are depressed and the lever F operated. Then the keys "2" and "9" corresponding to the thousand and ten columns, respectively, and the lever F are again depressed. This will add the said numbers and the dials will register "2215."

In multiplying by two or more numbers the dial W is operated, as above, with each number of the multiplier; but in so doing the keys are set with same numerals, but corresponding to the high positions on the keyboard—as, for instance, the tens, hundreds, or thousands for the lowest figure, according as the multiplying number is in the tens, hundreds, or thousands position. In this manner any numbers may be multiplied. Thus if it is required to multiply one hundred and twenty-five by fifty-eight the keys B' corresponding to "125" are depressed and the dial W set to "8" and the lever F then depressed eight times. Then the said keys B' are released and other keys of the same numerals, but of the next higher order—namely, "1250"—are depressed, the dial W is set to the "5" mark, and the lever F is depressed five times. This will register "7250" on the registering-wheels.

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. This construction of the

teeth b' is clearly set out in my former patent, No. 602,154, of 1898, and no claim is made to this feature in this application. The keyboard may be reciprocated in any suitable manner. As shown it has a detachable connection with a transfer-frame G, directly reciprocated by hand-lever F and links F'. The detachable connection is clearly shown in Figs. 3 and 5. It consists of a locking-lever I', pivoted to the carriage B and forced downward by a spring f, so as to hook over a sharp edge G^2 on the transfer-frame G. When the frame G is moved forward by the links F', it pulls the keyboard and carriage B with it. When the full movement of the carriage is made and the dials moved, the arm I^2 of the locking-lever I' strikes the stop I^3 and releases the carriage from the frame G. At the same time the lever I' locks itself upon the downwardly-extending lug I^4, which is received in the notch I^5. This holds the carriage B in position until the return of the transfer-frame G. To make the parts move smoothly, I prefer to carry the transfer-frame G on the carriage B by sliding connections G^3. Springs G^4 tend to bring the carriage and frame normally together, but permit the transfer-frame to move after the carriage has been disconnected and arrested. The frame G has been called the "transfer-frame" because it is the frame which carries the pawls I, which produce the transfer of the amounts from one registering-wheel to the next. The corresponding part has been heretofore called the "transferring-frame" in my former patent, No. 602,154, of 1898, and it has become known by that name.

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 shown in Fig. 2. H is a rack movable with the transfer-frame G. H^4 is a pivoted two-point pawl and has an obstruction H^5, adapted to snap to either side of a spring-tooth H'. The pawl H^4 has also a downwardly-extending arm h. The rack H has at each end a pin H^3 to strike the arm h and oscillate the pawl, so that first one of its teeth engages with the rack and then the other. As shown, the forward movement of the carriage and transfer-frame must be completed before they can be returned, because the left-hand pin H^3 must strike the arm h and tilt the pawl H^4 before the rack can be returned. Likewise in the return movement a full return must be made before the machine can be again operated for registering. Any other suitable means may be substituted for insuring these movements.

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 sufficiently 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 and ratchet-wheel 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 and ratchet-wheel D^3 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. A suitable spring S' returns the rack and step 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 nine sets of keys; but it is self-evident that there may be more or less of said sets of keys employed, as desired.

The return movement of the frame G operates upon all of the step-bars C previously moved in registering and returns them all to their normal position, as shown in Fig. 3, 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 lever K′, pivoted to a transverse bar K^5, secured to the main frame. The transverse bar may be of any suitable construction, and, as shown, is provided with projecting portions, to which the levers K′ are pivoted, said projections being treated as a portion of the bar. The upper end of the lever 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 lever below its pivot-point and locks with the lower edge of the frame K^5. The shape of the pawl K^4 is immaterial so long as the principle of its operation remains the same. In this position the pin *k* at the lower part of the lever is out of alinement with the transfer-finger I, pivoted at G′ on the transfer-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 lever, and consequently will not operate it. 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 lever 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 lever 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 K^4 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 when a transfer device is tripped after the transfer-fingers I were fully moved and did not have the opportunity to register the shield L will be held under the sight-opening L′ in the case to prevent the numbers on the dials being read, and thereby indicating that a second movement is required to the frame G. The shield L is shown as being a flat plate extending over the several dials and is pivoted to the shaft E, as indicated in Fig. 3, so as to move over the periphery of said dials. Its movement to uncover the dials is secured by a counterweight *l* or other equivalent means—such, for example, as an ordinary coil-spring. The several pawls K^3 of the dial-operating mechanism are provided with upwardly-projecting pins L^2, which are adapted to push the shield L over to close the sight-opening L′ with each forward movement of such pawls. As the last registering-dial does not operate a pawl, it is made to operate a shifting device L^3 for moving the shield to maintain it permanently closed when the maximum capacity for registration has been reached, as will be explained later on. 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 by the projection L^2 against the action of a weight or spring *l* and remains in this position until the transfer is positively made. The transfer-fingers I are flexibly supported, 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" is on the dials and one is added, the first movement of the frame G will turn the first dial to the proper number and set the transferring devices for the second dial, and this will necessitate a second movement of the frame G without operating any of the keys to complete the transference of "1" to the third dial. Without the second movement the sight-openings are covered and the dials could not be read. If a further addition is made, a separate second movement will not be required as a special operation, as the next additions made will produce such a movement. The same will be the case if the numbers are "999," only in this case a further additional movement will 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.

While the last registering-dial of the series is not required to have a transfer device for registering, nevertheless it is advantageous

to provide it with means to operate the shield L, as above, to indicate that the capacity of the machine has been reached. To do this, I provide the same parts K' K^4, but do not require the pin *k* or the transfer-pawl I. Furthermore, as there is no dial of a higher order to move, the pawl K^3 is substituted by the slide L^3, which moves the pivoted shield L. This slide may also have an upward arm L^4 to be operated by the hand in case it is desired to withdraw the shield. This will be necessary under certain conditions, because there is no means to again automatically move or reset the lever K', carrying the slide L^3.

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 or sheet passes. The paper strip or page of a book may be fed or moved through the guide N in any suitable manner. As shown, the guide N is hinged at N^5 and is pressed upward toward the type M by a spring N^4. It is pressed downward against the action of the spring by a roller N^8, moving on a cam-surface N^6, attached to the guide. A frame R carries at its free end the inking-roller *r*, adapted to travel under all of the type-bars M, so as to ink the type. This frame R is pivoted at the end of the lever R' and is pressed upward by a spring R^2. The lever R' is reciprocated to shift the inking-roller by the lever F through the pin R^3 in one direction, while the spring R^4 moves it in the other direction. This insures the shifting of the inking-roller. The roller N^8 is carried on the end of the lever R', so that when the inking-roller moves forward to ink the type the guide N is depressed out of the way. N^2 is a feeding-roller carried with the guide and is combined with a ratchet-wheel N^7, which is operated by a pawl N^9 to turn the roller and feed the paper when the feeding-roller is depressed with the guide. The guide N may be provided with a transparent portion Z at its free end, if desired, to guide the paper and yet permit reading the numbers printed. The printing would take place between the transparent piece and body of the guide through the aperture formed thereby. 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. 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 has at its upper end a pivoted spring-pawl device having a shoulder O', adapted to catch upon a stop O^2. This pawl is actuated by a pin O^3 to release the lever O at one time and to reset it in the position shown in Fig. 1 at another time. 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 and the pin O^3 will have approached the lever O and will next strike the surface O^4 and depress the pawl from the stop O^2, permitting the spring T to operate the printing-hammer. Upon the return movement of the keyboard the pin O^3 catches upon the shoulder O^5 of the pawl and draws the lever O back to the position shown in Fig. 1, when it is again locked by the pawl O'.

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, 4, 10, and 11.) The lower parts of the step-bars C are provided with downwardly-projecting portions or pins C^6 and also with lateral cam portions C^3, 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 Figs. 3 and 10. 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 hooked rods C^7, 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 pins C^6 of 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.

Every one of the step-bars which has 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 "1000," and this is true whether we assume the amounts to be printed as made up of cents and dollars or of dollars alone. The small movement to the step-bars when printing the zeros 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 allowing of the movement of the type-bar and its corresponding step-bars 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.

When it is desired to lock the printing mechanism against operation, the lever U^2 is moved so as to throw the catch U^3 over the free end of the lever O to prevent the hammer of the printing device working and at the same time to press the locking-lever U down at its free end to lock the inking-frame R against reciprocation. This latter function is accomplished by the projection U′ striking the short arm of the lever U. When the parts are in position for operating, the lever U^2 is turned so that the arm O is liberated and the portion U^3 strikes the lever U and raises it clear of the pin on the inking-frame R, as will be readily understood.

Under some conditions it is desirable to operate the printing devices without the registering mechanism, (as for printing the sum total of amounts printed and added,) and to permit this I provide the following construction: The racks D are carried at their free ends upon a transverse bar S, which is pressed upward by springs S^2. This bar may be moved upward or downward by an arm S^3 on a rock-bar S^4, which has upon its end a lever S^5, adapted to be moved by hand. When it is desired to throw the registering devices out of action, the lever S^5 is moved back until the pin S^8 catches in the notch of the spring-catch S^6. In this position the guide S is lowered and the racks D are out of gear with the pinions of the registering devices. This device would be used when it is desired to print the sum total of the amounts printed without disturbing the registered amounts.

The arm S^5 is automatically liberated at the end of the reciprocation for printing by the end of the rack H striking one arm of the pivoted lock S^6. The springs S^2 then raise the bar S and throw the racks D into gear with the registering mechanism.

As an additional feature for clearly indicating between the sums to be added and the sum total in the printing I may employ a pivoted type-bar Y, Figs. 1 and 5, which may be swung around on its pivot to come in line with the impression-hammers. Then if the registering devices are disconnected by drawing forward and latching the arm S^5 the reciprocation of the keyboard without any keys depressed will cause the printing of the transverse line. At the same time the end of the rack H will strike the lower arm of the lock S^6 and automatically liberate the arm S^5. This will allow the racks D to be forced upward again by the springs S^2 and S into operative connection with the registering devices. This same automatic releasing of the arm S^5 will take place at all times after latching said arm, but I do not confine myself to this automatic releasing of the arm and throwing of the registering devices into operative connection with the keys, as it may be accomplished by hand, if so desired.

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 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. To reduce the jar to a minimum, I provide a cushioning-cylinder A^2, having pistons and rods A^3, which connect with the frame G. The cushioning-cylinder may have holes at a short distance from each end, so as to permit the piston to move easily until it approaches each end, or this provision may only be had at one end to cushion the forward motion of the transfer-frame. In this manner the frame G in its forward movement is arrested smoothly and also the frame and keyboard when released come to a stop without jar, and, aside from eliminating much noise, prevents excessive wear coming on the parts.

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.

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

1. In an adding or calculating machine, a series of sets of keys, a series of registering devices operated by said keys, means for causing a relative reciprocation between the keys and registering devices whereby they move to and from each other, a single set of au-

tomatic locking devices for holding one or more of the keys in operative position when depressed in the normal operation of the machine when adding or registering, a movable part to operate the locking devices to release the keys, and automatic devices independent of said locking devices but acting upon the movable part to cause the said locking devices to be operated only after a predetermined number of relative reciprocations between the keys and registering devices to release the keys, the parts being adapted to permit the same locking devices to be operated independently or in conjunction with the automatic devices as desired.

2. In an adding or calculating machine, a series of sets of keys and registering devices relatively movable to and from each other to insure the operation of the registering devices, locking devices for holding one or more of the keys in operative position, and automatic devices independent of said locking devices for causing the said locking devices to be operated to release the keys only after a predetermined number of reciprocations consisting of a movable lock-releasing part adapted to be thrown into or out of operative position, a movable rack having a cam-surface adapted to hold the movable lock-releasing part out of operative position except for one position of adjustment of said movable rack, and means to intermittently move the rack with each relative reciprocation of the keys and registering devices.

3. In an adding or calculating machine, the combination of registering devices with a movable keyboard and keys thereof, a lock-releasing device for simultaneously releasing any of the keys which are locked in operative position, a movable tripping device adapted to operate upon the lock-releasing device when desired, a pivoted disk rotating on a fixed axis and having a cam-surface formed thereon and adapted to operate at one position in its movements to throw the tripping device into tripping position, and hand-controlled means for simultaneously reciprocating the keyboard and operating upon the teeth of the pivoted disk whereby the said disk is moved one tooth with each reciprocation and the tripping device is thrown into tripping position after a predetermined number of reciprocations of the keyboard.

4. In an adding or calculating machine, the combination of a lock-releasing device to release the keys which may be moved into operative position, a movable tripping device for operating the lock-releasing device, a pivoted disk W having a cam-surface adapted to be adjusted by hand so as to throw the lock-releasing device out of operative position, and intermittently-acting devices under the control of the operator in moving the registering mechanism to move the said disk one tooth with each registration whereby a series of duplicate registrations may be made and the disk ultimately turned to operate the tripping device to insure under normal operation the subsequent registration of a series of other amounts to the amount already registered.

5. In an adding or calculating machine, the combination of registering devices, a reciprocating transfer-frame, hand devices for reciprocating said transfer-frame, a keyboard having a series of sets of keys, connecting devices whereby said keys operate the registering devices, and a locking device for alternately connecting the keyboard to the transfer device and main frame, whereby the keyboard is first moved with the transfer-frame for a portion of its movement and then locked to the main frame in a stationary position during the further movements of the transfer-frame and until its return.

6. In an adding or calculating machine, the combination of registering devices, a reciprocating transfer-frame, hand devices for reciprocating said transfer-frame, a keyboard having a series of sets of keys, connecting devices whereby said keys operate the registering devices, and a locking device for alternately connecting the keyboard to the transfer device and main frame whereby the keyboard is first moved with the transfer-frame for a portion of its movement and then locked to the main frame in a stationary position during the further movements of the transfer-frame and until its return, and a cushioning device for cushioning the terminal movement of the transfer-frame.

7. In an adding or calculating machine, the combination of registering devices including transferring mechanism, a reciprocating transfer-frame, a keyboard having a series of sets of keys, mechanism adapted to be operated by the keys for moving the registering devices, a spring-lock I′ carried by the keyboard and having a laterally-extending projection L^2 and locking-shoulders above and below its free end one of said shoulders being adapted to lock the keyboard to the transfer-frame, a locking projection I^4 on the main frame adapted to act in conjunction with the other of said locking-shoulders of the lock for holding the keyboard in position, and a stop or projection I^3 adapted to act on the lateral projection I^2 of the pivoted lock for the purpose of making the said lock release the transfer-frame and lock itself on the projection I^4, whereby the keyboard remains stationary while the transfer-frame continues its movement to complete the transferring operation.

8. In an adding or calculating machine, the combination of registering devices, a keyboard containing a series of sets of keys, step-bars operated by said keys, means to reciprocate the keyboard, and hand-controlled devices operating on the step-bars for connecting or disconnecting them in operative relation with the registering devices.

9. In an adding or calculating machine, the combination of registering devices, a keyboard containing a series of sets of keys, step-bars operated by said keys, means to recip-

rocate the keyboard, and devices for connecting or disconnecting the step-bars in operative relation with the registering devices consisting of racks jointed to the step-bars, a vertically-adjustable guide for guiding the free ends of the racks into or out of connection with the pinions of the registering devices, and hand-controlled devices for operating said guides.

10. In an adding or calculating machine, the combination of registering devices, a keyboard containing a series of sets of keys, step-bars operated by said keys, means to reciprocate the keyboard, hand-controlled devices for connecting or disconnecting the step-bars in operative relation with the registering devices, locking devices for holding the keys in operative position for actuating the step-bars, lock-releasing mechanism for simultaneously releasing all of the keys, automatic devices acting upon the lock-releasing devices to cause the keys to be released after a given number of reciprocations of the keyboard, and printing devices operated by the step-bars whereby duplicate printing may be accomplished without disturbing the registering devices.

11. In an adding or calculating machine, the combination with registering devices, of movable type controlled by the keys for operating the registering devices, a movable impression-hammer for pressing the paper against the type, a spring to throw the hammer into operation to print, a trip to release the hammer immediately after the registration has been made and type moved, and a lock to hold the impression-hammer out of operation.

12. In an adding or calculating machine, the combination with registering devices, of movable type controlled by the keys for operating the registering devices, a movable inking device for the type, a movable impression-hammer for pressing the paper against the type, a spring to throw the hammer into operation to print, a trip to release the hammer immediately after the impression has been made and type moved, and a lock to hold the movable inking device for inking the type from movement.

13. In an adding or calculating machine, the combination with registering devices, of movable type controlled by the keys for operating the registering devices, a movable impression-hammer for pressing the paper against the type, a spring to throw the hammer into operation to print, a trip to release the hammer immediately after the impression has been made, and a locking device for simultaneously holding the inking device and hammer out of operation.

14. In an adding or calculating machine, the combination of registering devices actuated by a movable hand-operated part, printing devices having a pivoted impression-hammer, a spring to move the impression-hammer in the act of printing, a stationary stop O^2 and a pivoted pawl device O', O^4 O^5 carried by the hammer and operating in connection with said stop for releasing and resetting the impression-hammer in striking position and adapted to be tripped and returned under the action of the hand-operated part of the registering devices.

15. In a printing device for a calculating-machine, the combination of a series of sets of keys, a series of type adapted to be adjusted or moved into printing position by the operation of the keys, a movable hammer or platen, a paper-guide interposed between the type and the movable hammer or platen, feeding devices for the paper adapted to be put into operation by a depression of the paper-guide, a cam on the paper-guide, a spring to press the paper-guide upward close to the type, and means operated by the type-adjusting mechanism acting upon the cam-surface for alternately controlling the upward movement of the paper-guide under the action of the spring, and also positively depressing the paper-guide for the purpose of putting the feeding device into operation to feed the paper through the guide.

16. In a printing device for a calculating-machine, the combination of a series of sets of keys, a series of type adapted to be adjusted or moved into printing position by the operation of the keys, a movable hammer or platen, a paper-guide interposed between the type and the movable hammer or platen, feeding devices for the paper adapted to be put into operation by a depression of the paper-guide, a cam on the paper-guide, a spring to press the paper-guide upward close to the type, means operated by the type-adjusting mechanism acting upon the cam-surface for alternately controlling the upward movement of the paper-guide under the action of the spring and also positively depressing the paper-guide for the purpose of putting the feeding device into operation to feed the paper through the guide, and a movable inking device operated by the devices which operate upon the cam and paper-guide whereby the inking device is moved out of position when the paper-guide moves toward the type.

17. In a printing device for calculating-machines, the combination of a series of type-bars movable under the action of keys and hand-operated mechanism, a movable printing hammer or platen, a pivoted paper-guide having its free end movable between the printing-hammer and type-bars, a longitudinally-movable inking device adapted to travel against the type to ink them, and means for simultaneously moving the inking devices out of the way and raising the paper-guide close to the type-bars in the act of printing.

18. A paper-guide for a printing device of a calculating-machine consisting of the two plates forming the grooved guide N having a transparent transverse guide Z at its free end formed of celluloid or other transparent material and an open space between the said

transparent transverse guide Z and the body of the paper-guide N.

19. In an adding-machine, the combination of a series of registering devices, a series of keys for operating the registering devices, hand devices for reciprocating the keys to or from the registering devices, connecting mechanism actuated by the keys for moving the registering devices, a rack H movable with the reciprocating keys and provided with two pins H^3, a pivoted double-acting pawl H^4 on the main frame having an arm h in the path of the pins to oscillate the pawl, and a spring device to hold either of the pawl-teeth into engagement with the rack according to the direction in which it is moving.

20. In an adding or registering machine, the combination of the registering devices having the highest registering wheel or dial provided with a pin, a sight-opening for reading the registering devices, a shield movable for the purpose of closing the sight-opening when the maximum capacity of the machine has been registered, a mechanically-actuated part for moving the shield to close the sight-opening, and a lock to hold the mechanically-actuated part out of operation adapted to be released by the pin or projection on the registering device.

21. In an adding or registering machine, the combination of the registering devices having the highest registering wheel or dial provided with a pin, a sight-opening for reading the registering devices, a shield movable for the purpose of closing the sight-opening when the maximum capacity of the machine has been registered, a mechanically-actuated part for moving the shield to close the sight-opening, a lock to hold the mechanically-actuated part out of operation adapted to be released by the pin or projection on the registering devices, and a hand-operated part for liberating the shield and resetting the locking device and mechanically-operated part.

22. In an adding or calculating machine, the combination of registering devices, a keyboard, connecting devices controlled by the keys and adapted to operate the registering devices, hand-operated means for moving the connecting devices, means independent of the hand-operated means which move the connecting devices for throwing the connecting devices into operative connection with the registering devices but without registering, a lock independent of the hand-operated means to hold the connecting devices out of operative connection, and automatic tripping devices independent of but actuated by the hand-operated means for releasing the lock to throw the connecting devices into operative connection.

23. In an adding or calculating machine, the combination of registering devices, a keyboard, connecting devices controlled by the keys and adapted to operate the registering devices, hand-operated means for moving the connecting devices, printing mechanism operated by the connecting devices, means independent of the hand-operated means which move the connecting devices for throwing the connecting devices into operative connection with the registering devices but without registering, a lock independent of the hand-operated means to hold the connecting devices out of operative connection, and automatic tripping devices independent of but actuated by the hand-operated means for releasing the lock to throw the connecting devices into operative connection.

24. In a calculating-machine a series of keys, a series of type moved by the keys, a printing hammer or platen to operate in conjunction with said type, and a movable line-printing bar adapted to be moved into printing position when the type are out of printing position.

In testimony of which invention I hereunto set my hand.

CHAS. C. CLIFFORD.

Witnesses:
ERNEST HOWARD HUNTER,
R. M. KELLY.