(No Model.) 4 Sheets—Sheet 1.

J. RICHARDSON & F. E. HEATH.

ADDING MACHINE.

No. 453,507. Patented June 2, 1891.

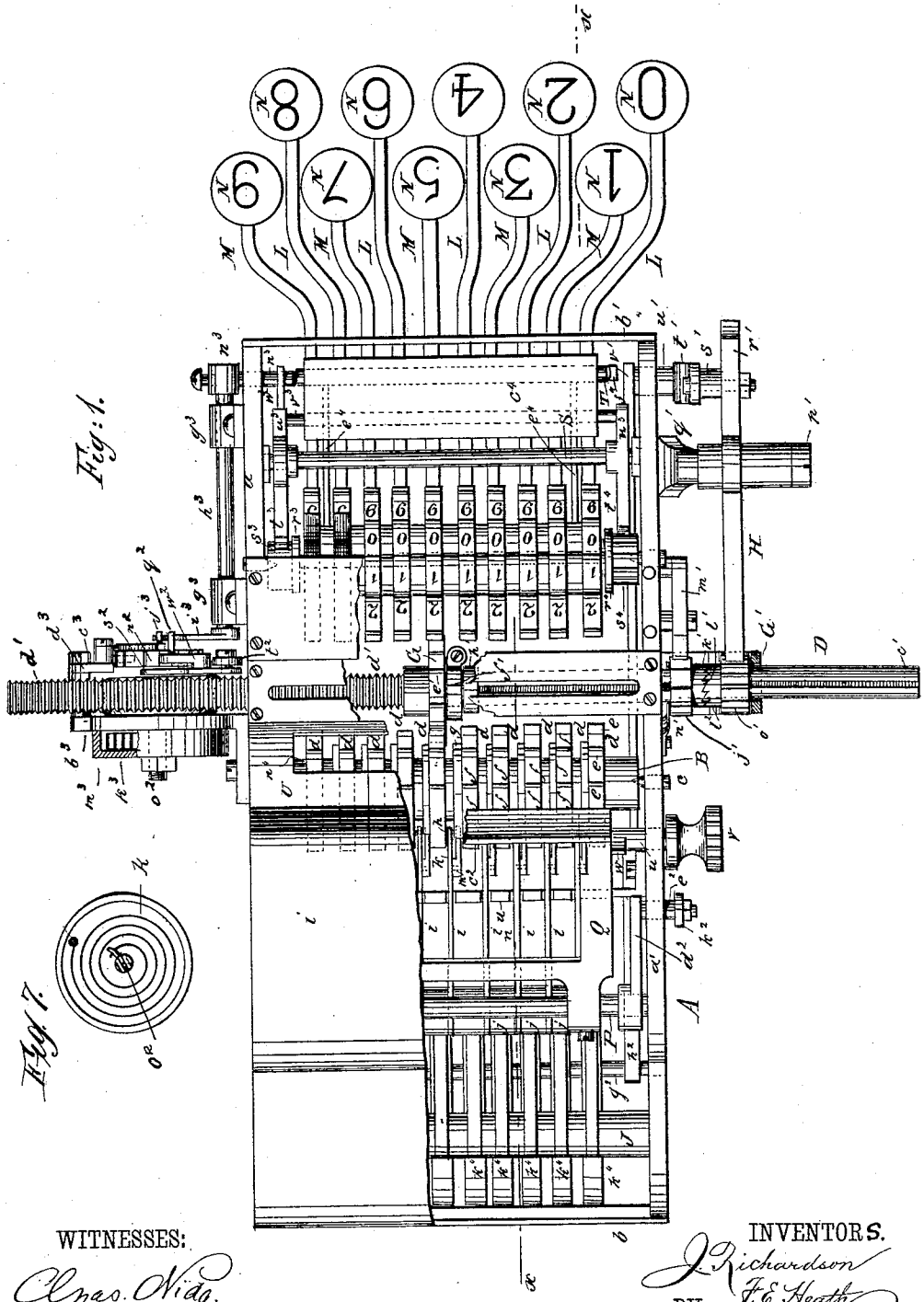


Fig. 1.

Fig. 7.

WITNESSES:

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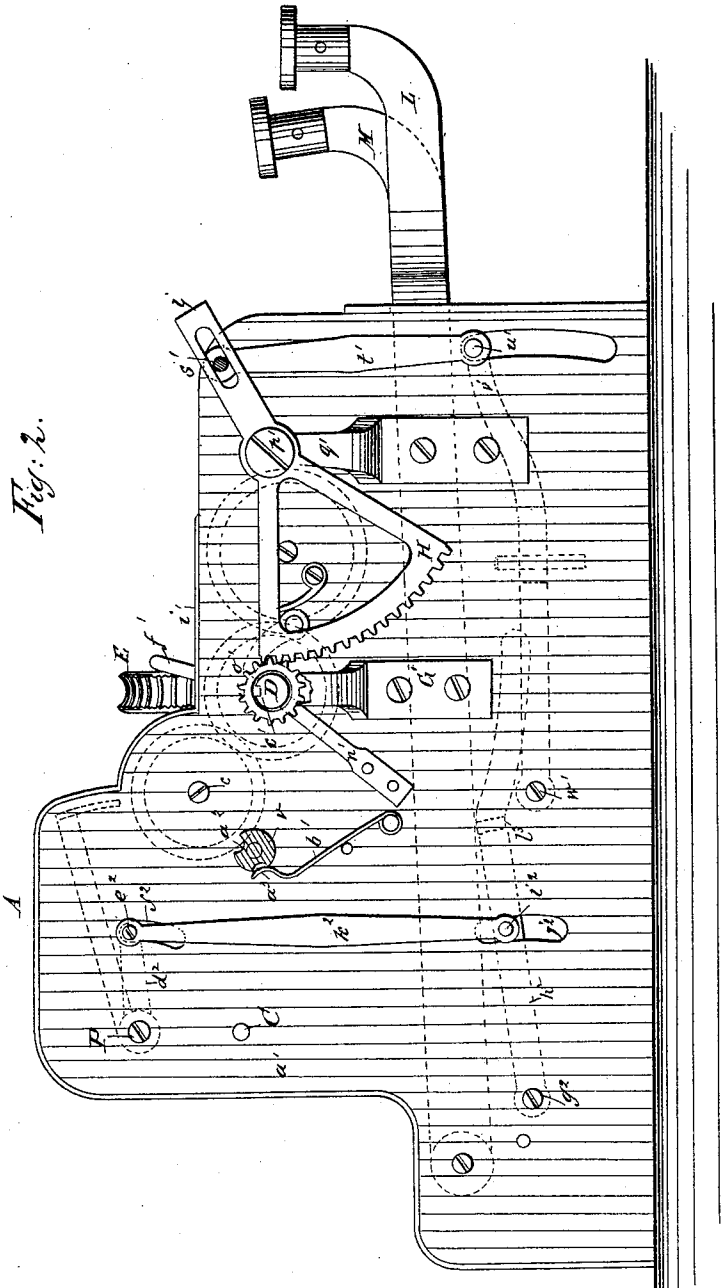
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Fig. 2.



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J. RICHARDSON & F. E. HEATH.

ADDING MACHINE.

No. 453,507. Patented June 2, 1891.

Fig. 4.

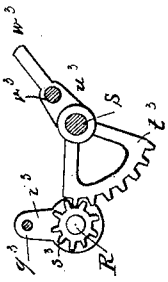
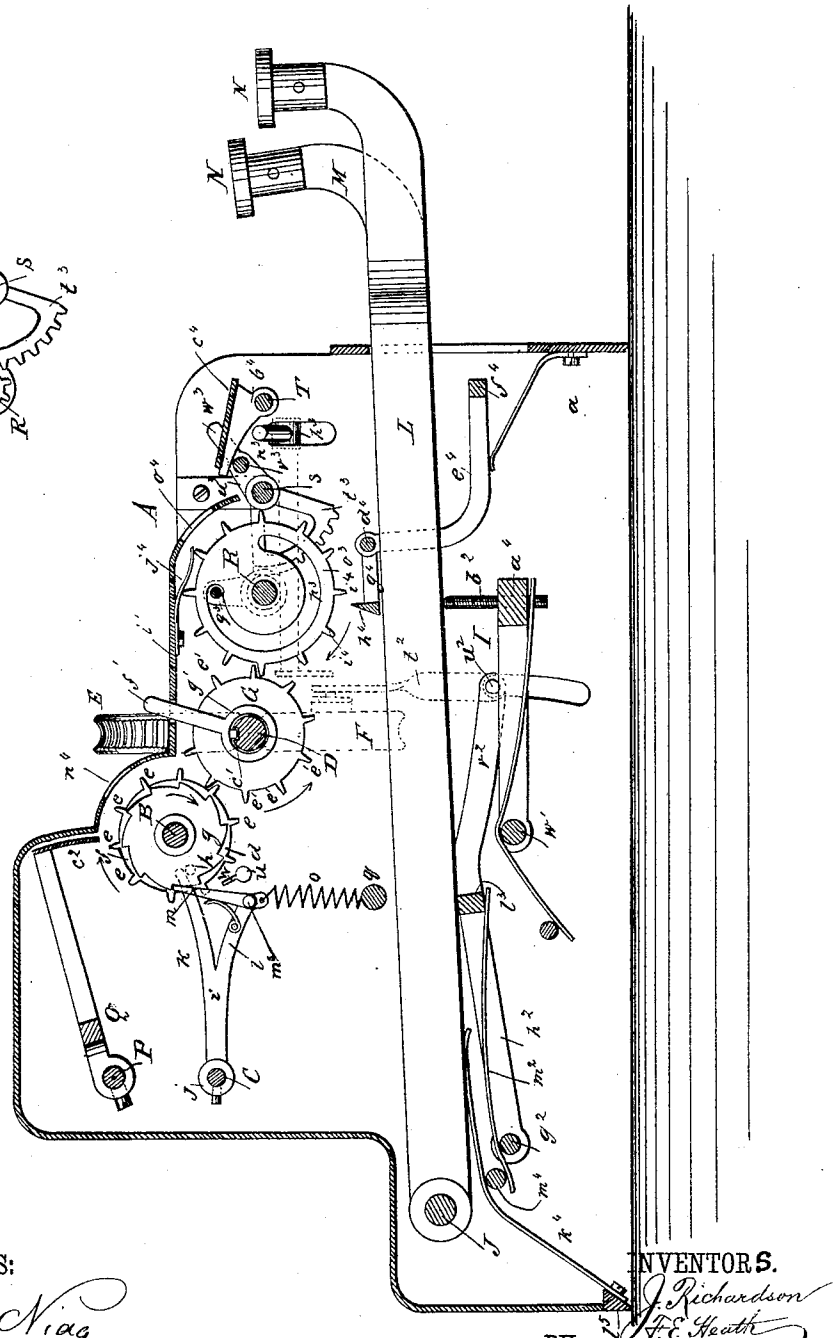


Fig. 3.



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ADDING MACHINE.

No. 453,507. Patented June 2, 1891.

Fig. 6.

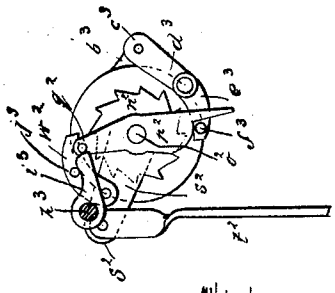
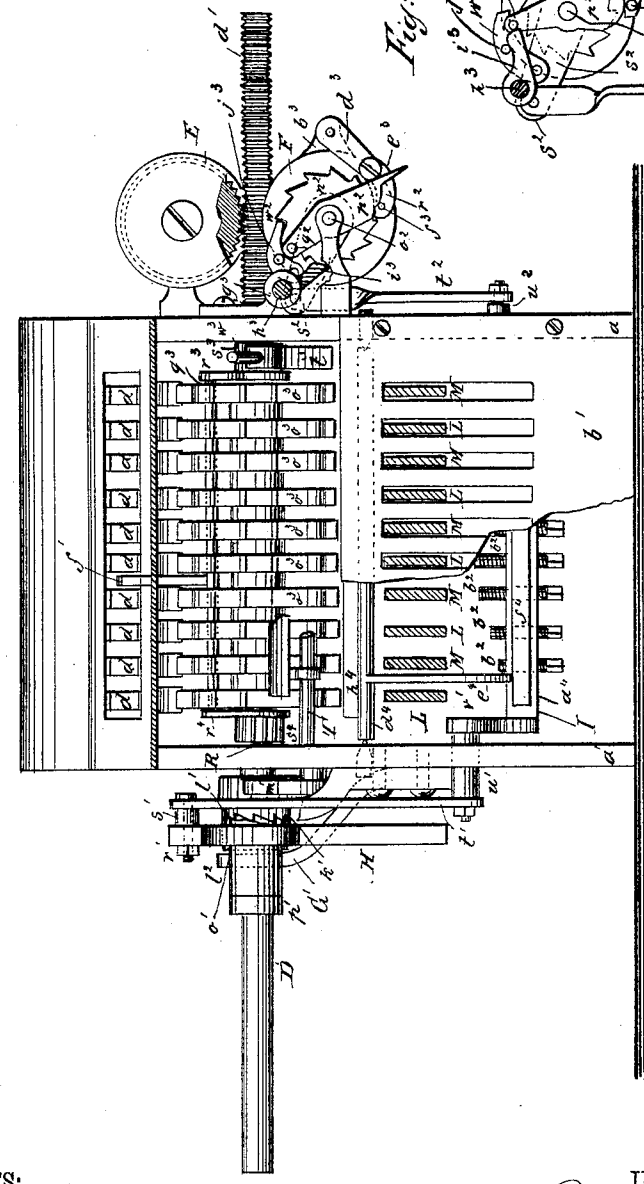


Fig. 5.



WITNESSES:

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UNITED STATES PATENT OFFICE.

JAMES RICHARDSON, OF NORTH TARRYTOWN, AND FRANK E. HEATH, OF NEW YORK, N. Y.

ADDING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 453,507, dated June 2, 1891.

Application filed April 14, 1888. Serial No. 270,635. (No model.)

To all whom it may concern:

Be it known that we, JAMES RICHARDSON, of North Tarrytown, in the county of Westchester and State of New York, and FRANK E. HEATH, of the city, county, and State of New York, have invented a new and Improved Adding-Machine, of which the following is a specification, reference being had to the annexed drawings, forming a part thereof, in which—

Figure 1 is a plan view of the machine with parts broken away to show the internal construction. Fig. 2 is a side elevation. Fig. 3 is a longitudinal section taken on line $x\,x$ in Fig. 1. Fig. 4 is a detail view of the read-justing mechanism of the verifying-wheels. Fig. 5 is a front elevation, partly in section, with the forward ends of the keys removed. Fig. 6 is a detail view of the feeding mechanism, and Fig. 7 is a detail view hereinafter referred to.

Similar letters of reference indicate corresponding parts in all the views.

The object of our invention is to construct a simple and accurate adding-machine.

Our invention consists in the combination, with a series of keys representing the figures from 0 to 9, of a series of registering-wheels, a series of verifying-wheels, mechanism for imparting motion to the registering and verifying wheels according to the number carried by each key-lever, and a novel positive carrying mechanism for causing any wheel of the series to carry one to the next wheel in order.

It also consists in the combination, with the registering and verifying wheels, of positive stops for preventing them from passing beyond the prescribed limit.

It also consists in the combination, with the feeding mechanism, of a let-off device for releasing the feeding-ratchets and a spring for returning the summation-wheel-turning mechanism to the point of starting.

The main frame A, which supports all the working parts, is formed of the side plates a a' and the end plates b b'. Upon pointed screws c, passing through the plates $a\,a'$ near their upper edges, is supported a spindle B, upon which are loosely mounted the summation-wheels d. Each summation-wheel d is provided with ten cogs or radial projections e, with intervening spaces f, upon which are impressed the figures from 0 to 9. A ratchet-wheel g, having as many teeth as there are spaces f in the summation-wheel, is attached to or formed upon the side of each summation-wheel except the first of the series, and from the opposite side of each summation-wheel except the last of the series projects a pin h, so placed that it just clears the end of the arm k, hereinafter described, at the point of starting and engages and moves said arm just before the summation-wheel to which it belongs completes its rotation.

Behind and slightly below the spindle B is fixed a rod C, upon which is placed a series of bars i, separated by intervening washers j. The ends of the bars i are forked, forming the arms $k\,l$. The arm k of each bar i projects into the space between two adjacent summation-wheels in position to be engaged by the pin h of one wheel, and the arm l carries a spring-actuated pawl m, pivoted to the said arm l by the stud m^5, which engages the ratchet-wheel g of the next summation-wheel d of the series. The stud m^5 projects beyond the pawl m and is capable of engaging the adjacent summation-wheel, as hereinafter described. The forked ends of the bars i are guided by a slotted plate n, extending across the frame A behind the summation-wheels, and the bars i are drawn downward in the slots of the said plate n by spiral springs o, connected with eyes p on the arm l and attached to a bar q, extending across the frame A. On the lower part of the slotted plate n are attached flat springs r, whose free ends are curved so as to present convex surfaces s to the cogs e, the said springs acting as brakes to the summation-wheels, also causing them to register.

A rock-shaft u extends across the frame A and is journaled in the side plates a a' and provided at one end with a milled head v, by which it may be turned. The rock-shaft u carries a feather w, which is adapted to engage all the pawls m above their pivots and between the arms k l and throw them out of engagement with the ratchet g when it is

desired to return the summation-wheels d to zero. The boss of the milled head v is provided with two notches a^2 a^3, which are engaged by the rounded end of a spring b', attached to the plate a'. One of these notches is designed to hold the feather w out of engagement with the pawls m, and the other is designed to hold the feather in engagement with the said pawls.

In front of the row of summation-wheels d is journaled a shaft D in the side plates a a' of the frame A. The shaft D is capable of sliding longitudinally through the frame A and is provided with a longitudinal groove c', which extends from a point near the center of the shaft to one end thereof. The opposite end of the shaft is grooved circumferentially to form a cylindrical rack d', which passes between toothed wheels E F, being engaged by both of the said wheels, so that when the lower one turns it will impart a longitudinal motion to the shaft D. Upon the said shaft D, between the plates a a' of the frame A, is secured a star-wheel G, whose teeth e' are adapted to engage the teeth e of the summation-wheels d, the said star-wheel being of about the same width as one of the summation-wheels. At the side of the star-wheel is placed an arm f', having a collar g' loosely embracing the shaft D and kept from sliding longitudinally thereon by a collar h', fixed to the shaft. The arm f' extends through a slot in the cover i' and serves as an index to show the position of the star-wheel with relation to the series of summation-wheels d.

Upon the shaft D, outside of the frame A and adjoining the plate a', is placed a ratchet j', provided with a feather (not shown) fitting in the groove c' of the shaft and furnished upon the outer side thereof with a boss k', provided with clutch-teeth l'. The ratchet j' is engaged by a spring-actuated retaining-pawl m', pivoted on a stud projecting from the plate a', and the ratchet is pressed outwardly in the direction of the length of the shaft D by a flat spring n', secured to the plate a'. The retaining-pawl m' is of such a length as to allow the ratchet j' to return a part of one tooth by frictional contact of the pinion o', hereinafter described, when this begins to return with the sector-lever. This brings the star-wheel G out of contact with the tooth of the summation-wheel with which it has been engaged, and allows it to move freely forward opposite to and ready to engage with the next summation-wheel.

Upon the shaft D, adjoining the boss k', is loosely placed a pinion o', provided with a feather fitting into the groove c' of the shaft. The boss of the pinion o' is provided with clutch-teeth l^2, which are engaged by the teeth l' of the ratchet j'. The pinion o' is held in its position upon the shaft D by the arm G', secured to the plate a' and extending upwardly outside of the said pinion, the arm being provided with an aperture for the passage of the shaft D.

On a stud p', projecting from an arm q', secured to the plate a', is journaled a toothed sector-lever H, which engages the pinion o'. The arm r' of the sector-lever H is slotted and carries a stud s', which is connected by a rod t' with a stud u', projecting through a slot in the plate a' from a lever v' within the frame A. The lever v' is formed integrally with a frame I, attached to the rock-shaft w', journaled in the side plates a a' of the frame A. A cross-bar a^4 of the frame I is provided with a series of screws b^2, which extend vertically above the bar a^4.

Upon a bar J, extending across the rear end of the frame A, are pivoted the key-levers L M, the levers L being longer than the levers M, the two series of levers carrying finger-plates N, which are made to alternate in position to economize space. The key-levers L M are arranged above the bar a^4 of the frame I and extend through slots in the front of the frame A, as shown.

The distance through which the star-wheel G is turned depends upon the distance through which the sector-lever H swings when one of the keys is depressed, and the screws b^2 in the bar a^4 vary in length according to the motion required in the wheel G to record the number represented by the key by which the wheel is turned. The greatest movement that frame I and lever v' are capable of making will turn the star-wheel G through nine-tenths of one revolution, thereby causing the summation-wheels d to register "9." The smallest motion which can be imparted to the frame I and lever v' is that which moves the star-wheel through one-tenth of a revolution and registers "1" on the summation-wheel. The screws b^2 are adjusted with reference to the keys and the number to which they correspond, so as to cause the keys to be engaged by the screws at that point in the downward movement of the keys which will cause the summation-wheel to turn through the required distance. For example, the 9-key begins to impart motion through the frame I and lever v' to the star-wheel at the beginning of its stroke, thereby causing the star-wheel to make nine-tenths of a revolution and add nine to the sum represented by the wheel it engages. The 8-key does not engage the screw b^2 corresponding with it until it has been depressed one-tenth of its stroke, and so on throughout the entire series of keys, the 1-key being arranged to push down the frame I and lever v', so as to cause only one-tenth of a revolution of the wheel G. The 0-key is able to move throughout its entire stroke without engaging the frame I or turning the star-wheel G.

In the frame A, behind and above the spindle B, is journaled a rock-shaft P, to which is attached a frame Q, which reaches forward over the series of number-wheels d and carries a curved stop-plate c^2, which is capable of being moved down between two of the rows of teeth e of the summation-wheels to check them and prevent them from moving beyond the

prescribed limit. To the rock-shaft P is fixed an arm d^2, carrying a stud e^2, which projects through a slot f^2 in the plate a' of the frame A.

To a rock-shaft g^2, journaled in the frame A below the keys L, is attached a frame h^2, which carries a stud i^2, which projects through a slot j^2 in the plate a' and is connected with the stud f^2 by a connecting-rod k^2. The frame h^2 is provided with a cross-bar l^3, which is supported normally in contact with all the keys L by a flat spring m^3, so that when any one of the series of keys is depressed the bar l^3 and frame h^2, of which it forms a part, are pressed downward, thereby imparting motion to the stop-plate c^2. By this construction whenever motion is imparted to any one of the summation-wheels d by depressing a key the stop-plate c^2 will be carried down in front of the advancing tooth e of the said summation-wheel and will prevent it from being carried beyond the prescribed limit.

To the shaft o^2 of the toothed wheel F is secured a ratchet-wheel n^2, and upon the shaft o^2, carrying the said toothed wheel and ratchet-wheel, is pivoted an arm p^2, which extends above and below the shaft. The upper end of the arm p^2 carries a stud q^2, and upon the lower end of the said arm is formed a cam r^2.

Between the toothed wheel F and the ratchet-wheel n^2 and upon the shaft o^2 is loosely placed an arm s^2, which is connected pivotally with the connecting-rod t^2, also connected with the stud u^2, projecting through a slot in the side of the frame A from an arm v^2 of the frame h^2. The arm s^2 carries a spring-actuated pawl w^2, which is adapted to engage the ratchet-wheel n^2.

To the bracket b^3, which supports one end of the shaft o^2, is secured a stud c^3, which supports an arm d^3, to the free end of which is pivoted a spring-actuated pawl e^3, provided with a stud f^3 and adapted to engage the ratchet-wheel n^2.

To the plate a of the frame A are attached ears g^3, in which is journaled a rock-shaft h^3, carrying a cam i^3, adapted to engage the stud q^2 of the arm p^2, and the pin j^3, projecting from the side of the pawl w^2. By means of this arrangement when the rock-shaft h^3 is turned in the manner presently to be described the pawl w^2 is lifted out of the ratchet n^2, and the arm p^2 is moved by the engagement of the cam i^3 with the pin q^2, thereby bringing the rounded lower end of the arm p^2 into engagement with the stud f^3, projecting from the pawl e^3, and lifting that pawl out of the ratchet n^2. The shaft o^2 is prolonged beyond the bracket b^3 to receive the inner end of a spiral spring k^3, the outer end of which is looped and received on a stud projecting from the bracket b^3. (See Fig. 7.) The spring is inclosed by a cap m^3, supported by the shaft o^2. When the wheel F is turned by the action of the pawl and ratchet in the manner presently to be described, power is stored in the spring k^3 for returning the wheel F and the shaft D to the point of starting after the release of the ratchet n^2. The forward end of the rock-shaft h^3 is provided with an arm n^3, which extends through a slot in the plate a into the frame A.

In the frame A, in front of the shaft D and slightly below the level of the shaft, is secured a rod R, upon which are placed the verifying-wheels o^3. The said verifying-wheels are provided with twelve cogs or radial projections, and in each wheel is formed a circular slot p^3 for receiving a rod q^3, which is carried by arms r^3 r^4, journaled on the rod R. To the arms r^3 r^4 are secured pinions s^3 s^4, which turn on the rod R.

In the frame A, parallel with the rod R, is journaled a rock-shaft S, carrying toothed sectors t^3 t^4, which engage the pinions s^3 s^4. The toothed sectors t^3 t^4 are provided with arms u^3, which carry a rod v^3, parallel with the shaft S. The arm u^3 of the sector t^3, adjoining the plate a, is provided with the finger w^3, which engages the arm n^3, carried by the shaft g^3.

In the frame A, in front of the shaft S, is journaled a rock-shaft T, carrying arms b^4, to which is attached a finger-plate c^4. The arms b^4 rest upon the rod v^3.

Below the rod R and wheels o^3, carried thereby, a rock-shaft d^4 is journaled in the side plates a a' of the frame A. To the said shaft d^4 are attached the curved arms e^4, carrying a cross-bar f^4 under the series of keys L, and to the same shaft d^4 are attached the arms g^4, which carry a bar h^4, adapted to engage the teeth i^4 of the verifying-wheels o^3. The teeth i^4 of the verifying-wheels are engaged by the teeth e' of the star-wheel, so that every movement of the star-wheel is registered upon the summation-wheels d and upon the verifying-wheels o^3. Each verifying-wheel is pressed by a curved spring j^4, which prevents it from moving too freely and also causes it to register. The keys L, when not being depressed by the fingers are supported by the springs k^4, secured to the cross-bar l^5 of the frame A and extending over a rod m^4, supported by the side plates a a' of the frame A.

The top of the machine is provided with a slot n^4, through which the summation-wheels d are viewed, and also with a slot o^4, through which the numbers upon the wheels o^3 are viewed, and the top U is provided with lines extending down across the slots n^4 o^4 to assist the operator in adjusting the arm f'.

The operation of our improved adding-machine is as follows: On touching a key—say the 3-key—the bar a^4, by the engagement of the lower edge of the key with the screw b^2 belonging to that key, is pressed downward a sufficient distance to turn the shaft D by the means already described, so as to carry the star-wheel G forward three notches, thereby

turning the summation-wheel with which the star-wheel is engaged three places forward from 0, displaying the figure "3" at the slot n^4 upon that wheel. The same depression of the key that turns the star-wheel in the manner described presses down the bar l^3 and the frame h^2, of which the bar forms a part, drawing down the stop-plate c^2, so as to bring it into engagement with one of the teeth of the summation-wheel. When the key thus depressed is allowed to rise, the upward movement of the arm v^2, under the influence of the spring m^2, causes the pawl w^2 to engage the ratchet n^2 and carry it forward one tooth. The pawl e^3 retains the ratchet in its advanced position. As the ratchet moves forward it carries around the toothed wheel F, and by the engagement of the said wheel moves the shaft D forward, so as to bring the star-wheel G opposite another summation-wheel, and the next downward motion revolves the star-wheel, so as to register the number called for by the particular key, and so on until the star-wheel arrives at the end of its travel, when the finger-plate w^3 is pressed, thereby bringing the cam i^3 into engagement with the pin j^3 of the pawl w^2 and with the pin q^2 of the arm p^2. The rounded end of the arm e^2 engages the pin f^2, projecting from the side of the pawl w^2, and lifts the said pawl out of engagement with the ratchet m^2, so that the spring k^3, which is wound by the forward movement of the toothed wheel F, may return the star-wheel G to the point of starting. Whenever the finger-plate c^4 is pressed, besides releasing the pawls in the manner described, through the agency of the rock-shaft h^3, it turns the sectors t^3, causing the rod q^3 to carry all of the verifying-wheels back to the point of starting, so that the figure "0" is seen on all the verifying-wheels throughout the length of the slot o^4 after the addition of each successive number and before the next is added. When it is desired to rearrange the summation-wheels d, so as to erase the footing and begin a new summation, the shaft u is turned, so as to release the pawls m from the ratchets g, when the said summation-wheels are turned by means of the keys corresponding to the number required to make ten when added to the number seen through the slot on each of the summation-wheels, respectively, moving from left to right, as in performing the addition. To effect the carrying for tens from one wheel to another, the pin h at the end of the revolution of the wheel carried by it engages the arm k of the bar i, which carries up the said bar i a sufficient distance to cause the pawl to act upon the ratchet of the adjoining wheel to the left and cause it to make one-tenth of a revolution. At the same time the stud m^5, supporting pawl m on end of arm l, engages the tooth of the summation-wheel that has been carried and locks it for an instant, so that it can go no more than one-tenth of a revolution. After its release the arm i is drawn downward by the spring o, attached to the lower end of the pawl m, so as to bring the pawl m into engagement with a new tooth of the ratchet g.

Having thus described our invention, we claim as new and desire to secure by Letters Patent—

1. In an adding-machine, the combination, with a series of summation-wheels arranged upon a common support, of a shaft capable of longitudinal and rotary movement, a star-wheel fixed to the shaft and arranged to engage the summation-wheel of the series, a series of finger-keys, and pawl-and-ratchet mechanism connected with the keys and shaft and adapted to impart longitudinal and rotary motion to the shaft, substantially as specified.

2. In an adding-machine, the combination of the summation-wheels d, provided with teeth e, the grooved shaft D, the star-wheel G, carried by the said shaft and adapted to engage the summation-wheels, the ratchet-wheel j', provided with clutch-teeth l', the pawl m', and spring n', the pinion o', provided with clutch-teeth l^2, the toothed sector H, keys L M, and mechanism intermediate between the keys and toothed sector, substantially as specified.

3. In an adding-machine, the combination, with the summation-wheel-operating shaft D, provided with a cylindrical rack, of the toothed wheels E F, the ratchet n^2, connected with the wheel F, the arm s^2, the pawl w^2, carried thereby, the spring-actuated pawl e^3, and means for imparting motion to the arm s^3, substantially as described.

4. In an adding-machine, the combination, with the summation-wheel operating-shaft provided with a cylindrical rack, of the toothed wheels E F, the shaft o^2, carrying the wheel F, the ratchet n^2, attached to the shaft o^2, the arm s^2, mounted loosely on the said shaft, the spring-pressed pawl w^2, pivoted to the arm s^2 and provided with the stud j^3, the spring-pressed retaining-pawl e^3, provided with the pin f^3, the arm p^2, mounted loosely on the shaft o^2 and provided with the stud q^2, the rock-shaft h^3 and arm i^3, carried thereby, and means, substantially as described, for turning the shaft h^3.

5. The combination, with the summation-wheels d and star-wheel G, of the slotted verifying-wheels o^3, adapted to be moved by the said star-wheel, the arms r^3 r^4, rod q^3, carried by the said arms and extending through the slots of the verifying-wheels, the pinions s^3 s^4, attached to the arms r^3 r^4, the toothed sectors t^3 t^4, engaging the pinions s^3 s^4, and the finger-plate c^4, adapted to operate the said sectors, substantially as specified.

6. In an adding-machine, the combination, with the summation-wheels d, provided with ratchets g and studs h, of the forked bars i, pivoted on a fixed support and carrying pawls m for engaging the ratchets g, the said forked

bars being arranged to be engaged by the pins *h*, substantially as specified.

7. The combination of the forked bars *i* and the pawls *m* of the carrying mechanism with the shaft *u*, carrying the feather *w* for engaging the said pawls, substantially as specified.

8. In an adding-machine, the combination, with the summation-wheels, of the pawl-carrying arm *i*, provided with the stud m^5, adapted to engage and stop the summation-wheel after being moved by the said arm, substantially as specified.

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