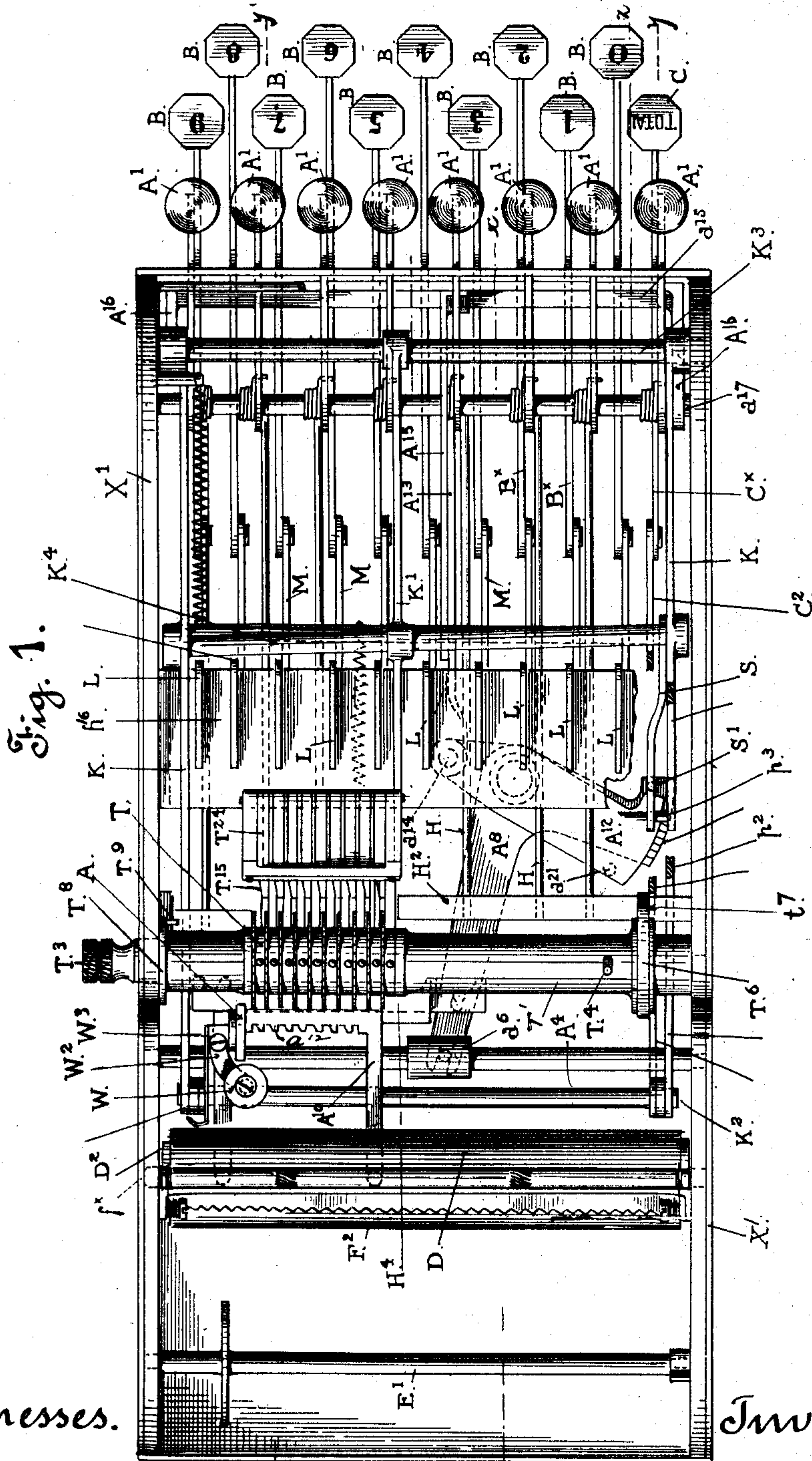


A. HOCH.
ADDING MACHINE.

(Application filed Jan. 9, 1899.)

(No Model.)

5 Sheets—Sheet 1.



Witnesses.

H. Monteverde
M. Regner

Inventor.

Adorn Hoch
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his Atty.

A. HOCH.
ADDING MACHINE.

(Application filed Jan. 9, 1899.)

(No Model.)

5 Sheets—Sheet 3.

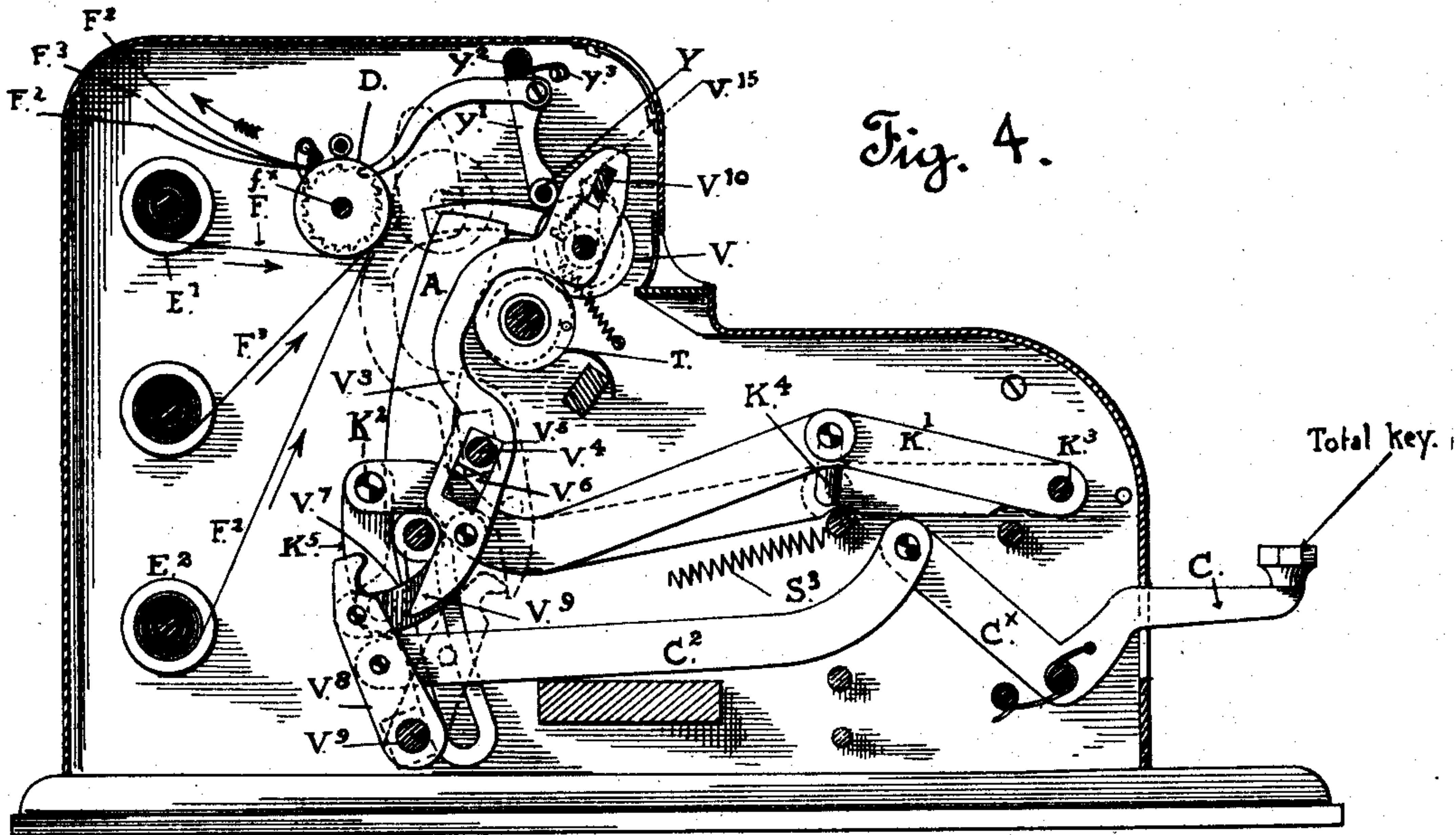


Fig. 4.

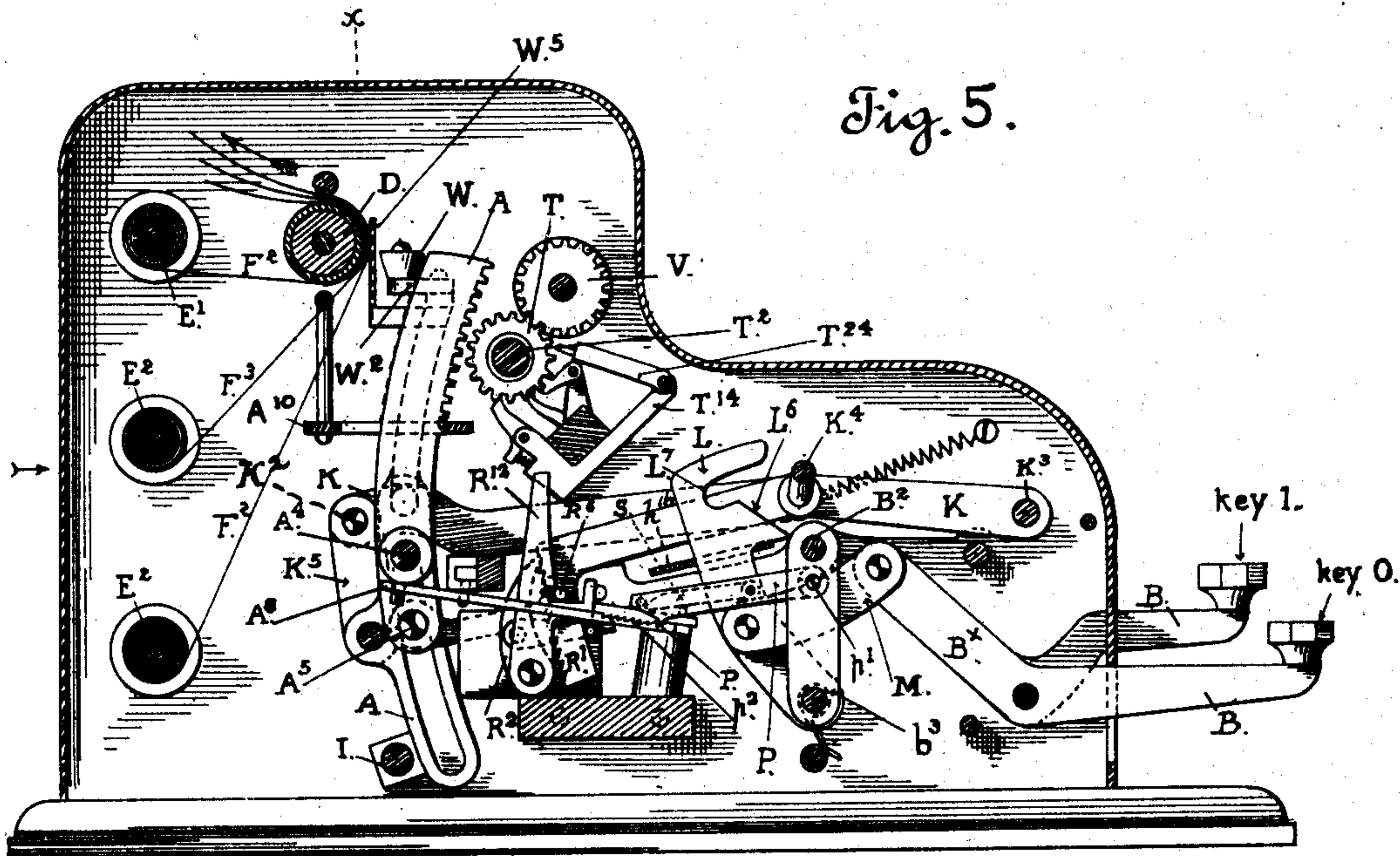


Fig. 5.

Witnesses.

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A. HOCH.
ADDING MACHINE.

(Application filed Jan. 9, 1899.)

(No Model.)

5 Sheets—Sheet 4.

Fig. 6.

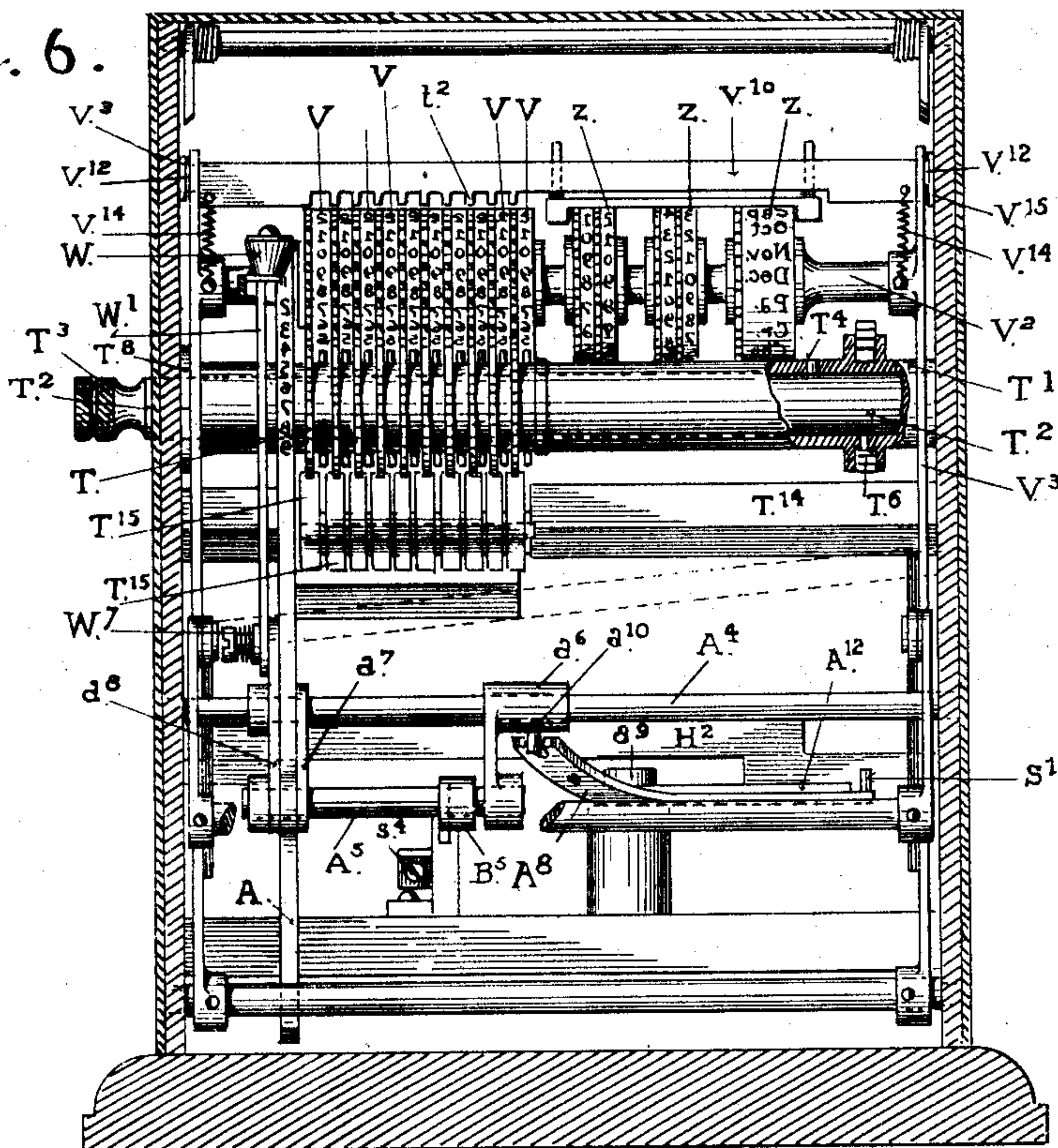
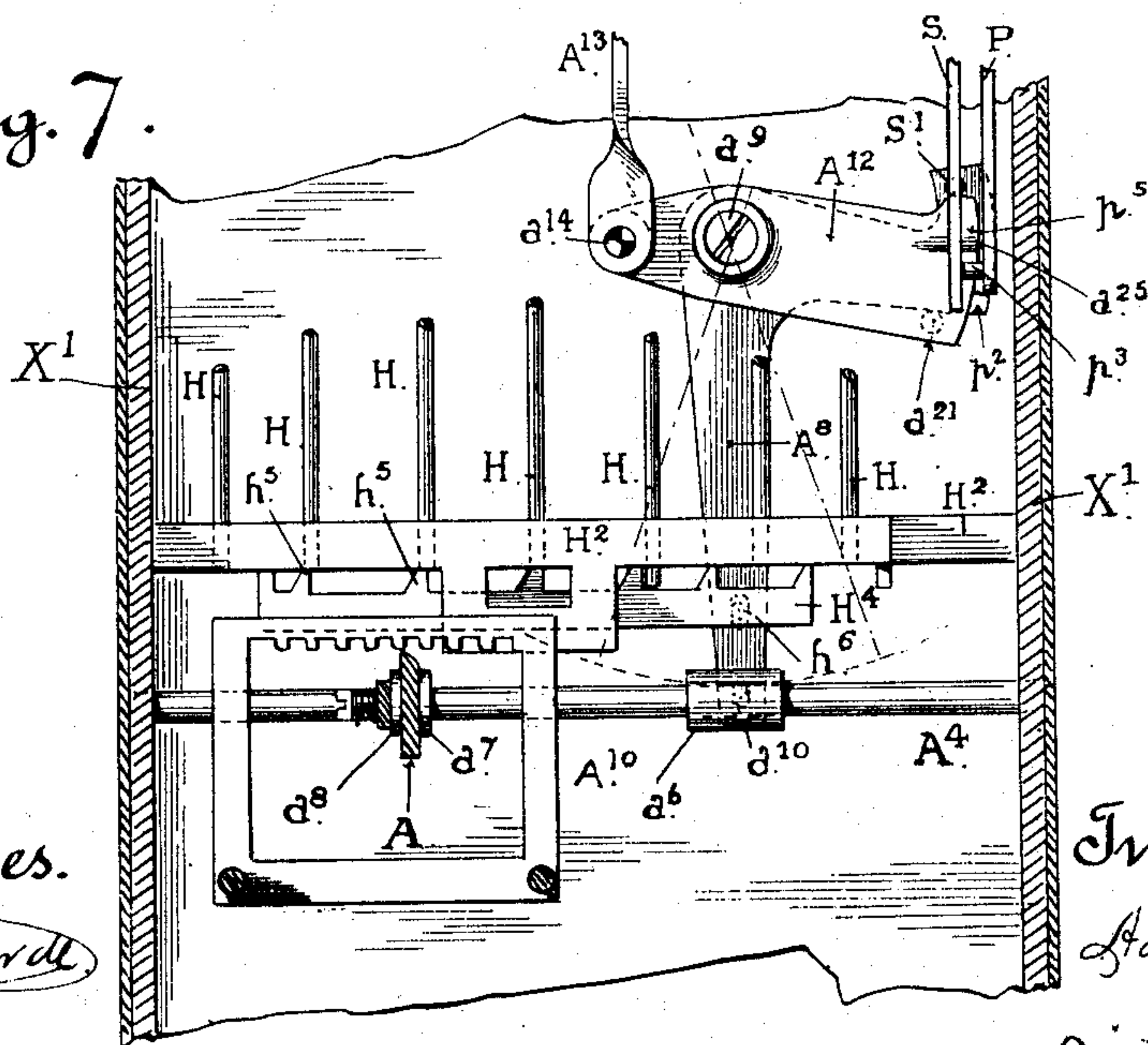


Fig. 7.



Witnesses.

Monteverde
of Regner

Inventor.

Adam Hoch

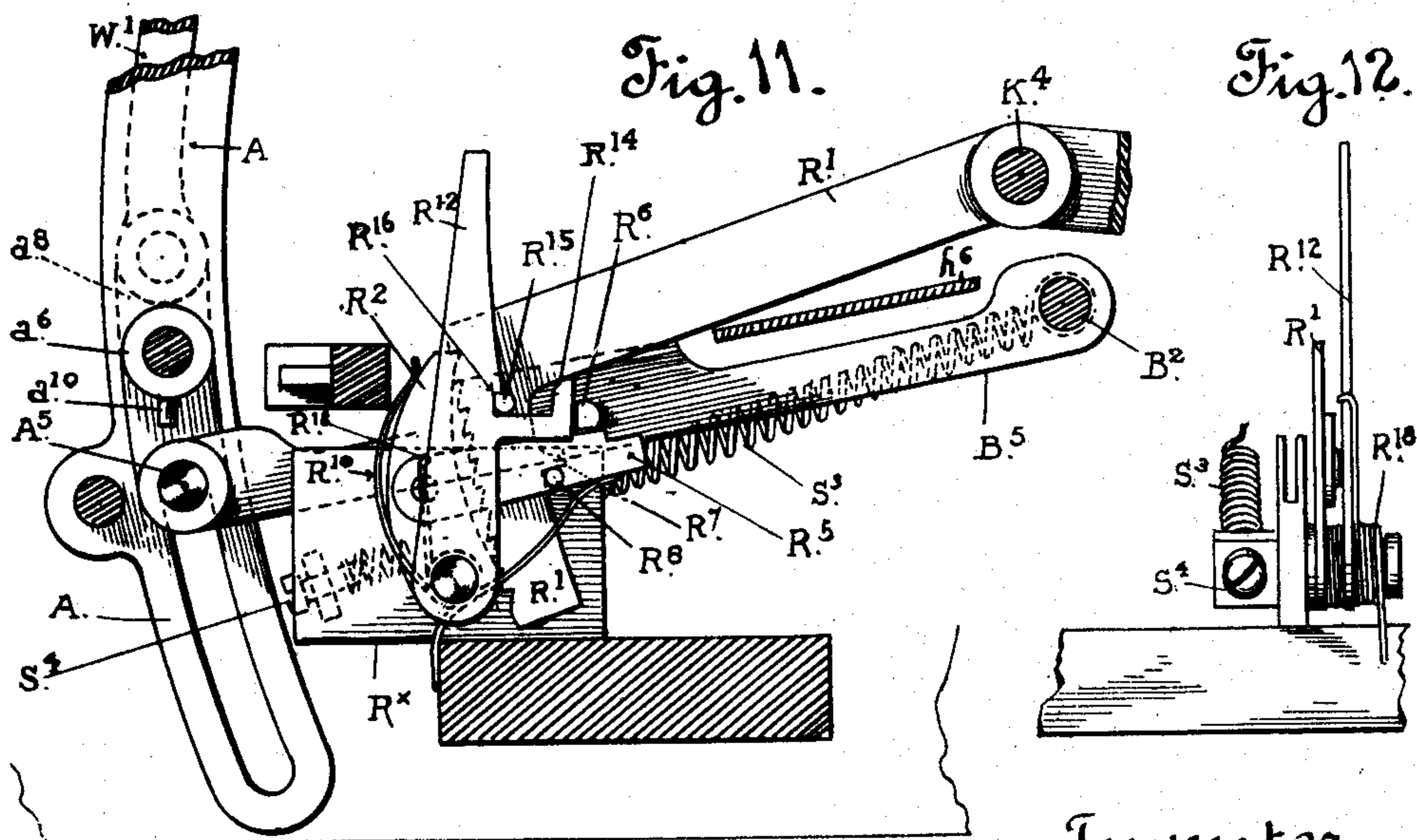
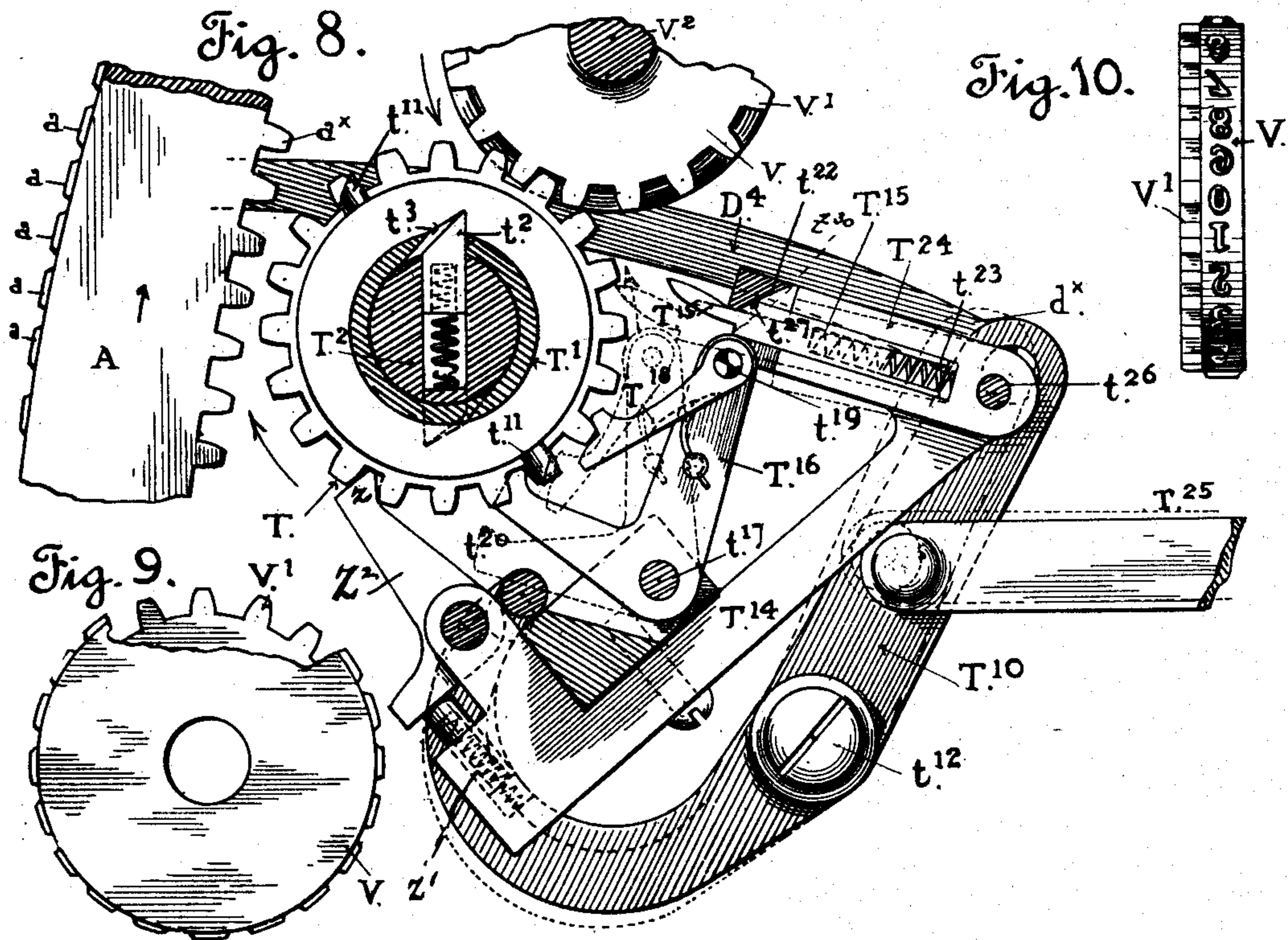
By *Smith & Babney*
his Attorneys.

A. HOCH.
ADDING MACHINE.

(Application filed Jan. 9, 1899.)

(No Model.)

5 Sheets—Sheet 5.



Witnesses.

W. H. M. M. M.
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UNITED STATES PATENT OFFICE.

ADAM HOCH, OF ALAMEDA, CALIFORNIA.

ADDING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 669,168, dated March 5, 1901.

Application filed January 9, 1899. Serial No. 701,665. (No model.)

To all whom it may concern:

Be it known that I, ADAM HOCH, a citizen of the United States of America, residing in Alameda, county of Alameda, and State of California, have invented a new and useful Adding-Machine, of which the following is a specification.

This invention relates to improvements made in adding-machines of that class or description which are operated through the medium of finger-keys and to print figures in numerical order in columns upon a strip of paper and also print the sum-total at the bottom of the column.

The principal novel features in the present machine comprise a type-carrying bar or arm combining in its structure and functions both a printing device to imprint in required numerical order on a strip of paper the ten digits in rows and columns to represent different amounts and a rack or prime mover to actuate an adding device by which is computed and recorded the sum of the several rows and columns of figures. In performing these functions the printing-arm is operated with different rectilinear and vibratory movements produced by two sets of independently-acting finger-keys and connecting mechanism, by one of which the printing-arm is set to the extreme left of the line or row of figures to begin at the highest order of numbers in the line to be added, and by the other set of keys the printing-arm is operated to print the figures and also to record and add the same to the sum recorded by the adding device of the machine. The first-mentioned set of keys, herein designated as the "shifting-keys," controls the position of the printing-arm with reference to the number of numerical orders occupied by the figures of the line to be printed and brings the printing-arm to required place by a transverse movement from right to left. The mechanism effecting this shifting movement brings the arm to its starting-point with a single throw or movement and locks the arm against a counter movement by the successive depression and release of one key. By the second set of keys, herein designated as the "adding" and "printing" keys, the printing-arm is caused to engage and actuate the adding device while being set to position to print and afterward is caused to disengage itself

from the adding device and print the proper figure in row and column on the paper, and, finally, to return to the starting-point for the next adding and printing motions.

The improvements include also novel means of producing each adding and printing operation and the feeding or spacing of the figures from left to right by the stroke of one key.

The improvements include also a novel means of printing the sum-total directly from the adding device and means whereby the figures composing the sum can be printed in a different color from the figures in the columns.

The improvements include also a sum-total-printing device actuated by an independent key to imprint the result on the paper.

The improvements include also novel key mechanism and its combination with the adding and printing devices whereby the two operations of printing a figure on the paper and of adding it to the sum already recorded are produced at each time of printing a figure by the successive depression and release of a single key.

The improvements include also the combination of interlocking mechanism with the two sets of keys beforementioned whereby all the keys of one set are locked or thrown out of action when the keys of the other set are in use and whereby also no one figure can be added unless it is printed and no figure can be printed without being added to the sum already recorded.

The improvements embrace also certain novel parts and combinations of parts producing a complete, simple, and durable machine, operating to give a perfectly accurate record of figures in rows and columns upon a strip of paper and the sum-total or result at the bottom of the columns, the aim and object in view being to reduce the number of working parts, to produce the various movements with a small number of keys, to secure accuracy and ease of operation, and to supply an adding-machine for commercial use at a moderate cost.

The following description explains at length the nature of my said improvements and the manner in which I proceed to apply and carry out the same, reference being had therein to the accompanying drawings, forming part thereof.

In the drawings, Figure 1 is a plan of an adding-machine embodying the said improvements. Fig. 2 is a side elevation, principally in longitudinal section, on the line $x x$, Fig. 1, showing the printing-arm in its lowest position disengaged from the adding device and the shifting mechanism, the printing and adding keys and some of the connecting parts being omitted. Fig. 3 is a longitudinal section at the line $y y$, Fig. 1, showing the printing-arm set to imprint the figure "8" and the position of the operating part at that time. The adding device and some of the actuating parts are omitted from this view. Fig. 4 is a longitudinal sectional view on the line $x y$ of Fig. 1, showing more particularly the sum-total-printing mechanism with the parts in two positions, the full lines representing the printing-wheels and their carrier in a position of rest and the dotted lines indicating the same parts in position to imprint the sum-total on the paper strip. Fig. 5 is a longitudinal section on the line $x z$, Fig. 1, showing the printing-arm in the lowest position at rest before engaging the adding mechanism. This view represents more particularly the general relation and arrangement of the spacing mechanism and interlocking means. Fig. 6 is a section on the line $x x$ of Fig. 5, some parts being partly broken away. Fig. 7 is a horizontal section showing details of the printing-arm shifting and feeding mechanism. Fig. 8 is a side view in detail, on an enlarged scale, of the adding mechanism. Fig. 9 is a side view, enlarged, of one of the adding and total-printing wheels. Fig. 10 is a front view of the total-printing wheels. Fig. 11 is a side view in detail of the lower part of the printing-arm, the parts of the mechanism actuating it, and the locking means by which it is held in position after being elevated. Fig. 12 is an elevation taken from the left-hand side of Fig. 11.

X X indicate the parts of a case inclosing the mechanisms.

A' A' are the keys that set the printing-arm A from units place toward the left to the required column or place of numbers in starting to add and print a row of figures. B B are the keys that operate the printing-arm to actuate the adding and printing devices and the feeding mechanism. C is the total-printing key. With these three sets of keys all the operations of the machine are performed. D is an impression-roller stationary as to position and having only a step-by-step rotary motion at intervals to feed the record-strip.

E' E² are rollers from which webs of paper for an original and a duplicate record-strip F² F² are supplied to the roller D, from one of which an ink or carbon ribbon F³ is introduced between the paper strips when a duplicate record is to be furnished by the machine.

The journals $f^x f^x$ of the impression-roller have bearings in the sides X' of the case, and

one of them carries a ratchet-tooth wheel D², that is turned one tooth at a time by a pivoted dog D³ on the end of a reciprocating rod D⁴, the movement of which is taken from one of the levers or parts that actuate the adding devices, as described hereinafter.

The part A, designated as the printing-arm, is a flat and relatively narrow bar of curved shape having on the outer or convex edge a series of type-figures α in spaced order one above the other, beginning with a "0" at the top and including the figure "9" at the bottom. On the opposite or concave edge of the arm is a row of spur-teeth spaced to correspond with the digits on the front edge of the arm. The function of this toothed rack α^x is to engage with and turn the wheels of the adding device, which is located for that purpose in front of the roller D, the space between the two parts being sufficiently wide to allow room for the oscillating motions and the up-and-down movements of the arm A. By its first-mentioned motion forward and backward this part A is first set into engagement with the gear-teeth of the adding mechanism, and by the return or backward throw the type-carrying side of the part is brought against the record-strip presented on the roller D, and that one of the type-figures which is situated at the time in position to make contact with the curved surface of the roller is imprinted on the paper by that movement of the arm. The figures on the arm A are set in position singly and one at a time in any required numerical order by a simple vertical movement or upward throw of the arm, the extent of which movement determines the figure that will be printed in the following oscillating motion of the arm. The extent of the upward throw called for in the present arrangement of the type-figures on the arm is greatest for the digit "9" and from that regularly decreases in length down to the "0," at which point the arm is oscillated without any preceding vertical set when a cipher is to be printed. In the upward throw preceding a contact with the paper a forward movement of the arm A brings the rack-teeth into mesh with the gear-teeth of that one of the adding-wheels with which the arm is alined, and the same movement that sets the arm in position to print also rotates that one of the adding-wheels with which the arm is alined. Thus the upward movement to bring the proper figures in position to be imprinted rotates the adding-wheel, and by a greater or less extent of movement, corresponding to the length of the reciprocation of the rack, the amount of that figure is added to the sum recorded on the adding mechanism. The rack so engaged with the adding device during the upward throw is afterward moved out of working contact with the wheel by the same forward oscillation of the arm A that brings the type into contact with the paper, and following that movement the arm is returned forward again to clear the paper and set the arm in position

midway between the adding device and the roller D or so as to stand clear of both parts. A final drop or movement of the arm brings it to its lowest position and starting-point, where it rises again in the following upward throw, by which it is set to print the next figure. These movements of the arm A to add and print figure after figure are all produced from the set of ten finger-keys B, one for each figure or character on the arm A, through the medium of mechanism connecting each key with the printing-arm A in such a manner that the successive movements of the arm to throw the rack into engagement with the adding mechanism, to move the arm upward to bring it in contact with the paper, and, finally, to disengage the arm and return it to its lowest position are all effected by the single depression and release of a key. The arm A is constructed also to operate these movements in any one of eight or more positions in the order of numbers, beginning with the number occupying the highest place in the row. Starting in each time of the operation to print a row of figures, the arm A is set by a single throw or movement from the extreme right of the line toward the highest number in the row by means of the shifting-keys A' and their connected mechanisms, which control and determine the starting-point of the printing-arm in working from left to right again. The feeding back of the arm following each transverse movement is performed by spacing mechanism actuated from the same keys. Thus it will be seen that the construction of the machine involves two principal and separate sets of mechanisms, one consisting of means for setting the printing-arm to start from the left-hand end of the row and the other the means that operates the arm to print given figures in rows and to add together and give the sum of the figures so printed.

The construction of the printing-arm A and its shifting mechanism will be more clearly understood by referring to Figs. 1, 2, 6, and 7 of the drawings.

A stationary rod A⁴, fixed across the space at the rear end of the case, forms a guide on which the arm A is mounted for transverse sliding movement and also constitutes the center of the oscillating or forward-and-backward movements of the arm.

A⁵ is a short rod suspended from the guide A⁴ by hangers that are fitted to slide on the guide, one of such hangers consisting of an arm a⁶ and the other of two links a⁷ a⁸, between which the printing-arm A is confined. The rod A⁵, fixed in the hangers, passes through the arm A, the lower part of the arm being slotted for that purpose, as seen in Fig. 2.

A⁸ is a bell-crank pivoted at a⁹ and having the end of its longer member attached to the hub of the hanger by a pin a¹⁰ in the hub and a slot in the end of the lever.

A¹² is a plate movable on the center a⁹ in a horizontal plane, and A¹³ is a rod attached to

the shorter member of the plate at a¹⁴ and connecting that part with a rocking frame located in the front part of the case and composed of the cross-rail a¹⁵ and the side pieces A¹⁶ A¹⁶. The rail a¹⁵ extends across the front directly under the key-levers A', and the sides A¹⁶ are pivoted at a¹⁷. The point of attachment of the connecting-rod A¹³ is located at a²⁰ below the center of movement a¹⁷, so that the shorter end of the vibrating plate A¹³ is moved back and its longer end is thrown forward as the front rail of the rocking frame is depressed by pressing down one of the keys A'. At such time of movement a pin a²¹ on the under side of the vibrating plate engages the shorter member of the bell-crank, thereby drawing it forward and throwing over the longer member from right to left of the machine. This movement taking place, as indicated in Fig. 7 by the dotted arc, shifts the arm A along the stationary guide A⁴, and thus sets the arm to the left a greater or less distance, according to the extent of movement of the bell-crank. The length of this lateral movement of the arm A, whereby it is set to one, two, or more places of numbers preparatory to the feeding-back operation to space the figures, is governed and determined by the length of contact continuing between the key-lever and the front rail a¹⁵ of the rocking frame in the downstroke of the key. To this end the front rail is set at an inclination upward across the case from right to left, (shown in dotted lines in Fig. 6, which is a transverse sectional view of the machine looking from the rear end,) so that the vertical distance between the top edge of the rail and the bottom edges of the key-levers A' above is greatest under the first key on the right of the keyboard and is least under the key at the extreme left, and the resulting movements of the rocking frame will vary in length with the particular key selected and depressed by the operator. The machine herein described being constructed to add and print as high as the ten-millions place of numbers in a single row, there are eight shifting-keys in the set A', one for each numerical order, and the arm A is brought to the required position, beginning at the highest number in the row, by a single stroke of the proper key. Before these lateral movements take place the arm A is always set to stand clear of the adding device in front of it and the impression-roller D behind it by a short oscillating or rocking motion of the arm on the fixed guide A⁴, produced in the upstroke of the shifting-key when the finger is removed. These parts, which go to form the oscillating mechanism, consist of a rocking plate A¹⁵, attached to the front bar and movable on the center a¹⁷, and the rod B⁵ and connection between the rocking plate and the arm A, whereby the movement of the rocking frame sets the arm A into gear with the adding device after it is shifted laterally to the proper column. These connections consist of the following parts: B² is a rod carried in the upper

end of the upright arms $b^3 b^3$, that are pivoted at the lower ends b^4 to the sides of the case and having limited swinging movement in a vertical arc on that center. B^5 is a connecting rod or bar attached to the swinging rod A^5 of the printing-arm A and at the front end attached to the rod B^2 . At the upper rear corner of the plate A^{15} the rod B^2 extends through a right-angle slot a^{23} , the perpendicular member of which allows the plate to rock without moving the rod, while the shorter horizontal member of the slot permits the rod B^5 to reciprocate without affecting the rocker-plate. The perpendicular member of the slot is slightly inclined, as shown in Fig. 2, to produce a short throw of the rod B^2 in the final movement of the shifting-key, and thereby set the rack of the printing-arm into mesh with the gear of the adding-wheel before the perpendicular throw of the arm A takes place. The length of the shifting movement is controlled by a separate stop device connected to each shifting-key, consisting of a sliding rod H, connected to a short elbow A^x on the key-lever and playing at the rear end through holes in a stationary guide H^2 , fixed across the machine-frame in front of the guide-rod A^4 . At the back of the guide H^2 a sliding stop-plate H^4 , with projections h^5 on the front edge, is attached by a pin-and-slot connection h^6 to the long arm of the bell-crank A^8 , so as to move with that part. The projections h^5 are spaced at intervals apart to correspond with the number of columns or places of number to which the printing-arm may be set and in such position also that when the stop H of a given key is projected through the guide H^2 by the depression of that key the end of the rod will engage that one of the projections which lies immediately to the right and will arrest the throw of the bell-crank when that projection strikes the end of the stop-rod. The leading edges of the projections are made straight to strike the ends of the stop-rails, but the opposite edges are inclined, so as to ride against and press back the stop-rod in the movement of the slide to the right. After the printing-arm is set to position in this manner, to begin at the proper column of numbers the type-figures corresponding to the figure to be added is brought into line with the paper by the perpendicular movement of the printing-arm rising from its lowest position, as shown in Fig. 2. At the end of that setting movement the arm turning on its guide-rod A^4 is thrown forward into engagement with the gear-teeth of the adding device, and then in its upward throw the arm rotates the wheel with which its rack is in mesh with a length of movement proportionate to the length of the upward throw of the rack. When the arm A comes to rest ready to make contact with the paper, that one of the type-figures on the arm which is left in position by that movement to be imprinted on the paper has been added to the sum already computed in the adding

mechanism, and the sum-total is read from the number-bearing wheels of that part of the machine. 70

The following mechanism connecting the printing-arm A with the individual keys of the second series B in the keyboard produces all the above motions of the printing-arm by the stroke of any selected one of the keys. The same key in its upstroke operates the step-by-step mechanism in the movement of the printing-arm from left to right to space for the next figure. 75

K K K' are three parallel bars joined at the rear end of the machine by a cross bar or rod K^2 and having eyes at the front ends fitted to turn on a stationary rod K^3 , that forms the center of vibration of the frame. K^4 is an inclined rod set higher at one end than at the other and secured in the bars of this frame, so as to stand in a slanting position across the machine. 80 85

L L are oscillating cam-plates, one for each key, each having a rod L' for a common center, on which they are independently movable in vertical arcs with a length of movement sufficient to engage with the inclined bar K^4 when brought by a forward movement into an upright position and to be disengaged from it by a contrary movement. There is one cam L to each key of the second set, and each cam is connected to its individual key by a link M, attached to the cam at m and to the end of the key-lever at m^2 , so that pressure upon the key throws the cam forward against the inclined bar K^4 . A helical spring m^5 on the rod L' assists in bringing the cam-plate back to place when the key is released. The contact of any one cam-plate with the bar K^4 in the forward throw lifts the frame K K K', of which the bar is a part, and by throwing up the rear end of that part raises the printing-arm perpendicularly a greater or less distance, according to the length of movement of the frame. This upward throw of the frame is produced by the incline L^6 on the front edge of the cam-plate acting against the inclined bar, and the length of throw produced by the stroke of one key over the next is varied by the angular position of the bar. The incline L^6 terminates in a concentric slot or recess L^7 , into which the cross-bar is seated at the end of the forward throw. 90 95 100 105 110 115

L^8 is a guard-hook with a rounded nose extending from the top of the cam-plate at an angle downward in front of the incline L^6 , with the nose in line with the cross-bar. 120

Each cam-plate is provided with a guard-hook, with the exception of the cam of the first or cipher key on the left of the line, where it is not needed, because the cipher is printed without a vertical set of the printing-arm and the inclined bar has no movement when that key is pressed. This hook performs the two functions of returning the frame to its lowest position after the printing operation, which it does by striking against and forcing down the inclined bar as the cam-plate is 125 130

drawn back by the spring, and of preventing a second cam-plate from engaging the inclined bar when that bar is already seated in the slot of another cam-plate. All the cams play in slots in a stationary comb or guide-plate h^{16} , extending across the machine-frame under the rocking frame $K K K^4$. In addition to these functions the cams L form the principal members of the mechanism that brings the printing-arm in contact with the paper to give the impression, the construction and operation of which will be understood from Figs. 3, 5, and 6.

The rod B^2 , extending across the machine above the cam-shaft L' and to which the connecting-rod B^5 is attached, is situated directly in front of the cams L , just below the bottom line of the inclines L^6 and in position to be struck by the front edge of the cam-plate and carried forward by that part in the downward stroke of the key. This rod being common to all the cam-plates it will be seen that in the forward swing of any one of the cams the printing-arm is thrown back against the impression-roller, because the rod B^2 by that contact with the cam-plate will be carried forward immediately after the cam has elevated the vibrating frame $K K K^4$. The oscillating movement of the printing-arm then taking place on the guide-rod A^4 is produced by the downstroke of the key. From these same swinging parts $B^2 b^3$ the step-by-step movements of the printing-arm are produced from left to right to space the figures in the same horizontal row through the following means: A dog P , pivoted at p' to the upright arm b^3 of the swinging rod B^2 , has a tooth on the free end engaging the segmental series of teeth p^2 , formed on the end of the short arm of the bell-crank lever A^8 , over which the point of the dog slips in the forward movement of the swinging rod B^2 ; but in the backward movement its end engages one tooth of the series and throws the longer arm of the bell-crank to the right on the upstroke of the key. This feeding movement of the dog is produced by the action of the spring S^3 when the pressure of the finger is taken off the key. This spring is attached to the rod B^2 and at the rear end to the stationary block R^x at S^4 . On the side of the dog P is pivoted a latch S , having its free end projecting over the top face of the plate A^{12} and having a shoulder S^{10} on its lower edge adapted at the proper time to engage a shoulder S^{11} on the plate A^{12} . The function of this latch is to prevent a key of the shifting set A' from working while the keys of the other set B are being being operated.

S' indicates a pin projecting upwardly from the end of the short arm of the bell-crank lever A^8 , and as the latter is moved its last step by the dog P the said pin will engage the latch S and lift it out of engagement with the plate A^{12} . The plate A^{12} will now be free to move. The parts are so arranged that when the plate A^{12} and the bell-crank lever are in

their normal positions the pin a^{21} will not be in engagement with the bell-crank lever. The plate A^{12} can therefore have a slight movement without affecting the bell-crank lever. The plate A^{12} has a lateral projection, the upper face of which is inclined, as shown at p^5 , and the parts are so arranged that when in their normal positions a laterally-extending pin p^3 on the dog P will be over the incline p^5 . During the movement of the plate A^{12} from its normal position until the pin a^{21} engages the bell-crank lever the inclined surface p^5 will, by its engagement with the pin p^3 , lift the dog P out of engagement with the teeth p^2 on the bell-crank, and the latter will then be free to move. The dog P will be held out of engagement with the teeth p^2 until the plate A^{12} has passed from under it in its return movement, and the dog will then drop into engagement with the teeth.

After the printing-arm is set to position with reference to the paper, so as to bring the required figure in line with the impression-roller and before the printing movement takes place, the lifting-frame $K K K^4$ is locked and held in a fixed position by a ratchet-bar R' , attached to that frame, and a pivoted dog R^2 , carried on a stationary support R^x under the frame. Figs. 3 and 11 show the construction of this locking mechanism, Fig. 3 representing the position of the parts when the printing-arm is set to imprint the figure "8" and Fig. 11 representing the parts in detail, on a larger scale, with the printing-arm in its lowest position. The lifting-frame $K K K^4$ and the printing-arm attached to it must be sustained at the end of the upward throw or the same would drop down again as soon as the printing-key was relieved of pressure and before the printing-arm would be drawn back to clear the paper. At this moment the notched segment on the end of the arm R' is engaged by the dog R^2 at the end of the perpendicular throw of the printing-arm A , and thus the arm is supported in its elevated position until the backward oscillation is finished and the arm is brought away from the paper preparatory to dropping to its lowest position. The dog R^2 is held against the segment by a spring R^{10} , so as to engage the notches in the upward throw of the segment; but at the end of the downstroke of the key and as the pressure is removed the dog is forced back clear of the notches by the trigger R^5 and the stop R^6 , projecting from the side of the connecting-rod B^5 , these parts being so arranged that as the rod begins to move back the stop engaging a shoulder on the trigger will carry the dog R^2 back with it, and thereby release the notched segment, which then drops and allows the lifting-frame of the printing-arm to drop with it. In such downward movement a shoulder R^7 on the notched segment comes in contact with a stop-pin R^8 , projecting from the side of the trigger, and releasing that part in its descending movement the segment restores the dog

R^2 to position again to engage the notches of the segment. An additional locking device, composed of a pivoted latch R^{12} , standing in upright position alongside of the segment, operates to hold down the lifting-frame and prevent it from rising until this lock is thrown off. A pin R^{15} on the side of the segment is set to engage a shoulder or recess R^{16} in the edge of the latch, and thus prevent the arm of the segment from rising. This latch is thrown off in the beginning of the backward throw of the connecting-rod B^5 by the stop R^6 on that rod striking an upright arm R^{14} , that projects from the latch. A spiral spring R^{18} on the pivot of the latch holds the same in upright position. These parts in their relative positions with the segment at rest are illustrated in the detail view, Fig. 11.

The arm A plays through a guide-frame A^{10} , having spaced fingers a^{12} on the front bar corresponding in number with the wheels of the adding device, the office of which frame is to steady the printing-arm and keep it always in line with the proper wheel during the upstroke of the arm.

The adding device is constructed in the general plan of adding or computing devices—that is to say, a number of adding-wheels mounted on a common axis are so connected one to the other by mechanism that in every complete revolution of one wheel the wheel of the next highest order of numbers is turned one tooth or space.

The adding-wheels T are mounted on a common barrel or hollow shaft T' , to which they are individually connected by a spring-bolt t^2 , carried by a solid shaft T^2 , turning within the barrel, and a recess t^3 in the wheel, so that while each wheel is free to turn independently of the others the whole set is locked and made fast on the shaft when the spring-bolts are brought into the recesses of the wheels. This locking-point in each wheel being located in line with the place occupied by the cipher on the face of the wheel, it will be seen that by rotating the shaft until all the wheels are taken up and locked by the bolts t^2 the wheels are set back to zero to begin at the starting-point for the next operation. For this purpose one end of the shaft T^2 is carried through the case to the outside and is fitted with a milled head T^3 for turning it.

The shaft T^2 is connected by a slot and pin T^4 to the surrounding sleeve T' and a spiral spring T^6 , surrounding the barrel and attached at one end to that part and at the other end to a fixed point t^7 on the frame. Thus when the inner shaft T^2 is rotated until the spring-bolts have engaged their respective wheels the spring T^6 , reacting as soon as the head T is released by the operator, will bring back all the wheels to the starting-point again. This position of the wheels is controlled by the stop-disk T^8 on the end of the tubular shaft, which is provided with one or more shoulders to engage a stop-pin T^9 .

Each wheel T in completing every half-revolution is caused to turn the adjacent wheel next highest in order of numbers and set it forward one point or number by means of the following mechanism: T^{10} is a rocking lever pivoted at t^{12} and rocking in a vertical arc on that point. T^{14} is a stationary frame fixed in an inclined position under the adding-wheels, furnishing support for a number of spring-bolts T^{15} on the upper part and a series of elbow-levers T^{16} below. Each of the last-named levers is pivoted at t^{17} to move in a vertical arc and is provided with a yielding pawl T^{18} on its upper leg, to which it is attached at t^{19} , and on the end of the other member a tooth or dog t^{20} . The point of the pawl and the dog t^{20} are so arranged with respect to its own adding-wheel and the adjacent adding-wheel that as the pin t^{11} on one wheel strikes the end t^{20} of the lever the opposite end is thrown back away from the push-bolt T^{15} of the next wheel. Each bolt T^{15} is provided with an inclined shoulder t^{27} , which engages an inclined shoulder t^{22} on the carrier T^{24} , and when the parts are in their normal positions these shoulders will be held in engagement by the contact of the upper end of the vertical arms of the elbow-levers T^{16} with the lower faces of the respective sliding bolts, as shown in full lines in Fig. 8. When, however, a pin t^{11} on a wheel strikes the end t^{20} of a lever T^{16} the vertical arm of such lever will release the bolt sufficiently to disengage the inclined shoulders, and the spring t^{23} will project such bolt. Each bolt is also provided with a shoulder t^{30} on its lower face, which when the vertical arm is moved by the action of the pin t^{11} will drop behind such vertical arm, and in the outward movement of the bolt the vertical arm will be carried with it, and thereby cause the pawl T^{18} to move the adjacent adding-wheel one tooth. As this latter movement is being effected the outer end of the bolt T^{15} will pass between two teeth of such moving wheel and prevent the latter from moving more than the distance of one tooth. (See dotted lines in Fig. 8.) Each bolt and its spring are confined in a slotted carrier T^{24} , fitted to swing in a limited arc on the center t^{26} , but otherwise stationary as to position, and the end of the bolt having a shoulder t^{27} is fitted to engage with and be held back by that shoulder when the carrier is pressed upward and held by the end of the upper member of the elbow-lever being set against the bolt from the under side. Thus the bolt is held within its carrier with its spring compressed as long as the longer member of the lever T^{16} stands in upright position. After its release and contact with the adding-wheel the bolt T^{15} is brought back to place and set ready for action by the return of the elbow-lever to position, which is effected by contact and pressure of the curved lower end of the lever T^{10} with the shorter member of the elbow-lever. As the longer arm of the elbow-lever moves back to position it will by its

engagement with the shoulder t^{30} on the bolt carry the latter back sufficient to bring the inclined shoulders t^{22} and t^{27} into engagement, and near the completion of its return movement it will again pass below the bolt and force it upward and rearward to its normal position. A connecting-rod T^{25} , attached to the part T^{10} and extending forward, is attached at t^{25} to the rocking frame of the shifting mechanism, so that the bolts are set back into their carriers through the movements of the shifting-keys. The rocking arm also actuates the lever D^4 , that rotates the impression-roller, that part being attached at d^x to the upper end of the arm. These parts are shown in working relation in Figs. 2 and 11.

Each adding-wheel is provided with a locking-pawl Z^2 , such pawl being in the form of an elbow-lever pivoted in the stationary frame T^{14} . The long arm of the lever is provided with a tooth z , having an inclined face on one side and a flat face on the other, which projects between two teeth of the adding-wheel. Such wheel may therefore turn in one direction, but is locked against movement in the opposite direction. The tooth z is held yielding in position by a spring z' , engaging the shorter arm of the lever.

In the present construction ten adding-wheels are employed, one for each order of numbers represented by the eight shifting-keys and two additional wheels to compute to two places of numbers beyond the column represented by the first key on the left. The figures on the rim of each wheel are repeated, one set on each half of the circumference, in order to furnish one set of figures for reading the sum and the other for printing the same on the paper, which construction requires the use of two pins t^{11} and two recesses t^3 , one diametrically opposite to the other, on each wheel.

To each adding-wheel is connected by spur-gears V' a printing and reading wheel V , with the type-figures "0" to "9," inclusive, repeated in two sets, one of which is in position to be read from the front of the machine, while the other set faces the paper and does the printing. All the wheels V are mounted on a common shaft V^2 to turn independently of one another, and the shaft is carried by arms V^3 V^3 , that have a perpendicular rising movement and also a rocking motion on centers V^4 , Figs. 4 and 6. This center supporting the arm V^3 consists of the stud V^4 and a square block V^5 , fitted to turn loosely on the stud and to slide in a slot V^6 on the lower portion of the arm. Below this center of oscillation a curved link V^7 connects the arm with a rocking lever V^8 , moving from a center V^9 in a vertical arc and itself connected with the key-lever C^x by a long link or connecting-rod C^2 . The key C thus connected operates when depressed to throw the wheels V with a backward swing and an upward movement against the paper, as indicated by the dotted lines in Fig. 4, first throwing the wheels clear of the

adding-wheels and then bringing them in working contact with the paper on the impression-roller. The wheels V are thus caused to print the total sum of the different numbers printed by the printing-arm A , and as the inking device for the wheels V is independent of the inking device for the arm A the total may, if desired, be printed in a color different from that in which A prints.

In the backward throw of the printing-wheels from the center V^4 the end of the lower arm V^8 makes contact with the toe V^9 on the end of the carrier-arm V^3 and brings the whole set of printing-wheels against the paper with a suitable degree of pressure. To prevent the wheels of this set from turning out of position after they are disengaged from the adding-wheels, a locking-bar V^{10} , carried at the ends in slots V^{12} in the arms V^3 above the wheels, locks all the wheels by engaging the teeth of the gears V' at the moment when these begin to clear the adding-wheel gears V . This bar is thrown into action by springs V^{14} and is set clear of the gear by a fixed incline V^{15} when the printing-wheels are brought forward to place into gear with the adding-wheels again.

The means for inking the type on the face of the printing-arm is mounted on the sliding carrier of that part. It consists of an upright bar W' , pivoted to the link a^8 and standing alongside of the printing-arm, a horizontal arm W^2 , swinging on a pivot W^3 and carrying an inking-roller W , and a guard-plate W^5 on the upright bar extending beyond the inking-roller and riding against the impression-roller in the sliding movements of the printing-arm and the carrier-bar W' . The function of this guard-plate is to keep the inking-roller from contact with the paper. A spiral spring W^6 on the pivot of the swinging arm W^2 holds the inking-roller in front of the printing-arm, but allows it to yield and be thrown out of the path of the printing-arm by the contact of that part with the inking-roller in the movement of oscillation which brings the type against the paper. A coil-spring W^7 on the pivot W^3 of the arm W^2 holds the guard W^5 always in riding contact with the paper. The inking device thus travels with the printing-arm and is operated by the movements of that arm to ink the type before every impression.

The separate inking device for the printing-wheels is an inking-roller Y , suspended by arms y' y' from points y^2 above and held against the type-rims of the wheels by a spring y^3 . When the printing-wheels move toward the impression-roller, the ends of the carrier-arms V^3 strike the carriers y' and throw the inking-roller from in front of the printing-wheels.

On the same shaft with the printing-wheels may be placed a set of dating-wheels Z Z , as illustrated in Fig. 6, so as to imprint the day, month, and year at the same operation.

Having thus fully described my invention,

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

1. An adding-machine having a series of adding devices one for each numerical order, a paper holding and feeding device, a printing device having a series of type-figures from "0" to "9" inclusive and adapted by its movements in one direction to make contact with the paper and imprint any one of its type-figures on the paper, and by its movement in the opposite direction to engage and actuate the adding devices, and means for separately shifting said printing device transversely of the paper by which it is set to print from the highest order of numbers in the row, and for actuating said printing device to successively add and print the figures one after another.

2. The combination in an adding-machine, of a printing-bar having a single line of type, and keys and connections controlling the lateral and vertical movement of the bar and its movements to and from a platen, substantially as specified.

3. The combination with the movable printing device of an adding-machine, of a series of order-keys and connections operating to carry the device laterally to any one desired of a series of starting-points, said starting-point being at the order represented by the key which is operated, substantially as set forth.

4. The combination with the printing device of an adding-machine, of two series of keys and connections, one series operating to carry the printing device to any one desired of a series of starting-points, and the other operating to control the position of the figures to be printed and also the step-by-step return of the printing device, substantially as set forth.

5. An adding-machine provided with a printing device, and a series of keys and connections operating independently of each other to effect the lateral adjustment of the printing device to any desired starting-point, substantially as set forth.

6. An adding-machine provided with a printing device having a single line of type, and two independent series of keys and connections, one series operating to control the lateral adjustment of the printing device to its initial starting-point, and the other its lineal adjustment, printing action and return feed, substantially as set forth.

7. An adding-machine provided with a printing device, an impression-roller, paper-feeding mechanism, and two independent series of keys and connections, one series operating to control the lateral adjustment of the printing device to its initial starting-point and simultaneously operating the paper-feeding mechanism, and the other series controlling the position of the figures on the printing device to be printed, the printing action and the return feed of the printing device, substantially as set forth.

8. An adding-machine provided with a printing device having a single line of type, a series of adding-wheels, and two independent series of keys and connections, one series operating to control the lateral adjustment of the printing device to its initial starting-point, and the other series controlling the movement of the printing device to effect the positioning of the figure to be printed and simultaneously actuating an adding-wheel, and also actuating the printing device to effect the printing and the step-by-step return feed of the printing device, substantially as set forth.

9. In an adding-machine, a series of adding-wheels, paper-holding rollers stationary as to position but having rotative movements to feed the paper, a printing-arm located between said adding-wheels and paper-holding rollers having on one side a series of type-figures arranged in vertical line and numerical order facing the paper-holding roller, a series of gear-teeth on the opposite side adapted to engage with and actuate the adding-wheels, by the movements of said printing-arm, means for shifting said arm transversely in front of the paper to print from left to right, means for feeding back said arm toward the lowest place of numbers to space the figures, means for setting said arm in a perpendicular line at right angles to its shifting movement after engaging with the adding-wheels, and means for oscillating said arm to successively engage it with, and disengage it from the adding-wheels and to bring its type-figure into working contact with the paper.

10. In an adding-machine, an adding device and a paper-supporting device, combined with a movable printing-arm located between said devices, mechanism to actuate the printing-arm to bring it into engagement with the adding device and to actuate the latter, and subsequently to disengage it from the adding device and move it into contact with the paper to print thereon the number added, substantially as specified.

11. The combination of a series of adding-wheels, a paper holding and feeding device, a rack having perpendicular rectilinear movement for actuating the wheels, and located for operation between said adding-wheels and paper-holder, type-figures in single line carried by said rack and by the rectilinear movements of that part adapted to be set in position to imprint in required order upon the paper, a series of keys and mechanism for imparting perpendicular movements to said rack, whereby the required figures to be printed are successively added, a second mechanism operated by the same keys by which the said rack is oscillated in one direction to engage the adding-wheels and in the opposite direction to be brought in contact with the paper to imprint the figures added.

12. The combination of adding mechanism, an impression-roller and paper-feeding mechanism, a traveling type-carrying arm, shift-

ing-keys and connecting mechanism controlling the position of said arm with respect to the number of places occupied by the row of figures to be added and separately operating on said arm to shift it to the extreme left of the row and a series of printing and adding keys and mechanism connecting each key individually with the type-carrying arm, by which the said arm is operated to actuate the adding mechanism and to imprint said figure on the paper.

13. The combination of adding-wheels, a paper holding and feeding device, a fixed guide, a type-carrying arm shiftable thereon across the paper, shifting-keys and mechanism separately connecting each key with the type-carrying arm, a series of printing and adding keys, and mechanism actuated by each key to operate said arm to successively add and imprint the figure corresponding to the key depressed, and interlocking means actuated by the keys of one series to lock the individual keys of the other set which is out of action.

14. The combination of adding-wheels, an impression-roller, paper-feeding means, a rack adapted to engage the adding-wheels and having rectilinear movement to actuate the wheels, a series of type-figures on the rack in position for contact with the paper, a fixed guide, means for shifting said rack transversely to set it to the required position in the row of figures to be added and printed, means for imparting rectilinear movement to actuate the adding-wheels and for disengaging the rack from the adding-wheel and bringing its type-carrying side in contact with the paper.

15. The combination of a traveling printing-arm located between an adding device and an impression-roller and having a toothed rack adapted to be set into engagement with any one of the adding-wheels and to actuate the same by the movement of said arm, a series of shifting-keys by which said arm is set to different places of numbers beginning with the number on the extreme left of the row, and a second series of keys and mechanism variably operated by said keys by which the rack is caused to actuate the adding-wheels and afterward is brought in working contact with the paper on the impression-roller.

16. An adding device having a series of adding-wheels on a common shaft, a series of printing and reading wheels corresponding in number with the adding-wheels and individually and directly geared therewith to be rotated thereby, means for disengaging all the printing and reading wheels simultaneously from the adding-wheels and subsequently, while so disengaged, bringing them into contact with a paper strip to print thereon, and means to lock said printing-wheels against rotation when disengaged from the adding-wheels, substantially as set forth.

17. The combination with a series of adding-wheels, of a printing-wheel individually

connected with each adding-wheel to rotate in unison therewith and means for simultaneously detaching said printing-wheels from the adding-wheels and bringing them in printing contact with a paper strip.

18. The combination of adding-wheels, an impression-roller presenting a paper strip, a traveling printing-arm adapted by engagement with the adding-wheels to actuate the same and by contact with the impression-roller to print thereon the figures added by the adding-wheels, means for operating said arm to cause it to actuate the adding-wheels and afterward to make printing contact with the roller, individual printing-wheels corresponding in number and position with the adding-wheels and detachably connected with the adding-wheels to rotate in unison therewith and be set thereby, means for disengaging said printing-wheels and bringing them in printing contact with the paper strip to print the sum-total of the adding-wheels, means for inking the printing-arm and an inking device for the printing-wheels.

19. The combination of adding-wheels, a tubular shaft on which the same are mounted to rotate, an internal shaft carrying spring-bolts adapted by rotative movement of the shaft to engage internal recesses in the hubs of the adding-wheels and lock said wheels on the tubular shaft, means for turning the inner shaft, and a stop device for arresting the rotative movement of the outer shaft at a determined point to set back all the adding-wheels, simultaneously to the starting-point.

20. The combination with a series of adding-wheels containing a repeated set of figures on the circumference in each wheel, a circle of gear-teeth on its circumference, stop-pins on each wheel, an elbow-lever movable in a vertical arc having on one end a pivoted pawl adapted to engage said stop-pins, and a tooth on the other end in position to engage the corresponding pin in the adjacent wheel, a rocking arm having a curved end adapted by contact with said elbow-lever to oscillate the same, a spring-impelled bolt setting in line with the teeth of the adding-wheel located with relation to one end of the elbow-lever to be held back by the lever against the reactive force of its spring.

21. The combination with the traveling printing-arm having a slotted lower member, of a fixed guide A^4 , and a shaft A^5 , both extending through the slot in the printing-arm, hangers pivotally supported on the fixed guide and carrying the shaft A^5 , a rod B^5 connected at one end to the shaft A^5 , a finger-key, and spring-controlled means connecting said key with the rod B^5 , whereby the printing-arm is oscillated forward and back by pressure and release of the key, substantially as set forth.

22. The combination with the traveling printing-arm, of the fixed guide A^4 on which the said arm is adapted both to oscillate and to have perpendicular rectilinear movement, vibrating frame $K K K^4$, a connection be-

10
between the printing-arm and the frame, and
means for vibrating the frame in a vertical
are consisting of the inclined bar K¹, rocking
cam-plates L, finger-keys B and connecting
5 means between the finger-keys and the cam-
plate whereby graduated rectilinear move-
ments of the printing-arm are produced by
pressure upon the keys.

23. The combination with a fixed guide and
10 a printing-arm mounted to slide and vibrate
on said guide, in front of an impression-roller
to make printing contact therewith, of an ink-
ing device movable laterally with the print-
ing-arm and located between the latter and
15 the impression-roller, said inking device yield-
ing laterally when engaged by the printing-
arm in its movement toward the impression-
roller.

24. In an adding-machine the combination

with a series of adding-wheels, of an individ- 20
ual printing-wheel to each adding-wheel bear-
ing type-figures composed of the ten digits,
means for rotating and setting said printing-
wheel in unison with the adding-wheels, and
25 means for disengaging the whole set of print-
ing-wheels from said adding-wheels and for
bringing them simultaneously in printing
contact with a paper strip, said printing-
wheels being arranged to print ciphers in all
the spaces to the left of the highest figure in 30
the line at the same operation of imprinting
the sum-total on the paper.

In testimony that I claim the foregoing I
have hereunto set my hand and seal.

ADAM HOCH. [L. S.]

Witnesses:

MAX BLUM,

EDWARD E. OSBORNE.