No. 680,340. Patented Aug. 13, 1901.

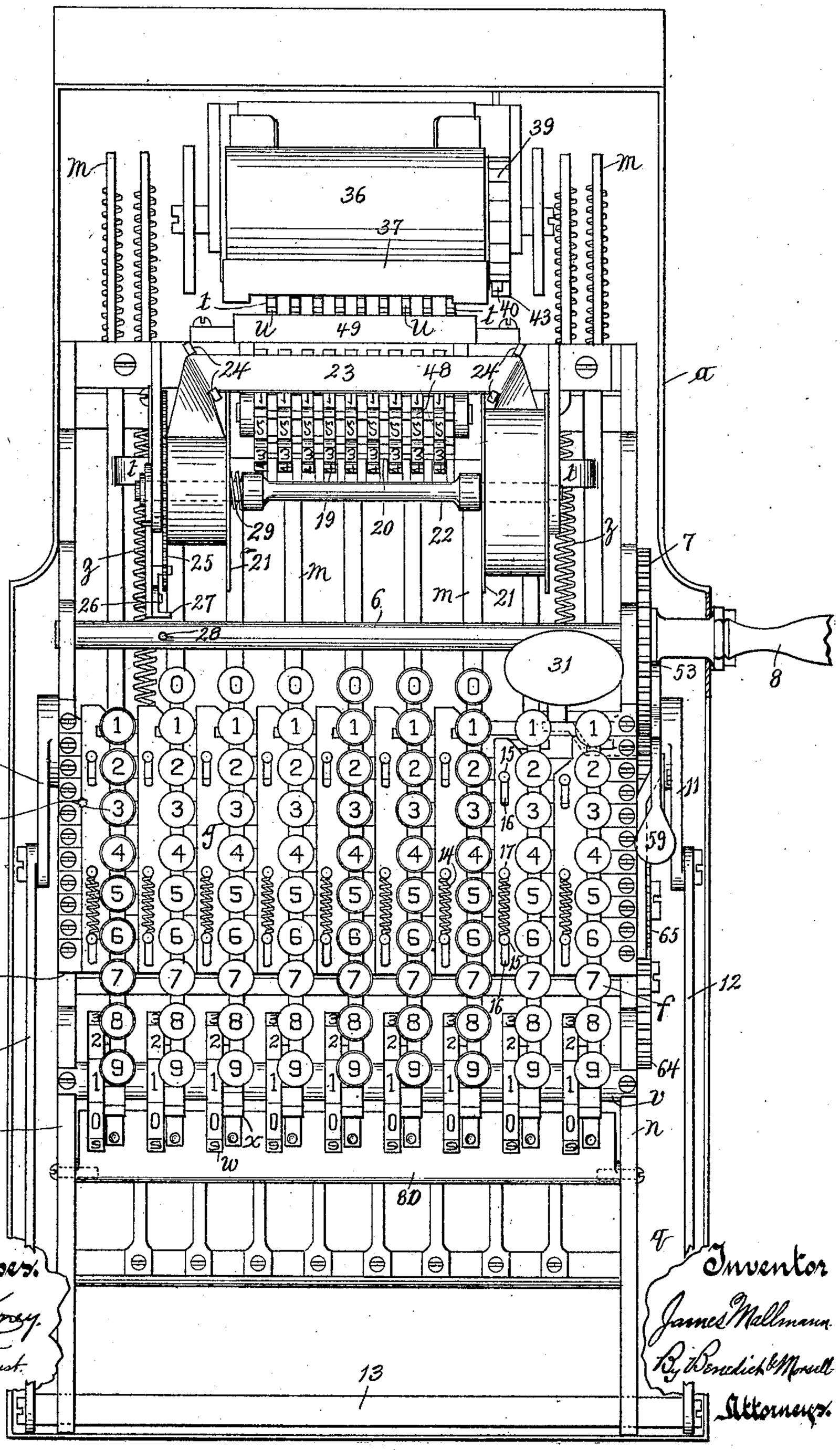
# J. MALLMANN.

## CALCULATING MACHINE.

(Application filed Sept. 1, 1900.)

(No Model.) 6 Sheets—Sheet 1.

Fig. 1.

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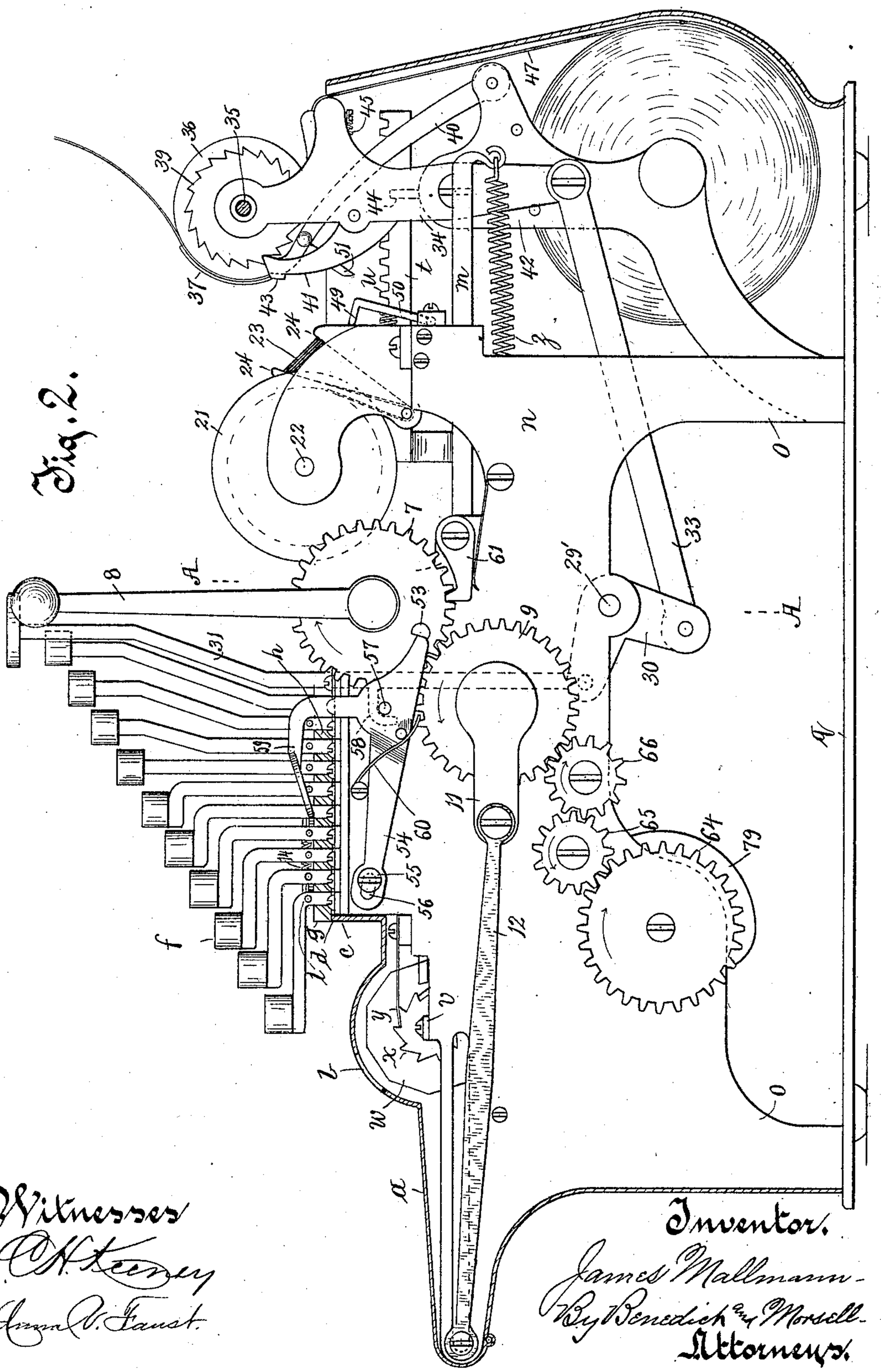
(No Model.) 6 Sheets—Sheet 2.

Fig. 2.

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(No Model.)

6 Sheets—Sheet 3.

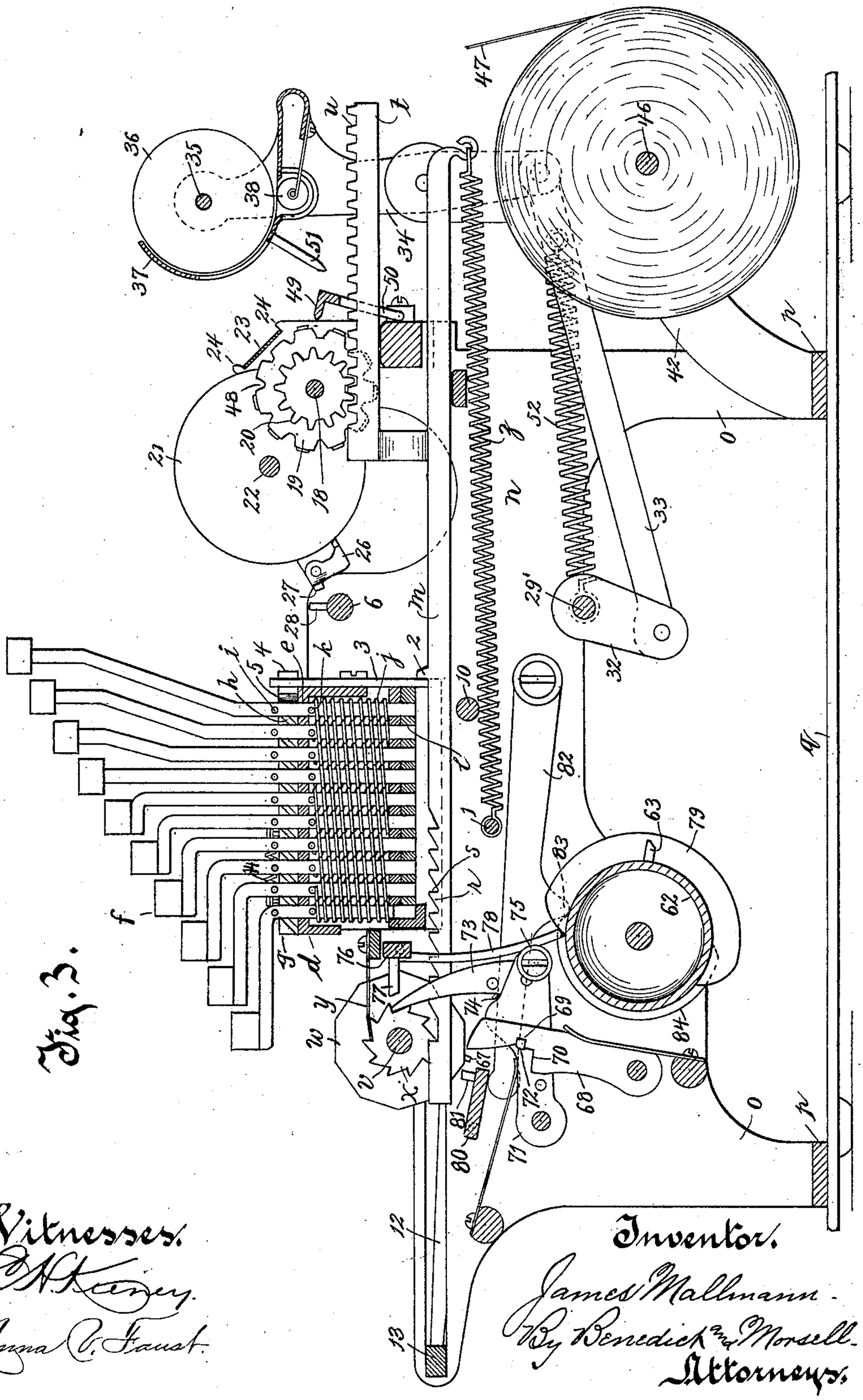

Fig. 3.

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(No Model.) 6 Sheets—Sheet 4.

Fig. 4.

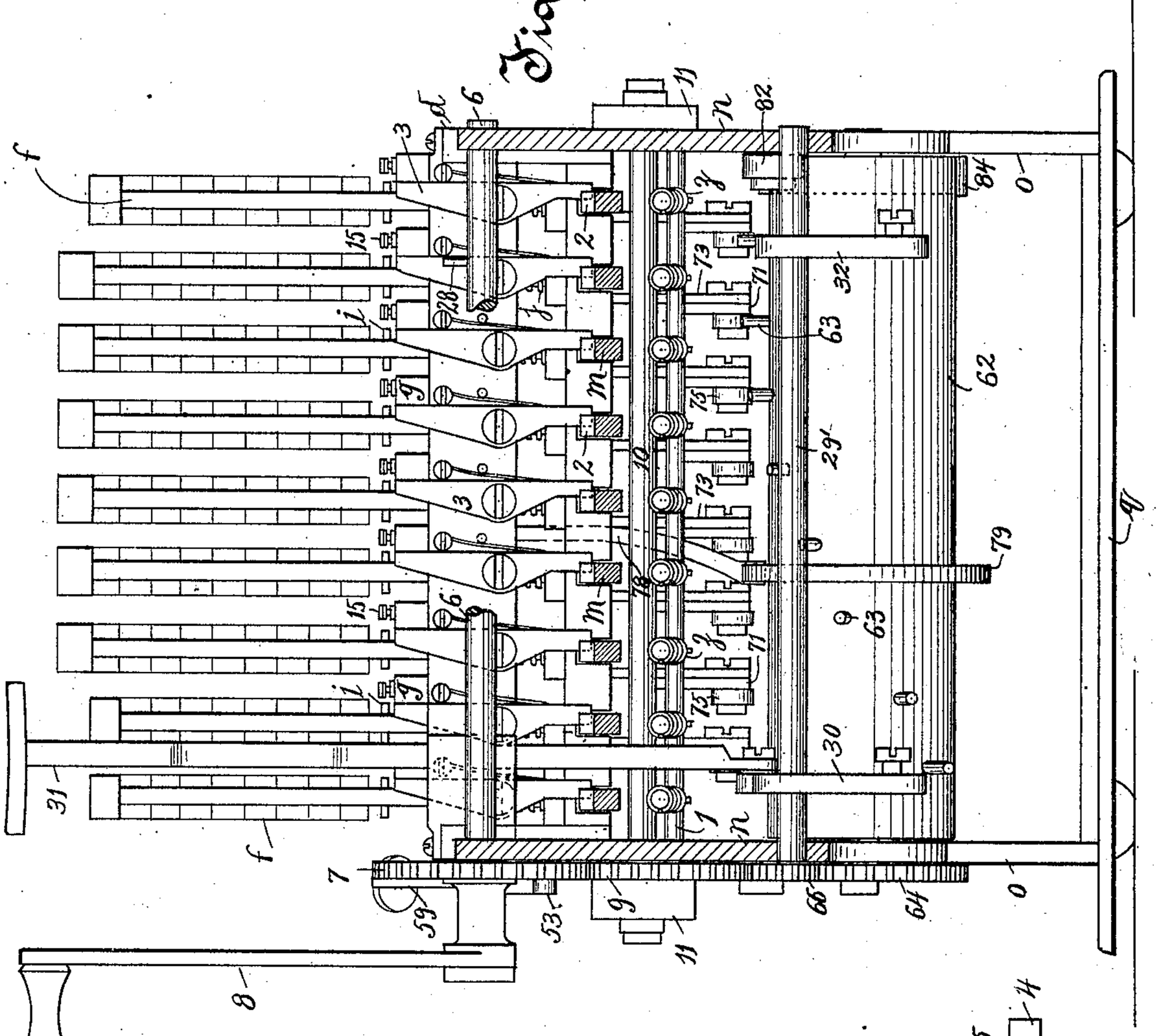



Fig. 5.

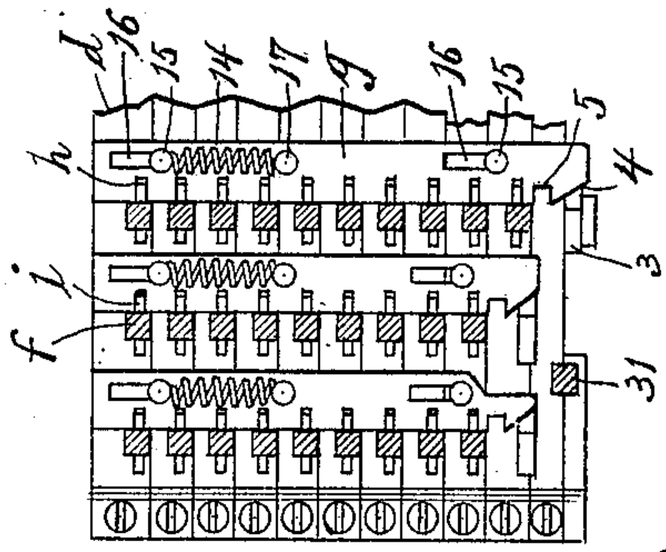
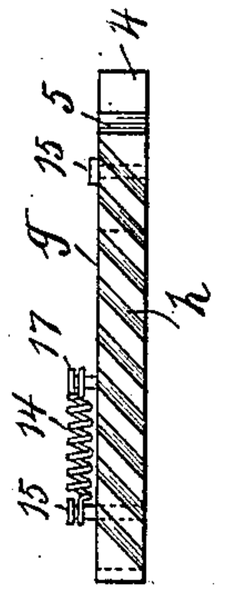



Fig. 6.

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## CALCULATING MACHINE.

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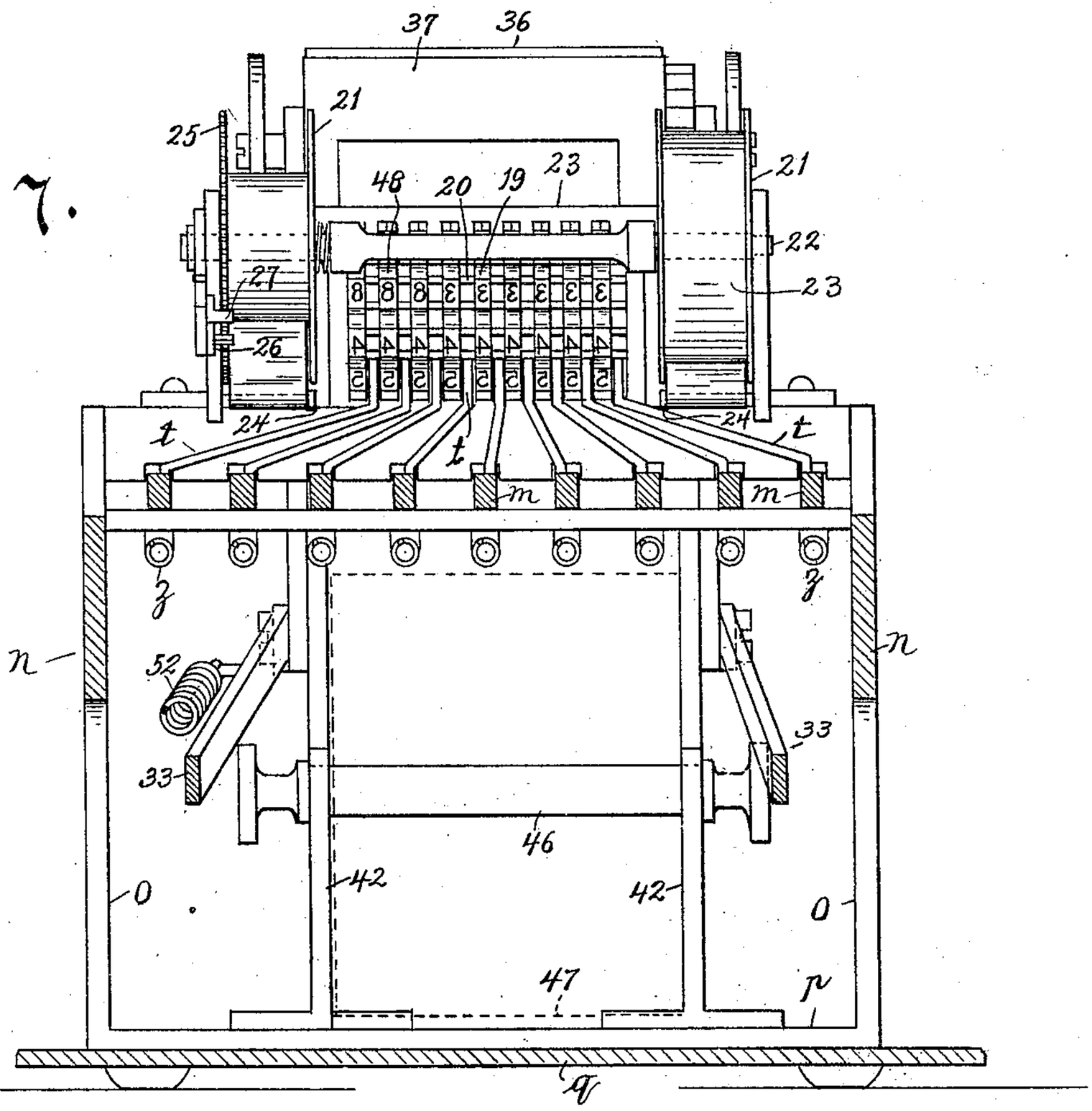
(No Model.) 6 Sheets—Sheet 5.

Fig. 7.



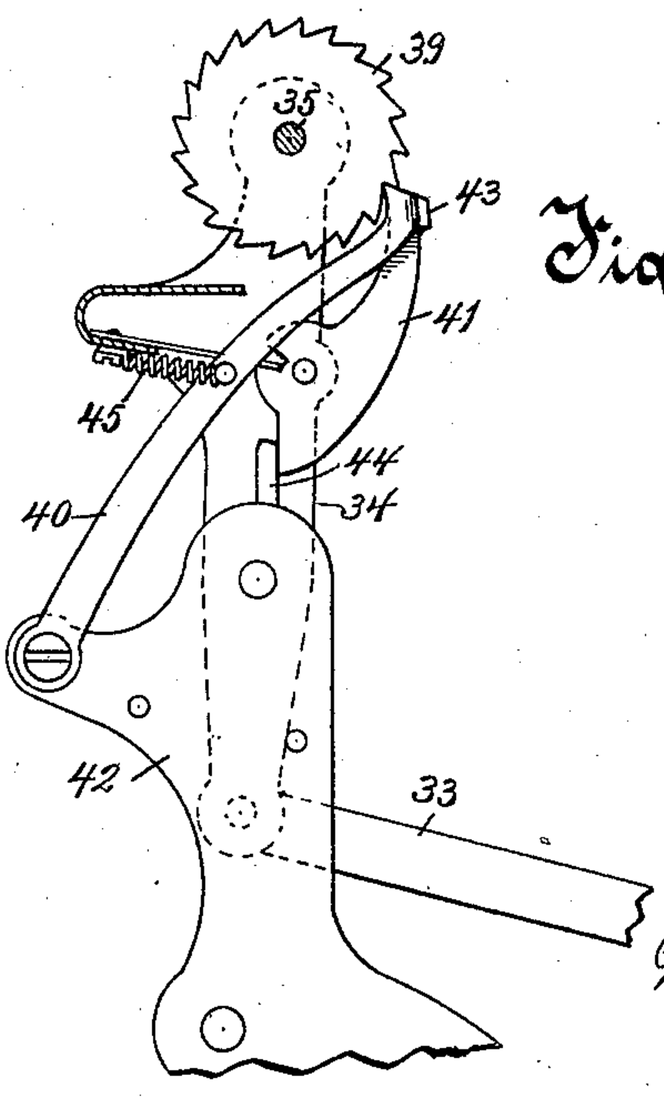




Fig. 8.

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## CALCULATING MACHINE.

(Application filed Sept. 1, 1900.)

(No Model.) 6 Sheets—Sheet 6.

Fig. 9.

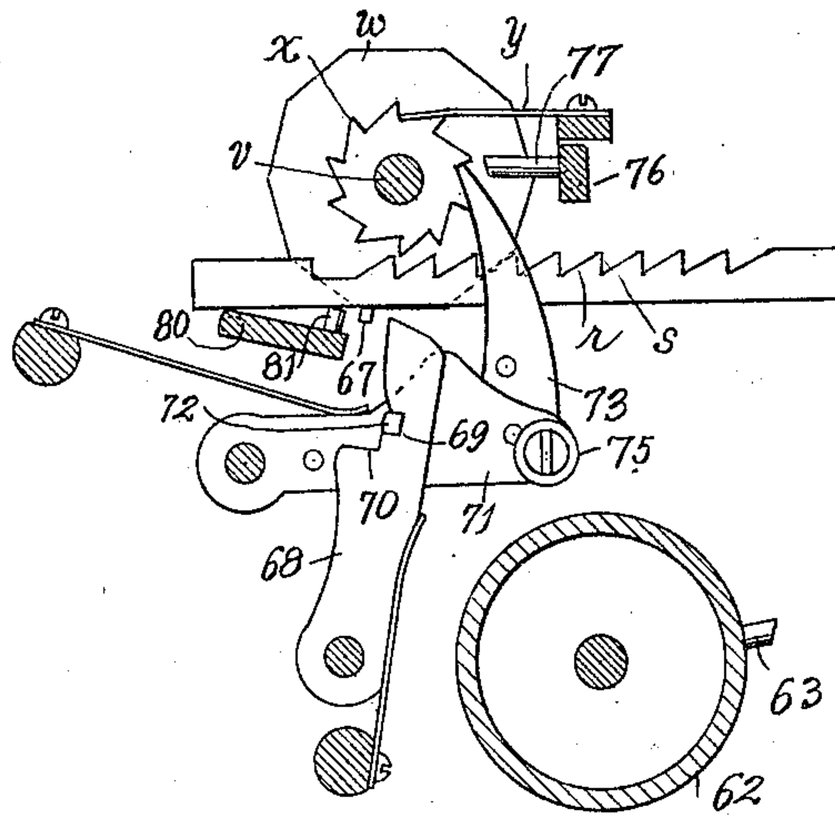



Fig. 14.

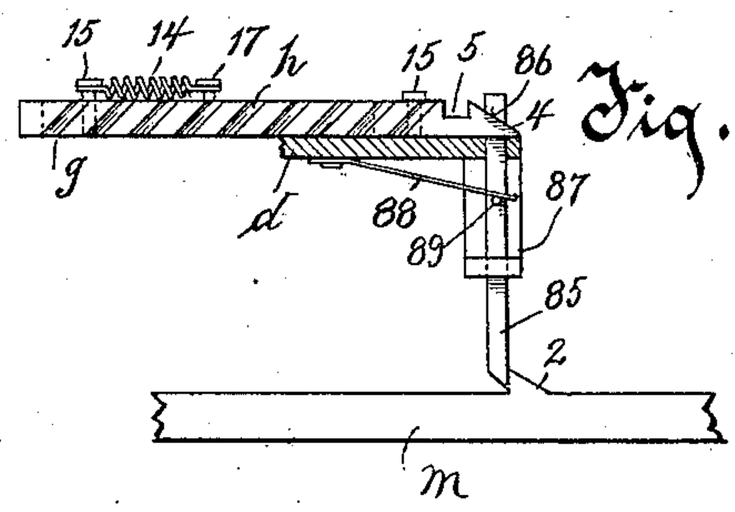



Fig. 10.

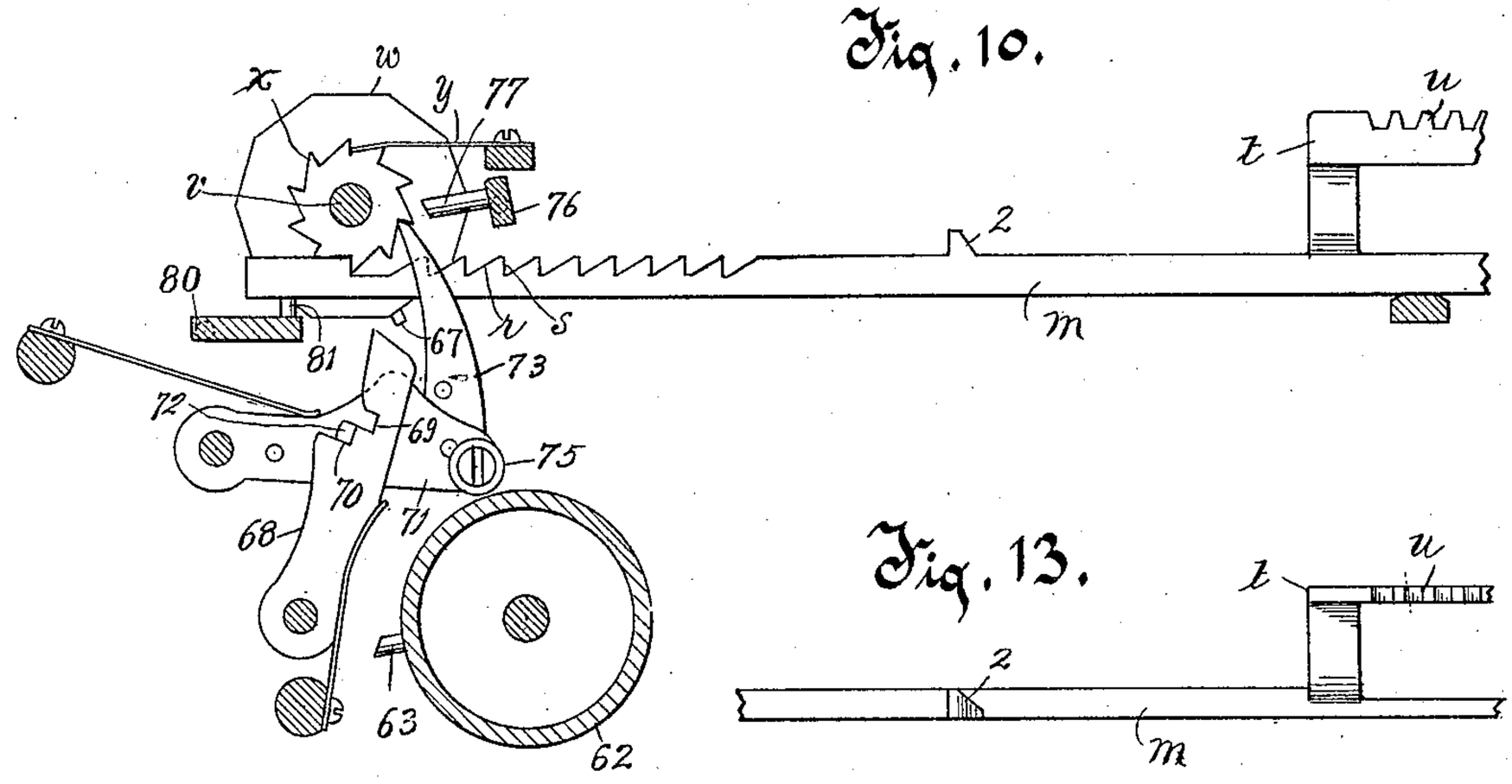



Fig. 13.




Fig. 11.

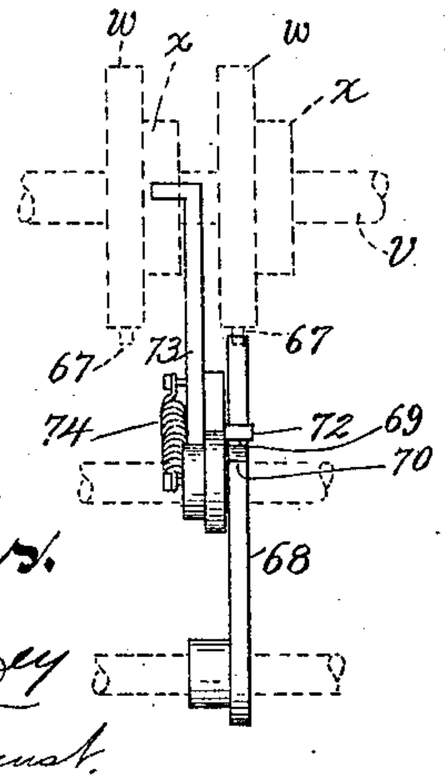
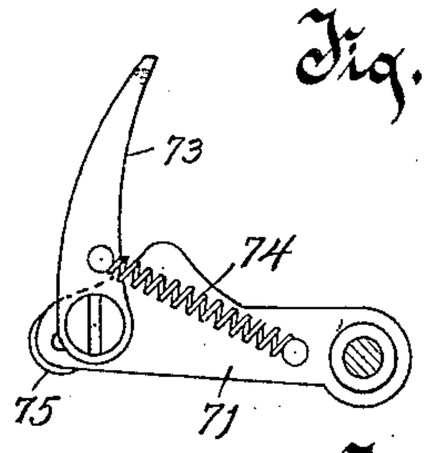



Fig. 12.

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# UNITED STATES PATENT OFFICE.

JAMES MALLMANN, OF SHEBOYGAN, WISCONSIN.

## CALCULATING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 680,340, dated August 13, 1901.

Application filed September 1, 1900. Serial No. 28,745. (No model.)

*To all whom it may concern:*

Be it known that I, JAMES MALLMANN, of Sheboygan, in the county of Sheboygan and State of Wisconsin, have invented a new and useful Improvement in Calculating-Machines, of which the following is a description, reference being had to the accompanying drawings, which are a part of this specification.

My invention has relation to improvements in calculating-machines, more particularly to certain improvements upon the machine covered by United States Letters Patent issued to me on May 15, 1900, No. 649,522.

The primary object of the invention is to provide in a machine of the same general class as that covered in the Letters Patent aforesaid an improved arrangement for operating the mechanism by pressure-keys instead of by an implement separate from the mechanism and operated by manual manipulation, as in said former Letters Patent.

With the above primary object and other incidental objects in view the invention consists of the devices and parts or their equivalents, as hereinafter set forth.

In the accompanying drawings, Figure 1 is a plan view of the entire machine with a part of the upper portion of the casing removed. Fig. 2 is a side view of the machine with one side of the casing removed. Fig. 3 is a longitudinal sectional view of the mechanism removed from the casing. Fig. 4 is a section on the line A A of Fig. 2 and looking to the left. Fig. 5 is a detail plan view of the keyboard with the keys in cross-section. Fig. 6 is a detail of one of the devices for locking the keys when depressed and also for unlocking the longitudinal actuating-bars. Fig. 7 is a cross-section on the line A A of Fig. 2, but looking to the right. Fig. 8 is a detail view of the paper-spacing mechanism. Figs. 9, 10, 11, 12, and 13 are detail views of working parts of the machine, and Fig. 14 is a detail view of a modification in the mechanism for unlocking the actuating-bars.

Referring to the drawings, the letter *a* indicates the casing of the machine, which may be of any suitable construction best adapted for inclosing the principal operating parts of the mechanism. In the top of the casing, near the front end thereof, are a series of sight-openings *b*, and back of these openings the casing is provided with a raised portion *c*. The top *d* of this raised portion, and which forms a keyboard, is provided with a plurality of longitudinal lines of openings *e*. Passing loosely through the openings of each line are operating-keys *f*, said keys gradually increasing in height from the forward key rearwardly and being properly bent, so as to make a step-by-step arrangement of the finger-pieces at the outer ends of the keys. The finger-pieces of each line of keys, with the exception of the first line of keys at the left hand of Fig. 1 and the first two lines of keys at the right hand of Fig. 1, are numbered consecutively from "0" to "9," the rear keys of the lines being numbered "0" and the numbers increasing consecutively toward the front. The said first line of keys at the left hand of Fig. 1 and the first two lines of keys at the right hand of said Fig. 1 are numbered from "1" to "9," the rear keys being numbered "1" and the numbers increasing consecutively toward the front and which arrangement is for a reason hereinafter to be referred to. It is obvious that any desirable number of lines of keys may be provided. In the machine illustrated in the accompanying drawings I have shown nine of said longitudinal lines of keys.

Secured to the upper side of the top *d* are a series of bars *g*, there being one of said bars for each line of keys. Each bar is formed with a series of diagonal slots *h*, the number of said slots corresponding to the number of keys in each line. Each key is provided with a laterally-extending pin *i*, which normally is in line with the upper end of the slot *h* corresponding thereto. Below the top *d* each key is encircled by a coiled spring *j*, and these springs at their upper ends act against pins *k*, intersecting the keys, and thereby normally hold the keys up. The lower ends of the keys fit in suitable guide-openings *l* in the framework, and the lower extremities of the keys of each line are normally a slight distance above the upper edge of a longitudinal actuating-bar *m*, there being one of said bars for each line of keys. This is true of all the keys of each longitudinal line of keys, with the exception of the forward key of each line, or the key numbered "9." This key while it fits in an opening *l* yet is not permitted to be

pressed downwardly, so as to extend below the lower end of the opening, but its downward movement is limited by an angular ledge which closes the lower end of said opening, as most clearly shown in Fig. 3.

The operating mechanism of the machine is connected to or carried by or supported on a suitable framework located within the casing. This framework may be of any desired form of construction best adapted for supporting the operative parts, and in the accompanying drawings I have shown said framework as consisting of the two side pieces *n n*, having the forward and rear depending legs *o o*, the lower connecting transverse pieces *p p*, and the lower longitudinal base-piece *q*.

The longitudinal actuating-bars *m* are adapted to slide in suitable guideways in the framework, and each of these bars is provided at its forward end and upon its upper edge with a series of rearwardly and upwardly inclined teeth *r*, there being nine of such teeth shown, and the rearward and forward inclined edge of each tooth terminates in an upright shoulder *s*. The rear portion of each longitudinal actuating-bar is formed or provided with an arm *t*. These several arms incline inwardly or converge toward each other, and from the termination of the inclined portions thereof they extend in straight parallel lines, the said straight parallel portions being provided on their upper edges with teeth *u*.

At the forward end of the machine and journaled in the side pieces of the framework is a shaft *v*, said shaft having mounted loosely thereon a series of calculating-wheels *w*, nine of said wheels being shown in the accompanying illustration of my invention, to correspond to the number of sight-openings *b* and to also correspond to the number of actuating-bars *m*. It is obvious, however, that any desired number of calculating-wheels, openings *b*, and bars *m* may be employed. Each calculating-wheel has arranged around its periphery a series of numbers running from "0" to "9." Each calculating-wheel has also projecting from one side thereof and integral with or fast to said side a ratchet-wheel *x*. A pawl *y* engages each ratchet-wheel and prevents backward rotation of said wheel, and consequently holds said wheel in adjusted position.

The rear ends of coiled spring *z* are secured to the rear ends of the longitudinal actuating-bars, and the forward ends of these springs are secured to a transverse rod 1, the said rod having its ends fixed in the side pieces of the framework. The tendency of these springs is to throw the longitudinal actuating-bars forward; but in order to prevent said springs normally from forcing said bars forward I provide the upper edge of each bar with a shoulder 2. Each shoulder is adapted to abut against the lower end of a medially-pivoted arm 3, there being one of these arms for each longitudinal actuating-bar. The engagement of these shoulders with the arms of course necessarily holds the bars back in the position shown in Fig. 3. When the arms 3 are swung out of engagement with these shoulders, then the springs at once thrust the actuating-bars forward, the said bars moving to the limit permitted by the engagement of the shoulders 2 with the particular key which has been depressed. In the case of the forward keys, or the keys numbered "9," the movement of the longitudinal bars is not limited by the engagement of the shoulder 2 with the lower ends of said keys; but the shoulders 2 in such case contact with the angular ledge, hereinbefore referred to, arranged below the lower ends of said forward keys. This unlocking of the actuating-bars is effected by reason of the action of the keys upon the slide-bars *g*. When one of the keys is depressed, the laterally-extending pin *i* thereof will ride down in the diagonal or inclined slot *h*, and this will necessarily force the bar *g* rearward. The rear extremity of each of said bars, it will be noticed, is beveled, as indicated by the numeral 4, and each bar is also provided just in advance of the beveled end with a notch 5. When, therefore, one of the bars *g* is thus forced rearwardly, the bevel 4 will act against the upper end of one of the medially-pivoted arms 3 and turn said arm on its pivot, so as to throw the lower end of said arm out of engagement with the shoulder 2 of the actuating-bar *m*, relating thereto. The moment the shoulder is thus disengaged the coiled spring *z* of the particular actuating-bar will thrust said bar forward, and with this forward movement the shoulder 2 is necessarily brought in advance of the lower end of the arm 3, and at this moment the upper end of said arm falls into the notch 5, and is thereby permitted to swing back to its normal position, and hence the actuating-bar which has been thrust forward will remain in its forward position by the action of the spring *z* until the shoulder 2 is again brought back of the lower end of the arm 3. This latter action is accomplished by means of the mechanism which will now be explained.

Journaled in the side pieces of the framework is a shaft 6, upon which is mounted a toothed wheel 7. On one extremity of this shaft is a hand-crank 8. The toothed wheel 7 meshes with another toothed wheel 9, carried on a shaft 10. On opposite ends of this shaft are cranks 11 11. To the ends of these cranks are connected links 12 12, the forward ends of said links being connected to a transverse bar 13. Whenever it is desired to return any one or more of the actuating-bars rearward, the hand-crank 8 is turned in the proper direction, and this, through the intermeshing of the toothred wheels 7 and 9, will cause the transverse bar to move rearward, and after said bar has moved rearward a certain distance it will contact with the foward ends of the actuating-bars *m*, which have been thrust forward, and thereby force said bars rearward. This will cause the shoulders

2 to be brought into engagement with and to press against the lower ends of the arms 3, and thereby turn said arms in a direction to permit the shoulders 2 to pass by the lower ends of the arms 3, and thereby resume their former positions back of the lower ends of said arms. This turning of the arms 3 will also cause the upper ends thereof to be thrown out of engagement with the notches 5, and thereby release the slide-bars *g*. The bars *g* are then returned to their normal positions by the action of coiled springs 14, there being one of said coiled springs for each bar *g*. The bars *g* are guided in their sliding movement by means of pins 15 15, which extend from the top *d* and pass through elongated slots 16 16 in each bar *g*. The rear end of each spring 14 is connected to a pin 17, extending upwardly from each bar *g*, and the forward end of each of said springs is connected to the forward pin 15. When the bars *g* are returned to their normal positions in the manner just explained, the upper ends of the arms 3 then ride on the bevels 4, and hence said arms 3 are turned in a direction so as to bring their lower ends in advance of the shoulders 2, and thereby again lock the actuating-bars *m* in their rearwardly-thrust positions. Also when the slide-bars *g* are returned to their normal positions in the manner just explained the coiled springs *j* act expansively against the pins *k*, which intersect the keys, and consequently force said keys upwardly to their normal raised positions.

Mounted loosely on a transverse shaft 18, which is located toward the rear of the machine, is a series of printing-wheels 19, each of said wheels having around the periphery thereof a series of type with the numerals "0" to "9" thereon. Secured fast to one side of each printing-wheel is a toothed wheel 20, and each of these toothed wheels is in position to be engaged by the teeth *u* of the arms *t*. From this arrangement it follows that when any one of the longitudinal actuating-bars is moved forward the teeth *u* will engage with the toothed wheel 20 relating thereto, and thereby turn the particular printing-wheel relating to said toothed wheel.

Suitable means should be provided for inking the type on the printing-wheels, and in the accompanying drawings I show the preferred means for accomplishing this, consisting of two reels 21 21, mounted loosely on a transverse shaft 22. Upon these reels is carried an inking-ribbon 23. This inking-ribbon passes from one wheel to the other and across the faces of the printing-wheels, as most clearly shown in Fig. 1, it being guided across the faces of the printing-wheels by reason of its passage between sets of guide-lugs 24 24 and 24 24. The ribbon is unwound from reel 21 at the right hand of Fig. 1 and wound up upon reel 21 at the left. To accomplish this, the outer side piece or flange of reel 21 at the left is provided peripherally with a series of teeth 25, which are adapted to be engaged by a pivoted dog 26. This dog is provided with a laterally-extending lug 27. The lug at certain intervals is engaged by a pin 28, extending from the shaft 6. When, therefore, the hand-crank 8 is turned, the pin 28, after the shaft 6 is rotated a certain distance, will contact with the lug 27 and throw the engaging free end of the dog 26 into engagment with the teeth 25 and through this means cause a slight rotation of the left-hand reel 21, and hence a slight movement of the inking-ribbon each time the crank 8 is turned, whereby new surfaces of the inking-ribbon are continually presented. In order to prevent the left-hand reel 21 from backward movement after it has been actuated by the dog 26, I provide a coiled spring 29 on the spindle 22, said spring bearing against the inner flange of the said reel 21 and throwing the outer flange thereof into frictional engagement with the framework, thereby forming a frictional brake. When the ribbon is fully wound up on the left-hand reel 21, it may be again wound up on the right-hand reel 21 either by turning said reel or the spindle 22 by hand.

Journaled in the side pieces of the framework is a rock-shaft 29'. Fast on one end of this rock-shaft is a bell-crank lever 30, and to the upper arm of this bell-crank lever is connected the lower end of a finger-key 31. On the opposite end of the rock-shaft 29 is a crank-arm 32. To the lower arm of the bell-crank lever 30 and to the extremity of the crank-arm 32 are pivotally jointed the forward ends of links 33 33. The rear ends of these links are pivotally jointed to the lower ends of medially-pivoted levers 34 34. The upper ends of these levers carry a spindle 35, upon which is mounted a paper carrying and feeding cylinder 36. This cylinder has adjacent thereto the usual curved paper guide and holder 37. Bearing against the under side of the cylinder is the usual yielding guide-roll 38. The spindle 35 has also mounted thereon adjacent to one end of the paper-carrying cylinder a ratchet-wheel 39 for spacing the paper. This wheel is engaged by two pawls, one of said pawls being indicated by the numeral 40 and the other by the numeral 41. Pawl 40 is pivoted to one of a set of standards 42 42, and pawl 41 is pivoted at a point between its ends to one of the medially-pivoted levers 34. The upper end of pawl 41 is provided with a projecting lug 43, which bears against the upper end of pawl 40 and holds said pawl in engagement with the teeth of the ratchet-wheel. The lower end of the pawl 41 bears against a pin 44, which serves as a stop to limit the movement of said pawl in one direction. A coiled spring 45 is secured to pawl 40 and serves to cause said pawl to jump into engagement with a tooth of the ratchet-wheel on the movement of the paper-carrying cylinder. Both of these pawls are normally in engagement with the same tooth of the ratchet-wheel, and said ratchet-

wheel is thereby held firmly against accidental turning from its normal position. In the operation of these pawls when the paper-carrying cylinder is swung forwardly, so as to bring the paper into contact with the printing-wheels, the pawl 41 necessarily remains in engagement with the same tooth of the ratchet-wheel, in view of the fact that said pawl is carried by one of the medially-pivoted arms 34. The pawl 40, however, on the forward movement of the paper-carrying cylinder will jump into engagement with the next lower tooth of the ratchet-wheel, by reason of the fact that said pawl is carried by one of the fixed standards 42. On the return rearward movement of the paper-carrying cylinder, however, the pawl 40 will necessarily cause the cylinder to be rotated rearwardly the distance of one tooth, thereby shifting the paper the space of a line, and the pawl 41 will then jump into engagement with the said tooth, and the two pawls will be again engaging the same tooth ready for a repetition of this operation on the next movement of the paper-carrying cylinder.

The standards 42 hereinbefore mentioned serve as bearings for the end of a roll 46, said roll having wound thereon the paper 47, upon which the printing is done. This paper is extended upwardly from the roll 46, thence between the guide-roll 38 and the paper-carrying cylinder, and thence between said cylinder and the curved paper guide and holder 37.

By referring to the printing-wheels it will be seen that there is a space 48 formed between every two of the projecting type. These spaces when several of the printing-wheels are brought to printing position are adapted to be engaged by suitable mechanism, so as to hold said wheels firm in adjusted position, and thereby provide for proper alinement. In the drawings I show for the purpose an angle-bar 49, said bar provided with a depending stem 50, which is pivoted at its lower end, so as to permit the angle-bar to swing. An arm 51 extends forwardly from the paper-guide 37, and as the paper-carrying cylinder is swung forwardly this arm will contact with the angle-bar 49 and throw the forward edge thereof into engagement with the registering spaces 48, and thereby hold the printing-wheels locked, with the characters on the several wheels properly alined ready for printing. Of course on the return rearward swing of the paper-carrying cylinder the arm 51 is brought out of contact with the angle-bar 49, and hence said bar is permitted to return to its normal position out of engagement with the spaces 48.

When the finger-key 31, hereinbefore referred to, is depressed, the links 33 33 are of course thrust rearwardly, and these links acting on the medially-pivoted levers 34 cause said levers to turn in a direction to throw the cylinder 36 forwardly, and thereby bring the paper carried by said cylinder into contact with the type on the printing-wheels which have been brought to printing position. In order to retrieve the several parts referred to when finger-pressure on the key 31 is removed, I provide a coiled spring 52. The rear end of this spring is connected to one of the links 33 and the forward end of said spring to the rock-shaft 29. The recoil of this spring will of course return the several parts to their normal positions.

The toothed wheel 7, hereinbefore referred to, is provided on one face with a projecting stop 53. Against this stop the rear end of a pivoted lever 54 is adapted to bear. The pivot-pin 55 of this lever extends through an elongated slot 56 in the lever. The lever has also a pin 57 extending laterally therefrom, and this laterally-extending pin is engaged by a hooked or bent arm 58, extending from the finger-key 31. The lever 54 is furthermore provided with an upwardly-extending arm 59, said arm provided at the extremity of its upper bent end with a finger-piece for convenience in operating. Now when the key 31 is depressed the hooked or bent arm 58 will act on the pin 57 and cause the rear end of the lever 54 to descend, thus throwing its rear extremity out of engagement with the stop 53. The free end of a flat spring 60 acts on the lever 54, and this spring the moment the end of the lever is forced down out of contact with the stop 53 will act to thrust the lever rearwardly until its end is beneath the stop. This movement of the lever is made possible by reason of the fact that the pivot-pin 55 extends through an elongated slot 56 in the lever. Now the moment the rear end of the lever gets beneath the stop, as just explained, said lever is held there as long as the lug 53 is bearing thereon, while the key 31 is permitted to return to its normal position. The hand-crank is now free to be turned, and the turning of this hand-crank returns the longitudinal actuating-bars *m* to their normal positions, as hereinbefore explained. The turning of the crank is continued until the stop is again brought into contact with the lever 54, the said lever of course having returned to its normal position the moment the stop ceased to bear thereon. If no locking means were provided for the crank 8, the operator might at times thoughtlessly turn the crank without type-writing the amount. If now it is desired to perform the calculating without putting the printing mechanism into operation, or if it is desired to set the calculating-wheels to "0," the finger-key 31 of course is not depressed at all, but instead thereof the finger-piece of the arm 59 is acted upon and the lever 54 depressed, so as to bring its rear end beneath the stop 53. This of course unlocks the shaft 6 and allows the hand-crank to turn the same. A spring-pressed pawl 61 engages the toothed wheel 7 and prevents backward rotation thereof.

It is necessary in machines of this character to provide means when one of the calculat-

ing-wheels has made a complete revolution—*i. e.*, has been turned so as to bring "0" to view through its appropriate sight-opening—for carrying over onto the next calculating-wheel of the series. To provide for this, I employ a cylinder 62, said cylinder having a series of graduated pins 63 extending therefrom and for a distance about one-half around and spirally of its circumference. For imparting rotation to the cylinder I mount on the axis thereof a toothed wheel 64. This toothed wheel derives its rotation from a train of gearing between it and the toothed wheel 9, said gearing consisting of two pinions 65 and 66. Projecting from the periphery of each calculating-wheel, excepting the last calculating-wheel of the series, is a pin 67. A series of spring-pressed pivoted dogs 68 are so arranged that their upper ends are in position to be acted upon by the pins 67 when the calculating-wheels make a complete revolution. Each dog is provided with a notch 69 and also with a shoulder 70 below said notch. A series of spring-pressed levers 71 are also provided, and each of these levers is provided with a laterally-projecting lug 72, which is normally in engagement with the notch 69, as shown clearly in Figs. 3 and 9. A pawl 73 is pivoted to the end of each lever 71, and the upper ends of these pawls are in position to engage with the teeth of the ratchet-wheels $x$, excepting the first ratchet-wheel at the right hand. Each pawl is held yieldingly in engagement with the teeth of the ratchet-wheel $x$ by means of a coiled spring 74, one end of each of said springs being secured to one of the pawls and the other end to one of the levers 71. At its rear end each lever 71 carries an antifriction-roller 75. In the operation of this carrying-over mechanism when one of the calculating-wheels is completing its revolution, or, in other words, is rotating the distance from the numeral "9" thereon to the "0" mark, the pin 67 of said calculating-wheel will engage the upper end of the dog 68 and turn said dog rearwardly on its pivot. This will release the lug 72 of the lever 71 from engagement with the notch 69, and thereby permit the lever to drop by the action of the spring thereon, bringing the lug thereof into engagement with the shoulder 70, as clearly shown in Fig. 10, and also bring the upper end of the pawl into engagement with the next lower tooth of the ratchet-wheel $x$ than the tooth with which it is shown in engagement in Fig. 3. Now with the rotation of the cylinder 62 one of the pins 63 of said cylinder is brought into engagement with the antifriction-roller 75, and the lever 71 is thereby again caused to be raised, and at the same time the pawl 73 is raised therewith. The raising of the pawl causes said pawl to rotate the ratchet-wheel $x$ with which it is in engagement the distance of one tooth, and consequently carry over one number from a preceding calculating-wheel of the series to a succeeding calculating-wheel of the series. The uplifting of the lever 71 also again brings the lug 72 thereof into engagement with the notch 69, and consequently the parts are again held at their normal positions. If no means were provided to guard against such contingency, the calculating-wheel, which is rotated by the carying-over mechanism in the manner just explained, might, owing to the momentum, be carried over beyond the required distance. In order to guard against this, I provide mechanism to prevent overrotation in carrying over, and this mechanism consists of a rock-bar 76. This bar has a series of fingers 77 projecting therefrom, there being one of said fingers for each pawl 73. The rock-bar has an arm 78 depending therefrom, the lower end of said arm being in position to be acted upon by a cam 79, formed partly around the circumference of the cylinder 62. When the crank 8 has been turned sufficiently to bring the bar 13 to the limit of its rear movement, and thereby thrust the bars $m$ rearwardly to locked position, the cylinder 62 will then have been rotated sufficiently far to bring the initial end of the cam 79 into engagement with the arm 78, and thereby turn the bar 76, and consequently thrust fingers 77 against the pawl 73. The pawl 73 being now in carrying position will be actuated by the further rotation of the cylinder 62, and said pawls in raising and carrying forward one tooth are wedged in between the ratchet-wheel $x$ and the pins 77. The ratchet-wheels and also the calculating-wheels are thereby prevented from possible overrotation through the momentum of the carrier action. When the arm 78 passes off of the cam 79, the bar 76, with its fingers 77, falls back and remains in this position during the movement of the arms $m$ rearwardly.

From the description of the machine thus far it will be apparent that on the forward movement of the longitudinal actuating-bars $m$ the ratchet-wheels $x$ are not rotated, the teeth $r$ of said bars slipping by the teeth of the ratchet-wheels without turning said wheels. On the reverse rearward movement of the actuating-bars, however, the teeth $r$ actively engage the teeth of the ratchet-wheels and cause a rotation of said wheels. In order to hold the actuating-bars firmly in engagement with the teeth of the ratchet-wheels during this rearward movement of said actuating-bars, I provide a pivoted bar 80, said bar provided with a series of projecting fingers 81, there being one of said fingers for each longitudinal actuating-bar. I furthermore provide a pivoted arm 82, said arm having its forward end beneath the bar 80. The under edge of the arm 82 is provided with a projection 83, which is in position to be acted upon by another cam 84 on the cylinder 62, said cam extending partly around the circumference of the cylinder. In the operation of this mechanism at the moment an actuating-bar $m$ begins its rearward movement the cam 84

on the cylinder 62 will act on the projection 83, and thereby turn the arm 82 upwardly, causing its forward end to act against the under side of the pivoted bar 80, and thereby throw the fingers 81 of said bar into engagement with the actuating-bars *m*, whereby the teeth of said actuating-bars are held firmly in engagement with the teeth of the ratchet-wheels *x* during the rearward movement of the actuating-bars.

In the operation of the invention the calculating-wheels are all first turned to "0." To set the wheels to "0," add in the ordinary way such an amount to the amount shown on the calculating-wheels as to bring all the wheels to "0." For example, if the calculating-wheels all show "9" add one by pressing the key "1" in the first column and turning the crank 8 once around. This will bring all the wheels to "0;" or if all the wheels show "0" excepting the wheel of the first column and that wheel shows the numeral "1" all the "9" keys are depressed and crank 8 is then turned once around, and all the calculating-wheels will then be brought to "0." Again, if the wheels show "000051690" press keys "99994831," turn crank-handle 8 once around, and all the wheels will be at "0." In performing a mathematical problem it is of course necessary to depress the keys *f*, and this has the effect of unlocking the longitudinal actuating-bars *m*, which bars are then moved forwardly by the springs *z*, the forward movement being limited by contact of the shoulder 2 of each actuating-bar with the lower end of the depressed key or with the angular ledge beneath the "9" keys in case these "9" keys are depressed, and this movement is such as to cause the printing-wheels through the engagement of the teeth *u* with the wheels 20 to be rotated the proper distance to bring the type thereon corresponding to the numerals of the keys depressed to printing position. The key 31 is next depressed, and the paper-carrying cylinder is brought against the type and the printing thereby effected. As the stop 53 is now out of line with the end of the lever 54, the crank 8 is free to be turned. The turning of this crank causes the bar 13 to act against the actuating-bars which have been moved forward, and said bars are thereby moved rearwardly to their normal positions. In thus moving rearwardly the teeth *r* thereof actively engage the ratchet-wheels *x*, and the calculating-wheels are thereby turned the proper distance to display the numerals corresponding to the numerals of the keys depressed through the sight-openings *b*.

In further explanation of the operation of the machine it will be supposed that it is desired to add and also type-write the numbers "4512," "1610," and "125." In the first place, key "4" of the fourth column is depressed; next, key "5" of the third column; next, key "1" of the second column; next, key "2" of the first column. Key 31 is now depressed, and this will cause the number "4512" to be printed on the paper. The crank 8 is now turned once around, and this will cause the same number to be shown on the calculating-wheels. The "1" key of the fourth column, the "6" key of the third column, and the "1" key of the second column are now successively depressed and then the key 31 again depressed and the crank 8 turned. The number "1610" will now be printed on the paper, and the calculating-wheels will show "6122." The "1" key in the third column, the "2" key in the second column, and the "5" key in the first column are now successively depressed and the key 31 and the crank 8 operated as before. The number "125" will then be printed on the paper, and the calculating-wheels will show the total of "6247." Having the several numbers now added and the several numbers type-written, the total is type-written. This is accomplished by first turning the paper-carrying cylinder by hand one space in order to leave a divisional space between the figures and their total. Key "6" of the fourth column, "2" of the third column, "4" of the second column, and "7" of the first column are now successively depressed. The key 31 is next depressed and the total is thereby printed.

Multiplication is accomplished in the following manner: Suppose it is desired to multiply twenty-four by three hundred and twelve. Key "3" of the third column, key "1" of the second column, and key "2" of the first column are successively depressed, and this operation is repeated three times. Crank 8 is now turned once around. Next key "3" of the fourth column, key "1" of the third column, and key "2" of the second column are successively depressed, the operation being repeated once. Finally turn crank 8 and the calculating-wheels will show the answer, "7488."

As hereinbefore pointed out, in the case of the first line of keys to the left of Fig. 1 the "0" key is omitted, and the "0" keys for the first two lines of keys at the right hand of Fig. 1 are also omitted. It is obvious that a "0" key for the first line of keys at the left hand is unnecessary. They are also not required in the case of the first two lines of keys at the right hand of Fig. 1, for the reason that the calculating-wheels are always first set at "0," so that in case it is desired to show, for instance, "100" on the calculating-wheels only the "1" key of the third column need be depressed, or in case it is desired to show, say, "105" on the calculating-wheels key "1" of the third column and key "5" of the first column are depressed, omitting altogether the depressing of a key in the second column.

It will be understood that the printing-wheels not only have the ten digits thereon, but also a blank space. In regard to the first line of keys at the left hand of Fig. 1 the

printing-wheel relating thereto is normally at a blank space, as it is never necessary to print "0" in this line of keys. In regard to the first two lines of keys at the right hand of Fig. 1, however, the printing-wheels relating thereto are normally at "0," and this for the reason that the shoulders 2 of the actuating-bars relating to said first two lines of keys are located at about the point the "0" keys would contact with the shoulders and limit the forward movement of the actuating-bars, if such "0" keys were provided for said first two lines of keys. (See Fig. 1.) The result of this construction is that when any key in the first two lines of keys at the right hand of Fig. 1 is depressed the actuating-bar relating thereto is moved forwardly the distance limited by contact of the shoulder thereof with the depressed key. Now on the return rearward stroke of these actuating-bars and any other of the actuating-bars which may have been brought forward said bars are all brought rearward by the action of the cross-bar 13 the same distance; but inasmuch as the arms 3 for the actuating-bars relating to said first two lines of keys are not at this point in position to engage the shoulders 2 of said bars, but are located slightly in advance of all the other arms 3, it is obvious that the springs *z* will compel said actuating-bars for said first two lines of keys to make a slight forward movement, the extent of this slight forward movement being limited by contact of the shoulders of the actuating-bars referred to with the arms 3 relating thereto. Now this slight forward movement of the actuating-bars referred to will cause the teeth *u* to engage the printing-wheels relating to the actuating-bars in question and turn said printing-wheels so that "0" will be in printing position, and hence it is for this reason that the printing-wheels relating to the first two lines of keys at the right hand of Fig. 1 are normally set so that "0" is at printing position. Attention is also directed to the fact that if a "0" key in any line of keys having "0" keys is depressed it will turn the printing-wheels relating to said line of keys so as to bring "0" on said printing-wheels to printing position instead of the blank space, which is normally in printing position. The calculating-wheels, however, are not disturbed, but are left at their normal position—*i. e.*, with "0's" showing through the sight-openings—and this owing to the fact that each of said actuating-bars near its forward end and upon its upper edge is provided with a blank space or with an untoothed portion, whereby the ratchet-wheels are not rotated under the actuation of these "0" keys.

In using the machine, in case an error is made in touching the wrong key it can be corrected before type-writing and adding. This is done by returning the actuating-bars, which is readily accomplished by lifting the front top cover of the casing and pushing back the actuating-bars, taking care to bear down slightly on the bars while they are being pushed back.

Verifying is done by observing carefully the keys as they are pressed down, in order that any error may be corrected before the type-writing and adding is done. Verifying by the type-written figures is quicker than by observing the pressed-down keys, inasmuch as the written figures are in line and show instantly.

While in the accompanying drawings I have shown the characters on the calculating-wheels and on the printing-wheels as numerals running from "0" to "9," yet it will be understood that these characters may be changed to characters in other languages or to suit currency designations used in any particular country.

While I have herein shown and described specific details of construction, yet I do not wish to be understood as restricting myself thereto, inasmuch as mechanical changes or variations thereof capable of performing the same functions are deemed to be within the spirit and scope of my invention.

In Fig. 14 of the drawings I show a modified form of locking mechanism for the actuating-bars *m*. Instead of employing the pivoted arms 3 shown in the other figures of the drawings I show a bar 85, having a beveled lower end and having its upper end formed with a projection 86, said projection adapted to engage the beveled end 4 of the sliding bar *g*. The bar 85 works in a guide 87, and a spring 88, bearing against a pin 89, projecting from the bar 85, normally holds said bar down, so that its lower end is engaged by the shoulder 2 of the bar *m*. In the operation of this modification when the slide-bar *g* is moved rearwardly in the manner hereinbefore fully explained the incline 4 thereof will serve to raise the bar 85 out of engagement with the shoulder 2, and the projection 86 of said bar will seat itself in the notch 5. When the actuating-bar *m* makes its return rear movement, the beveled surface of the shoulder 2 will act against the beveled lower end of the bar 85 and will cause said bar to be raised, so as to bring the projection 86 out of engagement with the notch 5, and hence the several parts will be free to resume their normal positions.

What I claim as my invention is—

1. The combination of actuating-bars provided at their rear ends with teeth and at their forward ends with teeth, mechanism for normally holding said bars locked against movement, a series of keys, mechanism between said keys and the locking mechanism, whereby when a key is depressed the locking mechanism is released from engagement with the particular bar relating thereto, means acting on the actuating-bars so as to cause said bars when unlocked to move forwardly a certain distance depending upon the particular key depressed, means for returning

the actuating-bars to their normal locked positions, means for returning the keys to their normal positions, a series of printing-wheels, each wheel having a toothed wheel fast thereto, the said toothed wheel being adapted to be engaged by the rear teeth of the actuating-bars, and being thereby rotated when said actuating-bars are moved forwardly, and a series of calculating-wheels having ratchet-wheels fast thereto, said ratchet-wheels being adapted to be engaged by the forward teeth of the actuating-bars and being thereby rotated, when said actuating-bars are moved rearwardly.

2. The combination of a series of actuating-bars, mechanism operated by said bars, locking mechanism normally holding the actuating-bars locked, a series of keys adapted, when depressed, to act on the locking mechanism and thereby release the actuating-bars, means, when the bars are so released for thrusting said bars forwardly a certain distance depending upon the particular key depressed, a revoluble shaft, crank-arms extending from said shaft, links connected at their inner ends to the crank-arms, a transverse bar connected to the outer ends of the links, said bar adapted, when the shaft is rotated, to be moved forwardly and with the continued rotation of the shaft to move rearwardly and thereby contact with the ends of the forwardly-adjusted actuating-bars, and thereby return said bars to their normal locked positions, and means for returning the keys to their normal positions.

3. The combination of a series of actuating-bars provided with projecting shoulders, a series of medially-pivoted locking-arms, each arm engaging with the shoulder of an actuating-bar, a series of keys, mechanism between said keys and the locking-arms, and adapted to be operated by the depression of the keys, and to act on the upper ends of the locking-arms, and thereby turn said locking-arms and release the same from the shoulders of the actuating-bars, mechanism, when the actuating-bars are released, for moving said bars forward a certain distance, depending upon the particular key depressed, mechanism operated by said actuating-bars on the forward thrust thereof, mechanism for returning the actuating-bars to their normal locked positions, mechanism operated by said actuating-bars on their return movement, and means for returning the keys to their normal positions.

4. The combination of a series of actuating-bars provided with projecting shoulders, mechanism operated by said actuating-bars, a series of locking-arms, each arm engaging at one end with the shoulder of an actuating-bar, a series of slide-bars having beveled surfaces engaging the locking-arms, and said slide-bars also provided with notches, a series of keys adapted, when depressed, to act on the slide-bars and cause said bars to move, and through the engagement of the beveled surfaces of the bars with the locking-arms to move said locking-arms out of engagement with the shoulders, the slide bars at the limit of their movements being locked by the engagement of the locking-arms with the notches, means when the actuating-bars are unlocked for moving said bars a certain distance depending upon the particular key depressed, means for returning the actuating-bars to normal positions, the return movement causing the shoulders thereof to contact with the locking-arms and thereby release said locking-arms from engagement with the notches of the slide-bars, means for returning the slide-bars to normal position when so released, the return movement of said slide-bars causing the locking-arms to again engage the shoulders and holding the actuating-bars in locked positions, and means for returning the keys to normal positions.

5. The combination of a series of actuating-bars, mechanism operated by said actuating-bars, locking mechanism engaging the actuating-bars and normally holding said bars in locked position, a series of slide-bars provided with inclined slots, a series of keys provided with projecting pins, the pin of any particular key adapted, when the key is depressed, to pass into the inclined slot of the slide-bar relating thereto and cause said slide-bar to move, the movement of the slide-bar acting on the locking mechanism and causing said locking mechanism to be released from the actuating-bar, said locking mechanism at the same time engaging the slide-bar and holding said bar in its adjusted position, means when the actuating-bar is unlocked for moving said bar a certain distance depending upon the particular key depressed, means for returning the actuating-bar to its normal locked position, the return movement of said bar releasing the locking mechanism from engagement with the slide-bar, means for returning said slide-bar to its normal position when so released, and means for returning the key to its normal position.

6. In a calculating-machine, the combination of a series of printing-wheels having printing characters on the periphery thereof with spaces between the characters, means for rotating said printing-wheels so as to bring different characters thereof to printing position and the spaces of the several wheels into alinement, a pivoted bar, arms carrying a paper-carrying cylinder, means for swinging said arms so as to cause the paper-cylinder to be swung to a position to bring the paper carried thereby into contact with the characters on the printing-wheels, and a contact-arm carried with the swinging arms and adapted to strike the pivoted bar and cause the same to engage the alined spaces of the printing-wheels.

7. The combination of printing-wheels, spindles, reels mounted loosely thereon, the

side flange of one of said reels provided with teeth around its periphery, a dog, and a rotatorily movable shaft having a finger projecting therefrom, said finger adapted to engage the dog and cause said dog to engage the teeth of the flange of the reel, to thereby give to said reel an intermittent motion and cause an inking-ribbon upon one of the reels to be unwound therefrom, and wound up upon the other reel.

8. The combination of a series of actuating-bars, calculating mechanism operated by the bars upon one movement thereof, printing-wheels operated by the bars upon the reverse movement thereof, a swinging paper-carrying cylinder, a revoluble shaft, a crank-handle for turning the same, a gear-wheel mounted upon the said shaft, another shaft having a gear-wheel thereon in mesh with the first-referred-to gear-wheel, a transverse bar, a connection between said bar and the last-referred-to shaft, whereby when said shaft is rotated the transverse bar will act on the actuating-bars which have been moved in one direction and return said bars to their normal positions, means for normally locking the revoluble shaft against turning, a key adapted, when depressed, to unlock said shaft, and mechanism between said key and the paper-carrying cylinder for causing a movement of said paper-carrying cylinder in a direction to thrust the paper into engagement with the characters on the printing-wheels which have been brought to printing position.

9. The combination of a series of actuating-bars, calculating mechanism operated by the bars upon one movement thereof, a swinging paper-carrying cylinder, a revoluble shaft, a crank-handle for turning said shaft, a gear-wheel mounted on the said shaft, said gear-wheel provided on one face with a lug, a pivoted limitedly-slidable lever having its free end normally in engagement with the lug, and also provided with a projecting pin, a key having a hooked or bent arm in engagement with the pin, said hooked arm adapted, when the key is depressed, to bring the free end of the lever beneath the lug of the gear-wheel, and thereby permit the revoluble shaft to turn, a connection between said key and the paper-carrying cylinder for causing said cylinder, when the key is depressed, to be swung in a direction to bring the paper carried thereby into contact with the characters on the printing-wheel which have been brought to printing position, another shaft, a gear-wheel mounted thereon and in mesh with the first-mentioned gear-wheel, a transverse bar, and a connection between said bar and the last-referred-to shaft, whereby when said shaft is rotated the bar will act on the actuating-bars which have been moved in one direction and return said bars to their normal positions.

10. The combination of a series of levers each having a projecting lug, a series of dogs each provided with two shoulders, the upper shoulder being normally engaged by the lug of the lever, a series of pawls, one of said pawls being pivoted to each lever, a series of calculating-wheels, each having a ratchet-wheel fast thereto, each ratchet-wheel being engaged by a pawl, and each calculating-wheel also provided with a projecting finger which is adapted, after the calculating-wheel has rotated a certain distance, to contact with the upper end of the dog and turn said dog so as to release the upper shoulder thereof from engagement with the lug of the lever and thereby permit said lever to drop and bring the pawl into engagement with the next lower tooth of the ratchet-wheel, a cylinder having a series of graduated fingers extending therefrom and arranged spirally around a portion of the circumference thereof, and means for rotating said cylinder, whereby after the cylinder is rotated a certain distance, one of the fingers projecting therefrom will contact with the lever and thereby raise said lever and cause the pawl to partially rotate the ratchet-wheel, and also cause the lug of the lever to again engage the upper shoulder of the dog.

11. The combination of a series of calculating-wheels, ratchet-wheels fast thereto, means engaging the teeth of said ratchet-wheels in order to operate the calculating-wheels, a pawl engaging each ratchet-wheel, means after a calculating-wheel has rotated a certain distance to cause one of the pawls to jump to a lower tooth of the next succeeding ratchet-wheel and to subsequently act on the tooth and partially rotate said succeeding ratchet-wheel and the calculating-wheel fast thereto, a rock-bar provided with a series of projections in line with the pawls, and a cam constructed to act on the rock-bar when the pawl partially rotates the ratchet-wheel so as to throw the projections of the bar close to the pawls, and thereby prevent the pawls from overrotating the calculating-wheels.

12. The combination of a series of calculating-wheels, actuating-bars for operating said wheels, a pivoted bar having a series of fingers projecting therefrom in line to engage the actuating-bars, an arm engaging the pivoted bar so as to swing said bar in a direction to cause the fingers thereof to engage the actuating-bars, and a cam for operating the arm.

13. The combination of a type-wheel, means for rotating said wheel to bring different characters thereof to printing position, links, levers pivotally connected to the links, a paper-carrying cylinder having its axis journaled in the levers, a ratchet-wheel rotatable with the paper-carrying cylinder, a spring-pressed pawl pivoted to a fixed part and having its free end engaging the ratchet-wheel, another pawl pivoted medially to one of the levers and having one end engaging the ratchet-wheel, a stop adapted to contact with and

limit the movement of the depending arm of the last-mentioned pawl in one direction, means for actuating the links in one direction, whereby the paper-carrying cylinder is thrown into a position to contact with the type on the type-wheel which has been brought to printing position, and a spring acting on the links to cause a reverse actuation thereof whereby the paper-carrying cylinder is returned to normal position.

In testimony whereof I affix my signature in presence of two witnesses.

JAMES MALLMANN.

Witnesses:
JAMES A. MALLMANN,
ANTON J. MALLMANN.