J. MALLMAN.

RECORDING CALCULATOR.

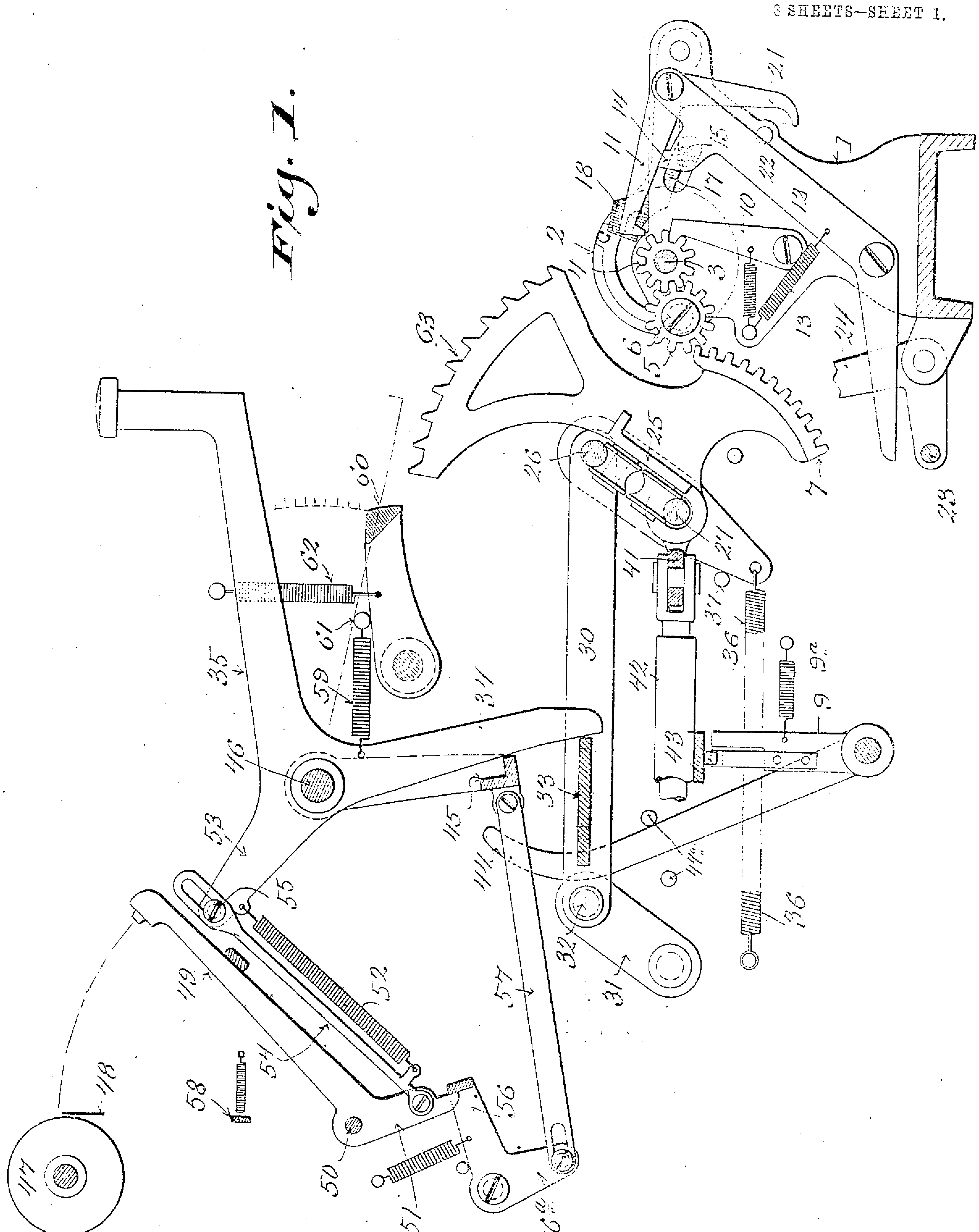
APPLICATION FILED OCT. 13, 1909.

970,250.

Patented Sept. 13, 1910.

3 SHEETS—SHEET 1.

Fig. 1.



Witnesses:
May Downey.
Thos J. Wlasthurst

Inventor:
James Mallman.
By [signature]
Attorneys.

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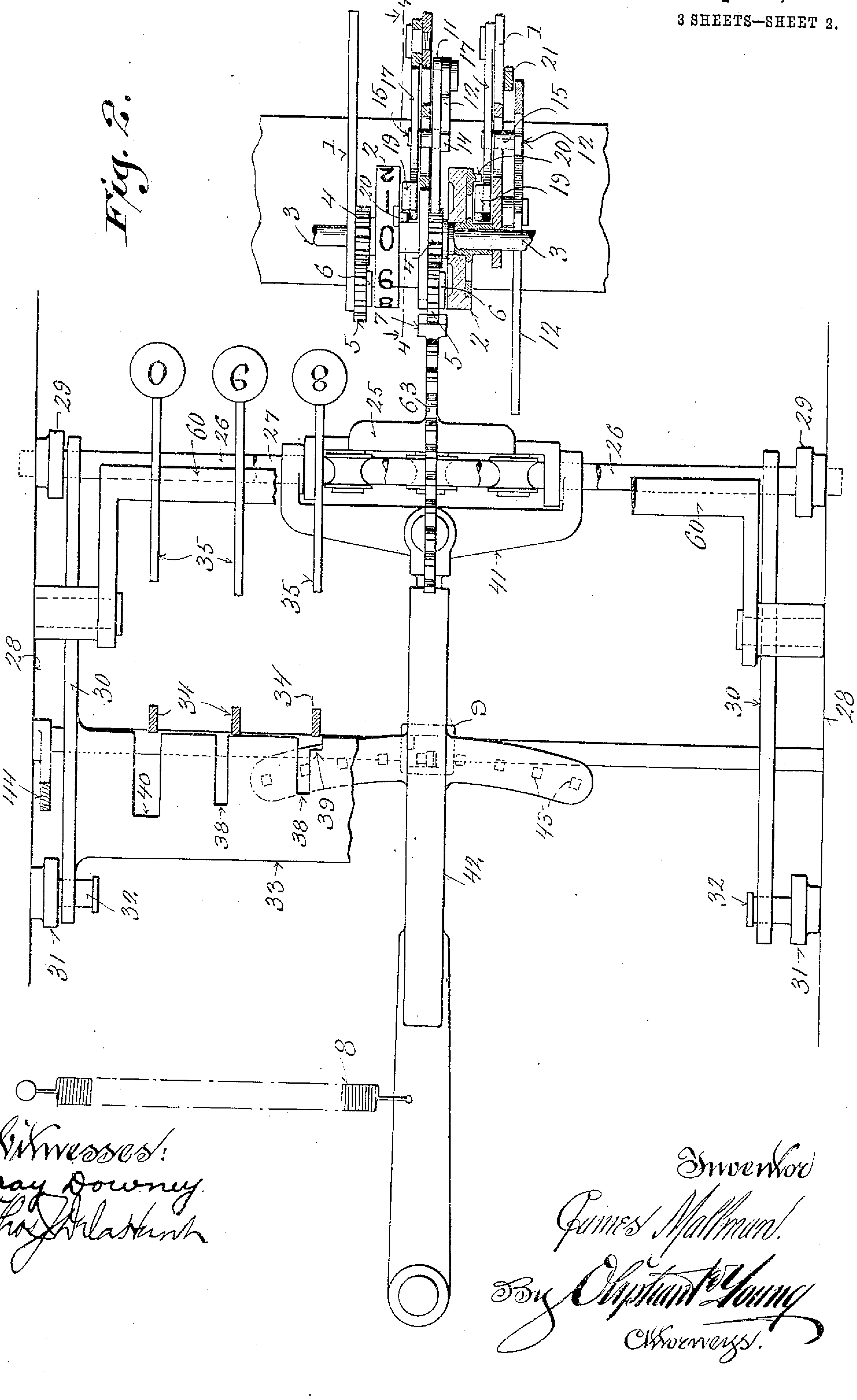
3 SHEETS—SHEET 2.

Fig. 2.



Witnesses:
May Downey
Thos. J. Wallace Jr.

Inventor
James Mallman.
By Olephant & Young
Attorneys.

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3 SHEETS—SHEET 3.

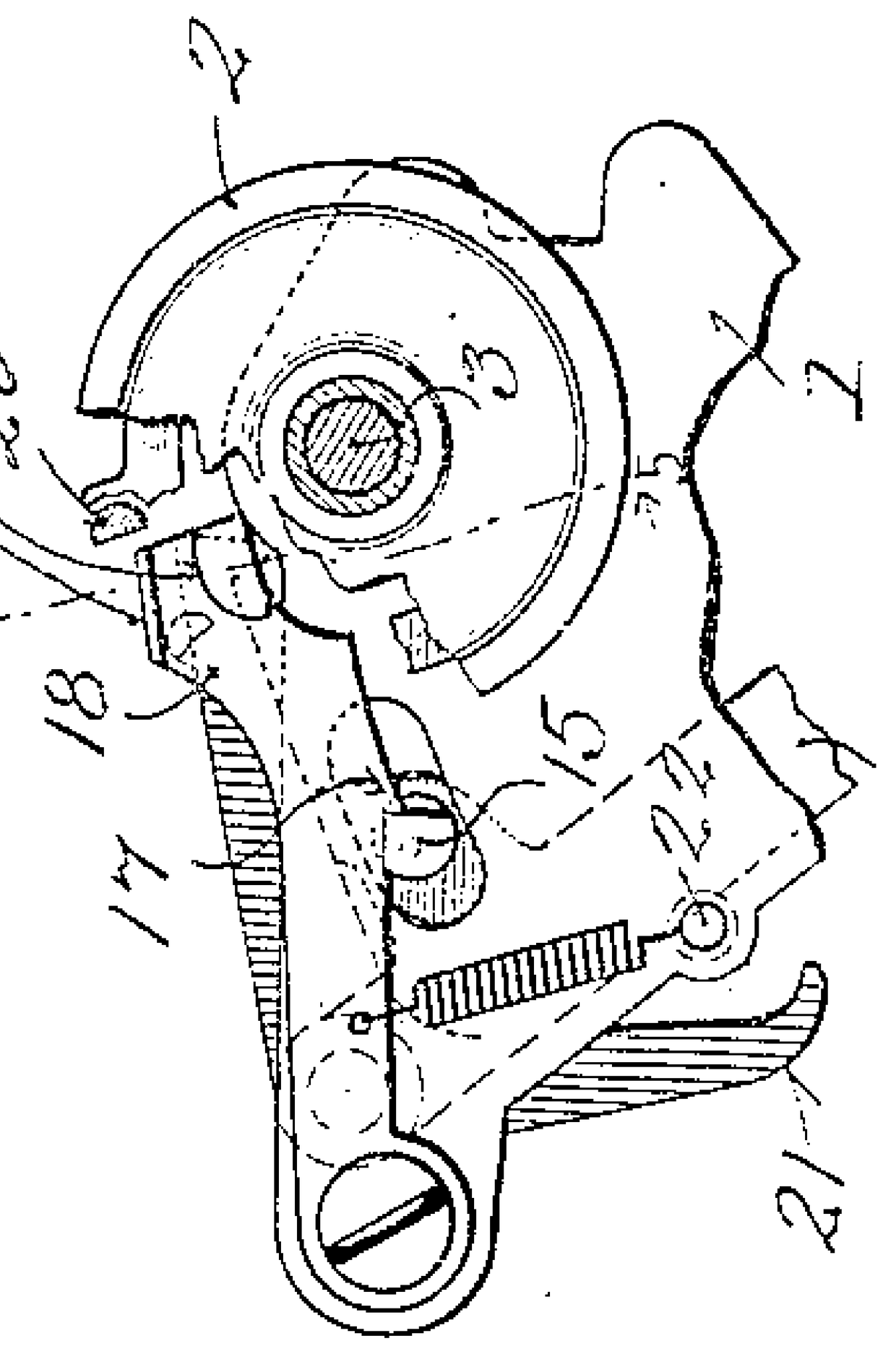

Fig. 4.

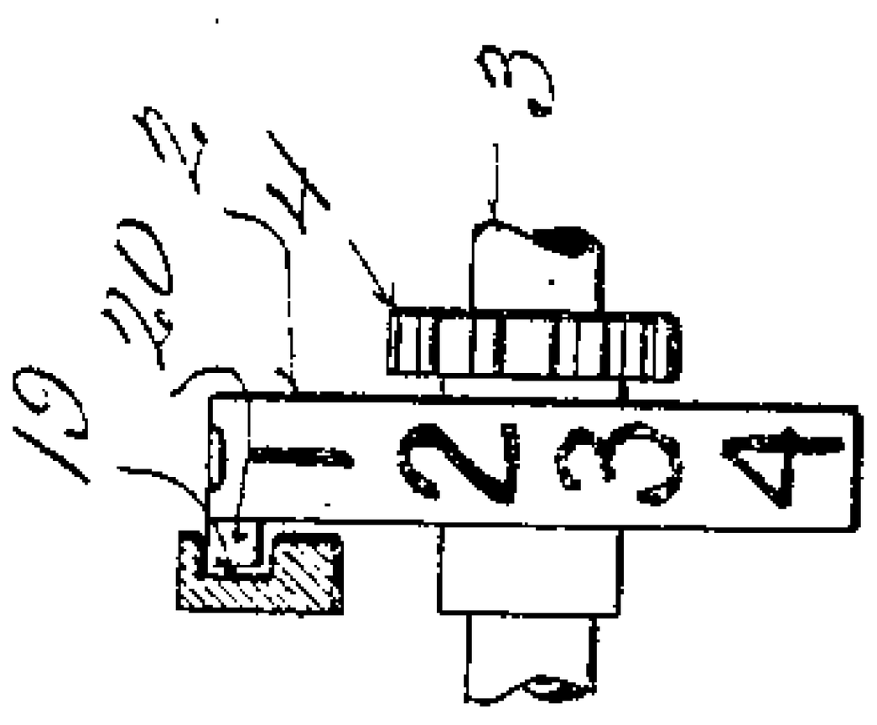

Fig. 5.

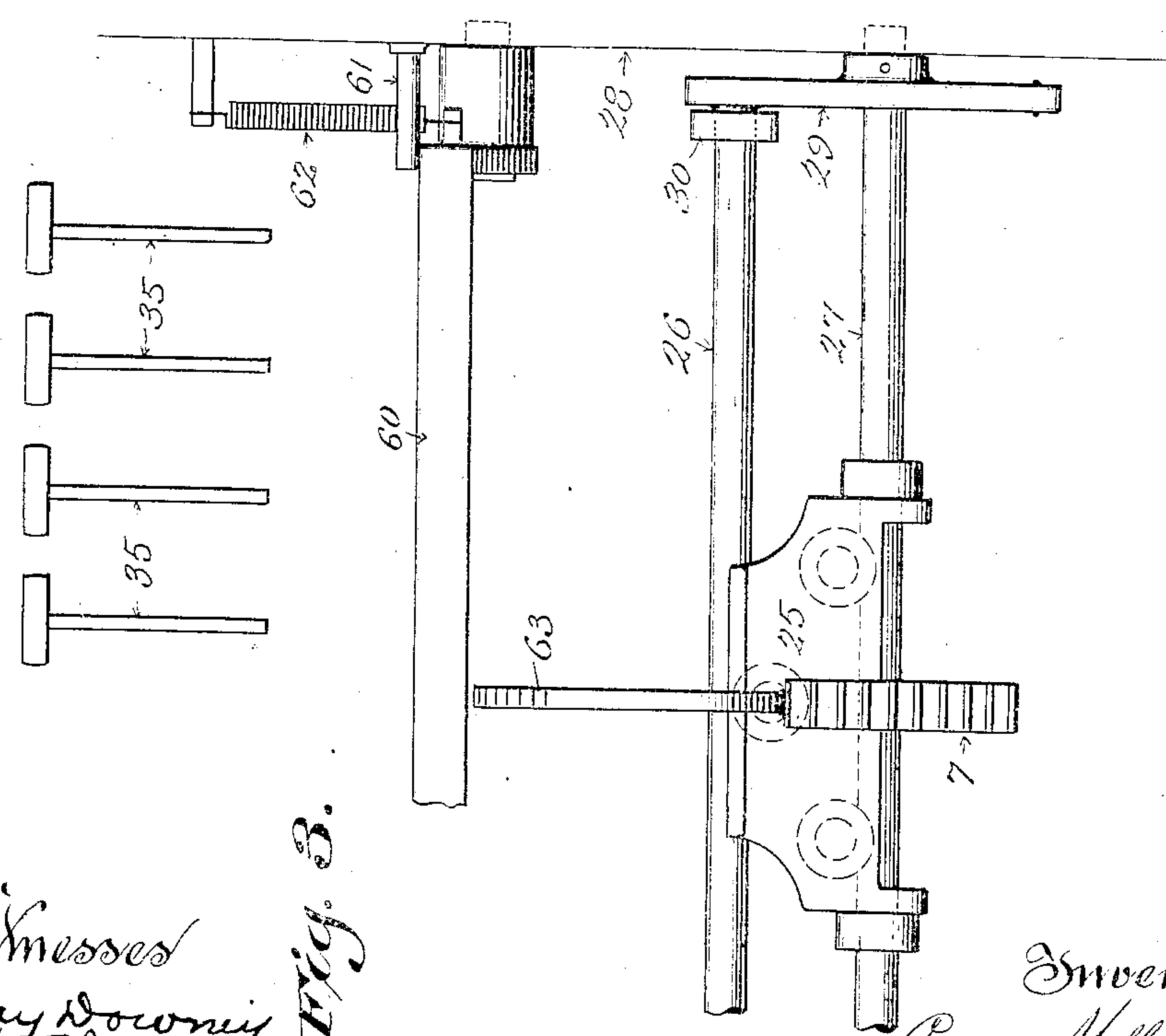

Fig. 3.

Witnesses

May Downey.

Thos J. Delatturn

Inventor:

James Mallman.

By Olyphant & Young

Attorneys.

UNITED STATES PATENT OFFICE.

JAMES MALLMAN, OF SHEBOYGAN, WISCONSIN.

RECORDING-CALCULATOR.

970,250. Specification of Letters Patent. **Patented Sept. 13, 1910.**

Application filed October 18, 1909. Serial No. 523,115.

To all whom it may concern:

Be it known that I, JAMES MALLMAN, a citizen of the United States, and resident of Sheboygan, in the county of Sheboygan and State of Wisconsin, have invented certain new and useful Improvements in Recording-Calculators; and I do hereby declare that the following is a full, clear, and exact description thereof.

My invention refers to certain features in connection with calculators such as described in an application for patent for improvements in recording calculators filed by me July 22nd, 1909, Serial No. 508,881.

The main object of my present invention is to provide simple, economical and accurate stops for the operating mechanism of the adding sections, whereby movement of each adding section is positively limited in a direct manner by checking the movement of the operating mechanism in opposition to momentum.

Another object of my invention is to provide means in connection with each carrying mechanism of the several adding sections, whereby said carrying mechanism is held against premature operation, the arrangement and construction being such that the spring power necessary to effect a carrying operation is reduced to a minimum, resulting in a proportionately lighter key action.

The invention therefore consists in certain peculiarities of construction and combination of parts to be fully set forth hereinafter with reference to the accompanying drawings and subsequently claimed.

In the drawings Figure 1, represents a longitudinal sectional view of such portions of a recording calculator as are necessary to show the general movements of the machine together with the novel features embodied in my invention, with portions broken away more clearly define certain structural features. Fig. 2, a plan view of the same with portions broken away and parts in section to show certain structural features. Fig. 3, a detailed front elevation of the carriage mechanism and key-levers with parts broken away. Fig. 4, a detailed cross-section of one of the adding sections, these sections being indicated by line 4—4 of Fig. 2, and Fig. 5, a detailed section of the carrying mechanism as indicated by line 5—5 of Fig. 4.

Referring by characters to the drawings, 1 indicates a series of brackets in which are mounted the several adding sections. Each of these sections consists of an adding-wheel 2, which is loosely mounted upon a shaft 3 that is secured in bearings of the brackets 1. The face of each adding-wheel as shown in Fig. 2, is provided with the usual cipher and numerals from 1 to 9 inclusive, being spaced equal distances apart circumferentially of said wheel.

Each adding-wheel carries a 10 tooth pinion 4, that extends from its hub and is adapted to mesh with a 12 tooth transmission pinion 5, which latter pinion is loosely mounted upon a stud 6 carried by the adjacent bracket. The transmission pinions 5 of each adding-wheel is arranged to be engaged by an oscillatory tooth-sector 7, which toothed sector is also capable of a longitudinal step by step movement, whereby each of the adding-wheels transmission pinions may be successively engaged when the sector is oscillated. The sector is controlled in its longitudinal movement by motor or spring 8 in opposition to an escapement mechanism 9.

Each bracket 1 carries a complete adding section, and also mounted upon each of said brackets is a spring-controlled click-pawl 10, which pawl engages the teeth of the pinion 4 and serves to prevent back lash of the adding-wheel incidental to its rotation.

A transfer mechanism for each adding-section comprising a feed-pawl 11 is pivoted to the upper end of a bell-crank lever 12, the bell-crank lever being fulcrumed to the adjacent bracket and provided with a loading-spring 13, which spring connects the lever with said bracket. This feed-pawl engages the pinion 4 with each carrying movement of the adding section, moving said pinion one tooth, whereby a carrying operation from an adding-wheel section of lower order is imparted to the next adding-wheel section of higher order.

The drawings illustrate the carrying mechanism in its loaded position, in which position the feed-pawl is clear of the pinion 4 and rests upon a finger 14 that extends from the bell-crank 12. This finger also carries a stud 15 that projects through a slot in the adjacent bracket, the stud being normally engaged by a locking-dog 17, which dog constitutes a portion of a spring-controlled

trip-latch 18. The trip-latch 18 is fulcrumed to the bracket 1 and is provided with a laterally extended cam-track 19 which cam-track is shown in the form of a groove that lies in the path of travel of a trip-pin 20, the pin being extended from the side of the adjacent adding-wheel of lower order.

When the adding-wheels are at zero, the ciphers being alined, the pins 20 of each adding-wheel will be in the position, as shown in Fig. 1, in advance of the cam-track 19 of the trip-latch. Now, if an adding-wheel is moved 9 spaces the trip-pin 20, will have reached a position, where upon the next movement it will enter the cam-track 19 of the trip-latch, and owing to the length of said cam-track, the pin must travel for a distance, approximately one space, before the locking-dog 17 is lifted from its engagement with the stud 15 of the bell-crank lever 12. The consequence of this movement is that the bell-crank lever is released and the carrying operation is effected, which operation causes the feed-pawl 11 to rotate the adding-wheel next in higher order, the distance of one space. By utilizing a long gradually inclined cam-track such as described, it will be seen that the trip-pin 20 must travel a proportionately great distance in engagement with the inclined face of said cam-track to effect a lift of the trip-latch, and consequently the power required to effect the lift is proportionately less. The effect of this reduction in power to release the transfer mechanism enables me to utilize lighter springs in connection with the trip-latch, resulting in a proportionately lighter key action, which springs, when a series of the trip latches operate simultaneously, offer considerable resistance. In the carrying movement, the feed-pawl is locked in mesh with the tooth pinion 4, by means of a tail 21, extending from the feed-pawl. This tail 21, upon the forward movement of the feed-pawl, engages a stop 22 in connection with the bracket and thus forces the head of the aforesaid feed-pawl downward, thereby holding the same into locked engagement with the pinion, thus preventing the carriers over-carrying from momentum. The bell-crank levers 12, are all returned to their normal position, after a carrying operation, simultaneously by means of a universal bar 23, which bar is operated by a lever 24, causing the same to engage the adjacent arm of all bell-cranks. The lever 24 is actuated by mechanism not shown in the accompanying drawings, said mechanism forming no part of my present invention and is clearly set forth in my application for patent herein referred to. The tooth-sector 7 is provided with ten teeth corresponding in number to the teeth of the pinions of the adding-wheels. The first tooth of the sector is normally in position to engage any one of the transmission gears 5, with which it is alined. This sector 7 extends from and forms a part of a carriage 25, which carriage is provided with rollers for engagement with upper and lower horizontally disposed rails 26, 27 respectively, of an oscillatory carriage frame. The lower rail of the carriage frame is rotatably mounted in suitable bearings provided in the opposite walls 28 of the machine frame, the walls being indicated in Figs. 2 and 3. The rails 26, 27 are connected by vertically disposed side-bars 29, which bars together with said rails, constitute the carriage frame. The upper rail 26 of the carriage frame is connected by straps 30, to rockers 31, by means of studs 32, which studs project from said rockers. The straps 30 are cross-connected by means of a gage-plate 33, and this gage-plate, together with the straps constitutes a rigid frame, that is adapted to be adjusted in a lateral direction upon the upper rail 26 and studs 32 of the rockers. The gage-plate is the medium through which the carriage frame is oscillated, being moved longitudinally in one direction by means of arms 34, of key-levers 35, and in the opposite direction by a coiled-spring 36, which spring returns the same together with the carriage frame to its normal position as shown in Fig. 1, in which position it is checked by a stop-pin 37.

The gage-plate 33 is formed with two sets of notches, 38 and 39 respectively, the notches 38 being successively varied in depth from right to left of the machine, while the notches 39 are varied in a similar manner from left to right of said machine, these two series of notches intersecting each other, and together form steps in the gage-plate. The arms 34 of the key-levers are normally arranged to engage the notches 39 but when the gage-plate is shifted from right to left, the notches 38 are brought into alinement with the key-lever arms. The first notch 40, from right to left of the machine, is designed to operate in conjunction with the cipher key-lever and is therefore of sufficient depth to permit the full movement of this lever, without imparting longitudinal movement to the gage-plate, the said notch being of such width that when said gage-plate is shifted, it maintains its alinement with the cipher key-lever. The next key-lever from right to left bears the numeral "9" and, as shown in Fig. 2, if actuated would move the gage-plate throughout the entire stroke of said key-lever, while the third lever marked "8" would have a movement of one space, before engaging the bottom of notch 39 and would consequently move the gage-plate 8 spaces. The remaining number of key-levers in the system (not shown) being ar-

ranged to move said gage-plate 7, 6 and 5 spaces respectively and so on down to one space. The gage-plate is manually shifted by any suitable means from its normal position relative to the key-lever arms 34, for the purpose of changing the stroke of the oscillatory movement imparted to the sector 7, when it is desired to print a total from the adding sections. The totals are read from the line of figures displayed at the point of vision of the adding-wheels, and for example, if the numeral 9 is displayed, at this point upon an adding-wheel and a total is to be ascertained, the operator would actuate the 9 key, for a printing operation. Prior to this action however, the position of the gage-plate would be changed or shifted. Consequently the depressed key-lever would only impart sufficient movement to the sector 7, to cause the adding-wheel to move one space and thereby clear said wheel, so as to display the cipher or zero. Should the gage-plate, however, remain in its normal position and the key-lever 9 be depressed, it would cause said gage-plate to move the full distance of nine spaces. This movement causes full rotation of the sector 7, the movement of which is transferred through its gear connection with the adding-wheel, and thereby will cause said adding-wheel to move nine spaces.

The carriage 25 is engaged upon opposite sides by a spanner 41, which spanner is slidably mounted upon the lower rail 27 of the carriage frame. This spanner serves as a connection for a telescopic rod 42, which is fulcrumed rearwardly of the machine, being swung in one direction by the spring 8, and manually shifted in opposition to said spring in the opposite direction. The spring 8 through its connections thus controls movement of the carriage 25 from left to right of the machine, this movement being controlled in a step by step manner by the oscillatory escapement 9, operating in conjunction with a series of teeth 43, which teeth depend from wing extensions of the telescopic rod 42. The space between the teeth 43 is proportioned so as to permit the sector 7 to move laterally from an adding section of higher order, to the next adding section of lower order, whereby said sector after each oscillatory movement is alined with the transmission pinion 5 of the next adding section.

As shown the escapement 9 is moved in one direction by a coiled-spring 9^a and in the opposite direction by an arm 44, which arm is engaged by a universal bar 45 at each movement of a key-lever. The universal bar 45 is extended across the machine and arranged to be operated upon by the key-lever arms 34, said universal bar being mounted upon a fixed shaft 46, which shaft also serves as a bearing for the series of key-levers. The arm 44 of the escapement is limited in its movement in either direction by stop-pins 44^a.

The printing mechanism shown consists of a roller-platen 47, ribbon 48 and a series of ten type bars 49, (only one being shown) which bars are fulcrumed upon a rod 50. The first type-bar from left to right carries a type designating a cipher and remaining of the series, type indicate the numerals from 1 to 9 in their order. Arms 51 extend from these type-bars, each being connected with a corresponding key-lever, 35, through a coiled spring 52, which spring is secured to an extension of the key-lever 53 and an ear of a rod 54, that is in pivotal connection with the type-bar arm 51. The opposite end of the rod 54 is connected to the key-lever extension 53, through a pin 55 that engages a slot in the end of said rod. A spring-controlled gate 56, is pivotally secured to the opposite side walls of the machine frame, the gate being arranged to normally engage the arms 51 of the series of type-bars and thereby lock said type-bars in their position of rest. An arm 56^a of the gate is also connected to the universal bar 45 by means of a link 57, the link being in slotted connection with a pin that extends from the gate arm 56^a, by means of which link said gate is actuated with each movement of a key-lever to effect the release of the type-bars.

From the foregoing description it will be understood that a depression of any key-lever will cause the coiled-spring 52 connected thereto to become distended, and just prior to completion of the key-lever stroke the link 57, through its connection with the universal bar 45, will cause the gate to be rocked free of the series of type-bar arms 56^a, and that type-bar which is connected to the depressed key is thereby released. The tension of spring 52 thus causes the type-bar to be swung to a printing position against the platen and thus effect a printing operation. Impact of the type against the platen is opposed by a spring-controlled strip 58, which strip is engaged by the type-bar and this retracts the same to a position so that its type will be clear of the paper after a printing operation. This mechanism forms no part of my present invention and it is understood that any printing mechanism may be substituted therefor. The key-levers are each returned to their normal position by independent coiled-springs 59, the springs being connected to said key-levers and a fixed member of the machine frame.

Fulcrumed under the key-levers 35, is a universal stop-bar 60, the bar being held against a stop 61 by means of a coiled-spring 62. This bar is spaced from the bottom edge of the key-levers, a distance equal to the full movement of said levers, minus one space. Thus when any key-lever of a series is

actuated, the universal stop-bar is depressed thereby, just prior to the completion of its key-lever movement.

The oscillatory carriage frame is located directly under the universal stop-bar 60 and the carriage 25, which travels in said frame has extending therefrom a segmental stop-plate 63 provided with a series of peripheral teeth, spaced equal distances apart and adapted to engage the universal stop bar, whereby momentum of the oscillatory sector 7 is effectually checked upon that part which performs the drive or rotation of the adding-wheels. As shown, the segmental stop-plate is preferably of a greater circumferential diameter than the bottom sector 9 in order to obtain a greater latitude for engagement between the teeth of the stop-plate and the universal bar, by which construction accuracy is insured.

From the foregoing description it will be seen that the universal bar will not move until the segmental stop-plate is about to complete its movement, and consequently engagement of the correct tooth thereof with said universal bar is assured whether the movement be one space or nine. It will also be seen that a positive stop for the oscillatory movement of the segmental stop-plate is attained in connection with the universal stop-bar 60.

Referring back to the trip-latch and its cam-track, it should be understood that the upper and lower working faces of said cam-track engage the trip-pin 20, the engagement of which pin prevents premature rise or fall of the trip-latch during such engagement, and thereby insures a premature release action of said trip latch caused through momentum of the adding-wheel, which momentum might otherwise throw or release the aforesaid trip-latch, upon the engagement of the adding-wheel trip-pin with the trip-latch. By providing the cam-track with these upper and lower working faces, the trip pin in passing therebetween, is thus provided with an easy grade and is assured of a positive movement relative to the trip-latch. The carrying mechanism therefore, cannot be brought into action, until the trip-pin 20 has traveled the full distance of a space equal to the distance between the numeral 9 and 0. During this movement the upper working face of the cam-track acts to lift and release the trip-latch, while the lower working face prevents premature release of the same.

With the use of the segmental stop plate 63 and improved trip-latch 18, the assembling can be done easier and quicker since by using these, the very close adjustment in the vital parts of the adding mechanism is dispensed with.

I claim:

1. In a recording calculator having a series of type-bars adapted to be brought to a common printing point and a series of alined gear-actuated adding sections, an oscillatory carriage-frame, a spring actuated longitudinally movable carriage mounted upon the carriage-frame, toothed sector carried by the carriage for engagement with any one of the gear-actuated adding sections, an escapement mechanism connected to the carriage for controlling the longitudinal movement thereof relative to said adding sections, a gage-plate in connection with said carriage frame, actuating key-levers connected to the type-bars and arranged to oppose the gage-plate, a universal stop-bar for the key-levers and a segmental toothed stop-plate carried by the aforesaid carriage for engagement with the universal stop-bar.

2. In a recording calculator having a series of type adapted to be brought to a common printing point, and a series of actuating key-levers for the type, an adding mechanism comprising a series of alined adding sections, a laterally movable and oscillatory toothed sector for actuating the adding sections, actuating mechanism connecting the key-levers and toothed sector whereby oscillatory motion is imparted to the latter, a universal stop-bar adapted to be opposed by said key-levers, and a segmental toothed stop-plate carried by the toothed sector engageable with the universal stop-bar.

3. In a machine of the character described a series of adding sections, a longitudinally movable and oscillatory toothed sector for actuating the adding sections, a supplemental toothed stop-plate carried by the toothed sector, and a universal stop-bar adapted to be moved into engagement with the toothed stop-plate.

4. In a machine of the character described a series of adding sections, a laterally movable and oscillatory carriage, a circumferential toothed section carried thereby for engagement with the adding sections, a circumferentially toothed stop-plate in connection with the toothed section, the stop-plate being struck from an axis common to said toothed sector but upon a greater circumferential plane, and a universal stop-bar adapted to be moved into engagement with the teeth of said stop-plate.

5. In a recording-calculator having a series of type-bars adapted to be brought to a common printing-point, a series of alined gear-actuated adding-wheels, a spring-controlled oscillating carriage-frame, a laterally movable toothed sector mounted upon the carriage for engagement with any one of the gear-actuated adding-wheels, a gage-plate in connection with the carriage-frame, a series of spring-controlled key-levers arranged to oppose the gage-plate, whereby different degrees of oscillatory movement are

imparted to the carriage-frame, arms extending from the type-bars, actuating-springs connecting the arms and key-levers, a locking-gate disposed to engage the type-bar arms, gate-releasing means controlled by the aforesaid key-levers, a universal stop-bar arranged to be opposed by the aforesaid key-levers and a segmental toothed stop-plate carried by the carriage for engagement with the universal stop-bar whereby momentum of said carriage is checked at different degrees of its oscillatory movement.

6. In a recording calculator having a series of type-bars, key-controlled actuating mechanism therefor, a series of adding-sections in operative connection with the key controlled actuating mechanism, each of which sections comprises an adding-wheel, a pinion revoluble with the adding-wheel, a spring-actuated lever, a feed-pawl carried by the lever for engagement with the adding-wheel pinion, a pivoted locking-dog engageable with said lever, a trip-latch portion carried by the locking-dog having a laterally extended cam-track and a pin extending from the adding-section of lower order adapted to engage the trip-latch cam-track.

7. In a recording calculator having a series of type-bars, key-controlled actuating mechanism therefor, a series of gear-actuated adding sections in operative connection with the key-controlled actuating mechanism, each adding-section being provided with a carrying mechanism comprising a spring-controlled carrying lever, a feed-pawl mounted upon the carrying lever for engagement with the actuating gear of an adding section of higher order, a locking-dog for the carrying lever, a trip-latch portion carried by the locking-dog having a laterally extended elongated cam-track, and a pin extending from the adjacent adding section of lower order for engagement with the cam-track.

8. In a machine of the character described, a series of adding sections, a longitudinally movable and oscillatory toothed sector for actuating the adding sections, a series of radially disposed teeth constituting stops carried by the toothed sector and a universal stop-bar adapted to be moved into engagement with any predetermined stop tooth.

9. In a machine of the character described, an adding-wheel, an oscillatory toothed sector for actuating the adding-wheel, a series of radially disposed teeth, constituting stops, carried by the toothed sector and a universal stop-bar adapted to be moved into engagement with any predetermined stop-tooth.

10. In a recording calculator having a series of type-bars, key-controlled actuating mechanism therefor, a series of gear-actuated adding sections in operative connection with the key-controlled actuating mechanism, each adding-section being provided with a carrying mechanism comprising a spring-controlled carrying lever, a feed-pawl mounted upon the carrying lever for engagement with the actuating gear of an adding section of higher order, a locking-dog for the carrying lever, a trip-latch portion carried by the locking-dog, a cam-track having upper and lower working faces, carried by the trip-latch and a pin extending from the adjacent adding-section of lower order for engagement with the upper and lower faces of the cam-track.

11. In a recording calculator having a series of type-bars, key-controlled actuating mechanism therefor, a series of alined adding-wheels, and actuating mechanism for each adding-wheel in operative connection with the key-controlled mechanism, a carrying mechanism for each adding-wheel and a release mechanism for each carrying mechanism comprising a trip-pin and a cam-track having upper and lower working faces for engagement with the trip-pin.

In testimony that I claim the foregoing I have hereunto set my hand at Sheboygan in the county of Sheboygan and State of Wisconsin in the presence of two witnesses.

JAMES MALLMAN.

Witnesses:
WILLA ODENBRETT,
A. BUSCHMANN.