

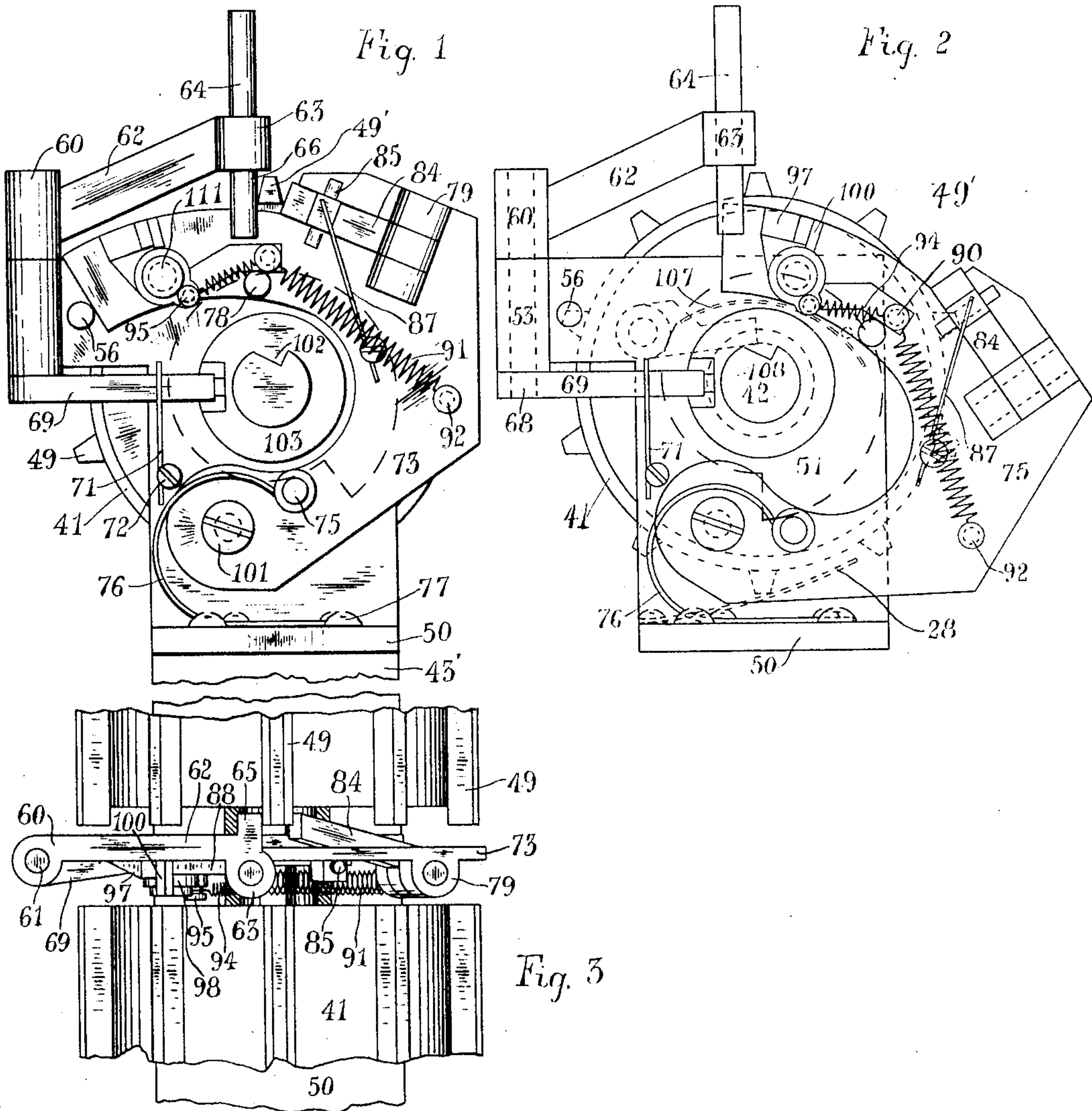
No. 859,552.

PATENTED JULY 9, 1907.

E. S. ENSIGN.  
CALCULATING MACHINE.

APPLICATION FILED SEPT. 22, 1905.

4 SHEETS—SHEET 1.

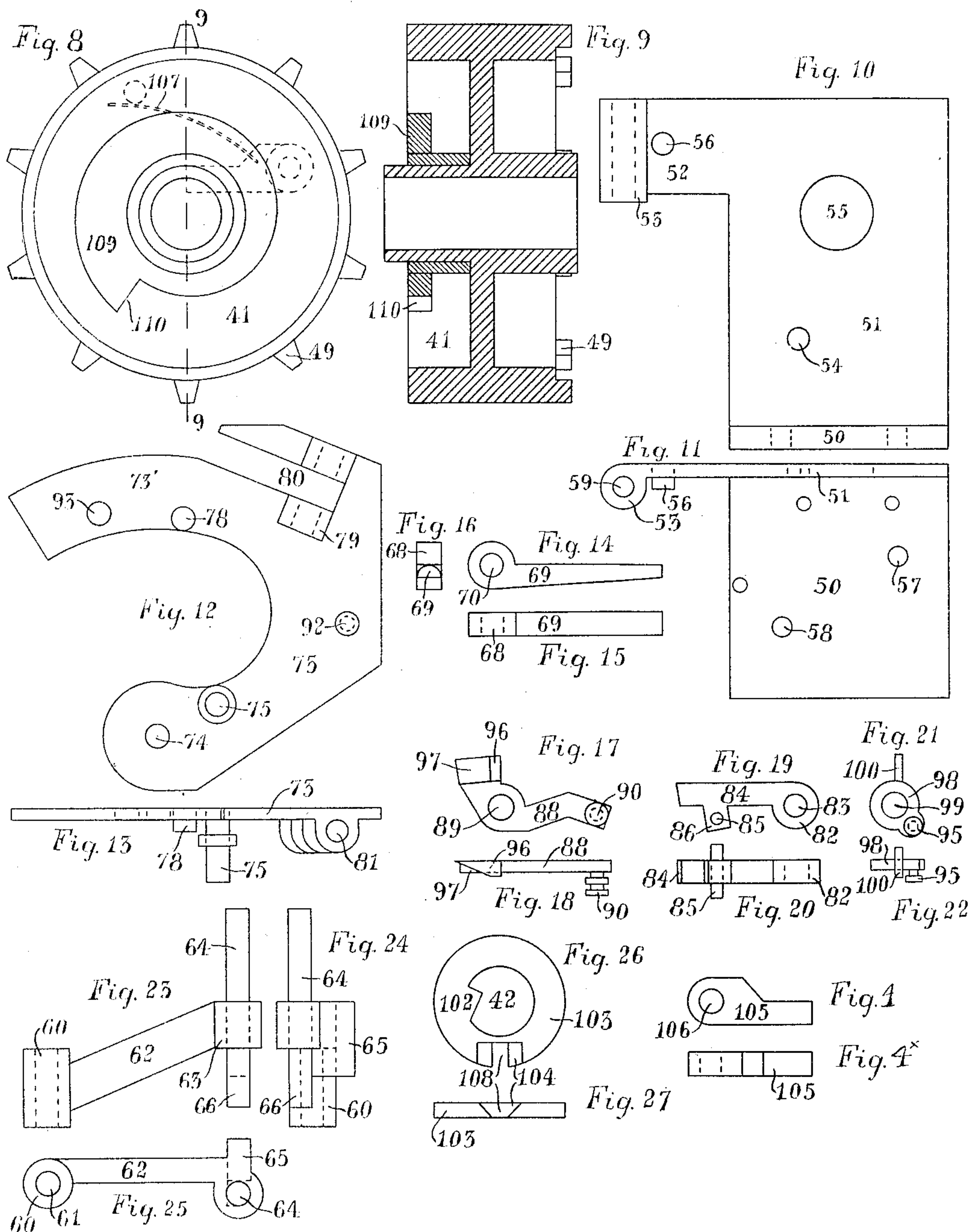


Witnesses.  
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E. S. ENSIGN.  
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4 SHEETS—SHEET 2.



Witnesses.

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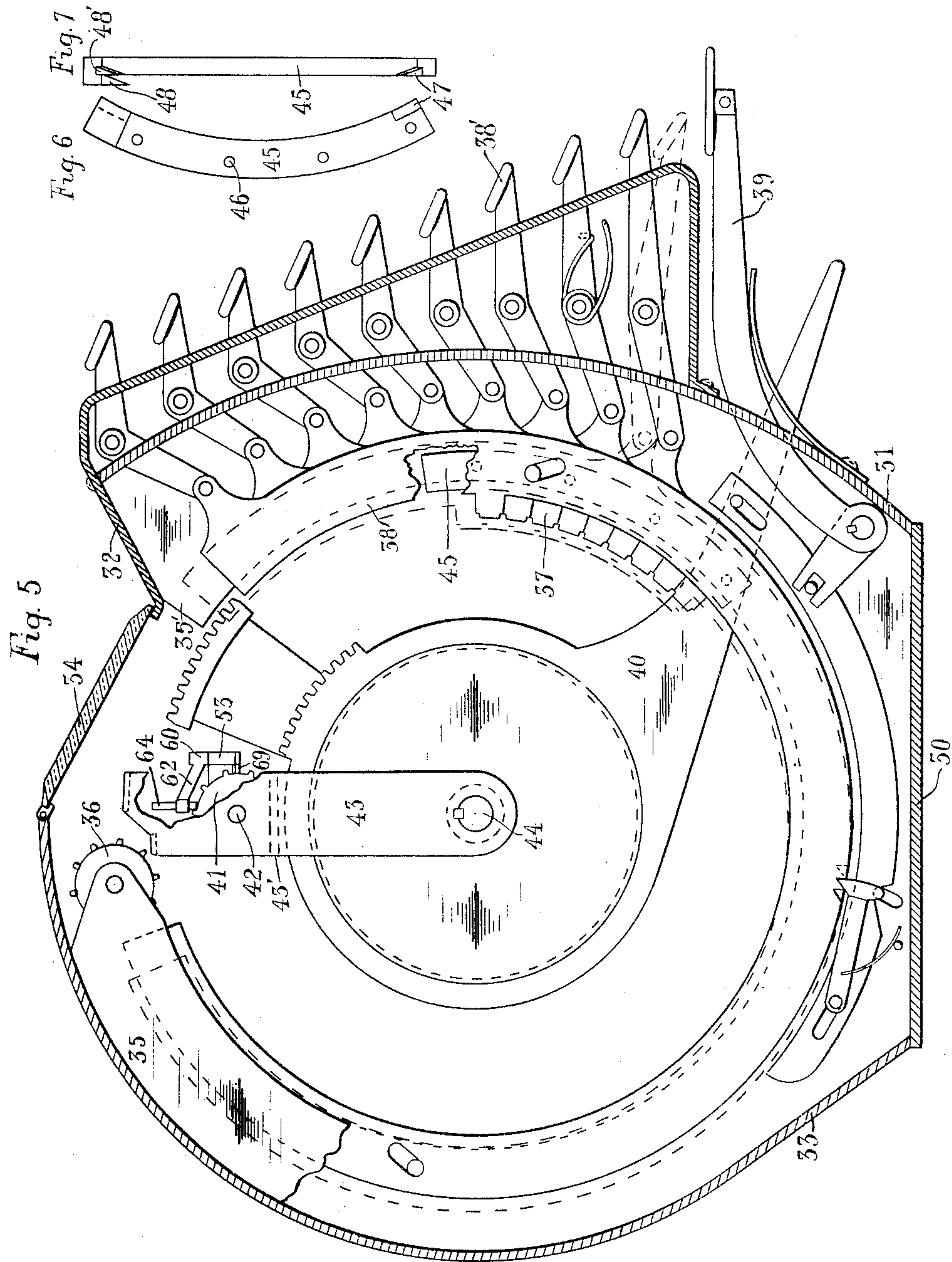


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4 SHEETS—SHEET 3.



Witnesses.

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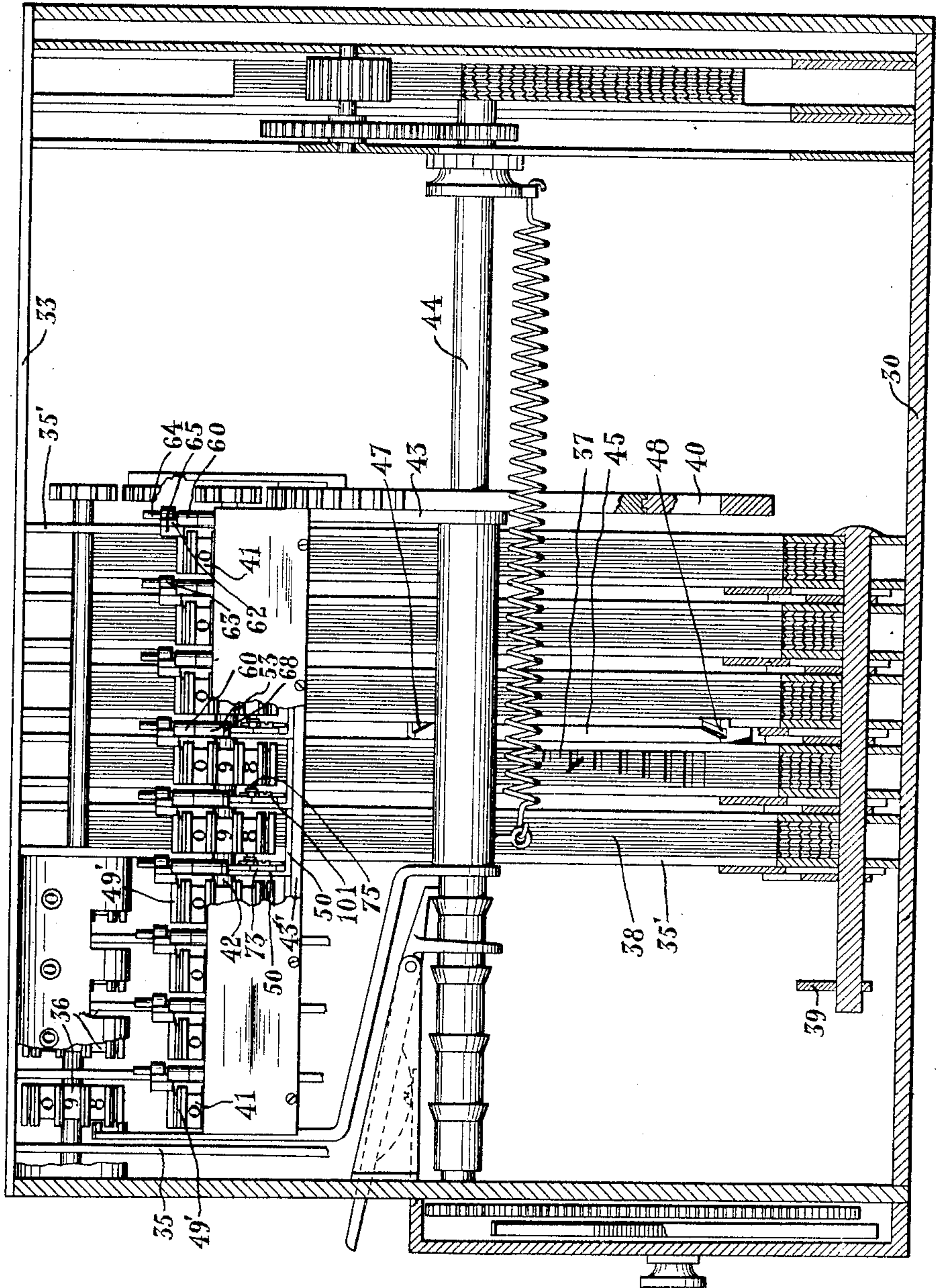
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4 SHEETS—SHEET 4.

Fig. 28



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# UNITED STATES PATENT OFFICE.

EMORY S. ENSIGN, OF CAMBRIDGE, MASSACHUSETTS, ASSIGNOR TO ENSIGN MANUFACTURING COMPANY, OF BOSTON, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

## CALCULATING-MACHINE.

No. 859,552.

Specification of Letters Patent.

Patented July 9, 1907.

Application filed September 22, 1905. Serial No. 279,680.

*To all whom it may concern:*

Be it known that I, EMORY S. ENSIGN, a citizen of the United States, residing at Cambridge, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Calculating-Machines, of which the following is a specification, reference being had therein to the accompanying drawing.

My invention relates to certain improvements which may be applicable to many kinds of calculating machines but which were made as improvements upon the machine having a swinging rotatable meter shown in my United States Letters Patent Number 773,632, issued November 1st 1904, and numbered 809,047, issued January 2nd, 1906.

Said improvements relate particularly to stop motion devices to prevent over-rotation in which each indicator wheel of the meter is adapted to be unlocked as that indicator wheel reaches the teeth of its series of actuating disks and remains unlocked until the last tooth which would operate it has been passed when it is arrested and automatically locked during its period of rest and while the other indicator wheels of the meter are passing the teeth of their respective disks but are adapted to be unlocked when necessary to be operated by the carrying device and again instantly relocked.

A further object of the invention is the providing of a simple, cheap and effective carrying device particularly designed to be used in a machine built along the lines of the aforementioned patents.

The invention consists in the combination of elements and in certain parts of novel construction embodied in the combination of said elements to obtain the desired result.

A full understanding of my invention can best be given by a detailed description of a preferred construction embodying the various features of my invention, and such a description will now be given in connection with the accompanying drawings, and I obtain my object by the mechanism there illustrated, showing such preferred construction, and the features forming the invention will then be specifically pointed out in the claims.

In the accompanying drawings, Figure 1 is a side elevation from the right of my invention with the carrying device in its upper-most position just after it has carried forward the indicator wheel one movement and showing the indicator wheel as locked. Fig. 2 is a side elevation of the same with the carrying device at nearly its lowest position. Fig. 3 is a plan view of the parts shown in Fig. 1. Fig. 4 is a side view of the pawl shown in dotted lines in Fig. 2. Fig. 4X is a plan

view of the same. Fig. 5 is a side elevation from the left, with the casing removed, of my calculating machine upon which the improvements are used. Fig. 6 is a side elevation from the right of the throw-bar. Fig. 7 is a rear elevation of the same. Fig. 8 is a left side view of one of the indicator wheels and cam. Fig. 9 is a sectional view of the same on the line 9 9 of Fig. 8. Fig. 10 is a side elevation of the lever plate. Fig. 11 is a plan view of same. Fig. 12 is a side view of part of the carrying device. Fig. 13 is a plan view of same. Figs. 14 to 27 are detail views of some of the other parts. Fig. 28 is a front elevation of my machine with the front portion of the casing removed.

Latitude is allowed herein as to details, as they may be changed or varied at will without departing from the spirit of my invention and the same yet remain intact and be protected.

Corresponding and like parts are referred to in the following description and indicated in all of the views of the drawings by the same reference characters.

In the drawings, the numeral 30 (see Fig. 5) represents the base of the calculating machine upon which the side walls and cover portions are supported and from the forward portion of which extends the upward curved front cover portion 31 which supports the secondary cover 32 for partly protecting the shanks of the primary keys 38' and which extend partly rearward forming a seat for the glass lid 34 pivoted to the rear cover portion 33.

Within the casing are several series of disks 38, the series shown in Fig. 5 being the tenth's disks or next to the last series met by the meter during its revolution around the inner peripheries of the disks, each series comprising nine disks having from one to nine teeth 37 respectively, each disk 38 being thrown by a finger lever 38' from its normal position into operable position to be met by the teeth 49 of the epicycle meter 41 as it is carried around the inner periphery of the disks by the arms 43 revolving on the center driving shaft 44. Each series of disks are held between side plates 35 35' as shown in Fig. 5.

In the drawing I have shown the indicator 36, the lever 39 for releasing the disks, the resetting lever 40 to instantly reset the meter 41 and indicator 36 back to their initial positions, after the same have been operated, all of which have been shown and explained in my prior patents. Extending outward from the driving shaft 44 are arms 43 in which is mounted the shaft 42 carrying the meter 41.

Attached to the left side of each plate 35', of each series of disks 38 is a throw bar 45 attached by screws or rivets through the holes 46; this throw bar having the same radius as the disks and is cut away at its lower



portion as at 47 for throwing out the throw pin 64, releasing the respective indicator wheel 41 to be met by that series of teeth 37, so that the teeth 37 will cause the wheel to revolve according to the number of teeth upon the disk thrown out, only one disk of each series being thrown out at a time. The throw bar 45 is also provided near its upper inner part with the finger 48 to again throw in the lever pin 64 through the slot 48' so that the wheel will instantly become locked after the wheel has passed the last tooth and over-rotation of the meter prevented.

Extending across between the arms 43 and carried by them just below the meter 41 is the platform 43' upon which is supported plates 50 by screws extending through the screw holes 57 58, (see Fig. 11) and from which plate extends upward at right angles to it the plate 51 having a forward extending arm 52 carrying a hub 53. Extending inward from the arm 52 is the stop pin 56 to limit the forward movement of the carrying lever 73. The plate 51 is also provided with an opening 55 through which extends the shaft 42 of the meter so that a plate 51 is between each wheel of the meter. The plate 51 is also provided with a smaller opening 54 for receiving the screw stud 101.

Supported on the hub 53 is a hub 60 held in place by its stud pin 61 which passes downward through the opening 59 of the hub 53 and its lower portion extending through the opening 70 in the hub 68 of the lever 69 to which hub it is made fast so that movement of the swinging arm 62 to the right will swing to the right the lever 69 or vice versa, as hereinafter stated. The hub 60 carries a swinging arm or lever 62 extending diagonally upward, as clearly shown in Fig. 23, having at its outer end a hub 63 in which is held a lever or throw pin 64 extending above the hub 63 and also extending below the hub as at 66. The swinging arm 62 has also at its upper end a plate or detent 65 attached to or made integral with it, as shown in Figs. 3, 24 and 25 and for the purposes hereinafter stated. The swinging arm 62, which normally holds its meter wheel 41 against forward rotation by its plate 65, is adapted, when the meter 41 is revolved around the inner peripheries of the disks by the driving shaft 44, to swing to the right by the throw pin 64 coming in contact with the throw bar 45 thus unlocking the wheel and allowing it to revolve on its shaft 42. The lever 69 is also adapted to be moved to the right by the plate 103 as hereinafter explained but is normally held in a locked position in the slot 108 of the plate 103 by a spring 71 supported on the plate 51 as at 72.

A carrying hammer or lever 73 is supported on the plate 51 by the screw stud 101 passing through its opening 74 in the lower portion and into the opening 54 in the plate 51. This carrying lever 73 is normally held in its extreme upward position by a spring 76 attached to the stud pin 75 of the carrying lever 73 and supported by the screw 77 inserted into the lower plate 50. The stud pin 75 of the carrying lever 73 extends quite a distance to the right, see Fig. 13, so that the carrying lever 73 is operated by the cam 109 on its respective right hand wheel of the meter, so that as this wheel is revolved from left to right as its teeth 49 come in contact with its respective disk's teeth 37 the carrying lever 73 is gradually forced backward and downward by the cam 109 until it has reached its extreme down-

ward and backward position, as will be understood by examining Figs. 1, 2 and 8 at which time the stud 75 has reached the outermost position of the cam and the stud is then forced up the portion 110 by the carrying lever 73 being carried upward by the force of the spring 76 at which time the carrying lever 73 carries forward a distance of one tenth of its circumference the wheel 41 on its left, it being remembered that the upward movement of the carrying lever 73 is towards the operator when the meter is in its normal position. This carrying lever 73 is cut away, as shown in Fig. 12, so as not to come in contact with the shaft 42 or the plate 103 during any portion of its movement and is provided with the two studs 78 and 92, with a circular opening 93 on its forward part 73' and has an elongated recess 80; it is also provided with the hub 79 made integral with it having the openings 81 through which is inserted a pin securing the lever 84 through the opening 83 provided in the hub 82. This lever 84 is also provided with the projection 86 carrying a pin 85. The lever 84 is normally held against a tooth 49' of its corresponding wheel 41, see Fig. 1, by a spring 87 secured at one end to the carrying lever 73 and having its free end pressing against the head of the projection 86, but the lever 84 is prevented from passing clear through the opening 80 of the carrying lever 73 and against the side of the wheel 41 by the pin 85 coming in contact with the side of the lever 73, but it will be seen by examining Fig. 3 that the free end of this lever 84 is obliged to extend quite a distance towards the left beyond the portion 73' in order to meet the projecting portion of the tooth 49' of the meter 41. It will be readily seen that the backward movement of the carrying lever 73 by the riding of the stud pin 75 over the surface of the cam 109 does not affect the wheel 41 as the lever 84 is merely forced backward against its spring 87 by the forward movement of the wheel. As the carrying device pushes the wheel around from the position in Fig. 2 to the position in Fig. 1, the tooth 49' is brought against the plate 65 of the swinging arm 62 which acts as a stop to prevent over-rotation. At the same time the forward part 73' of the carrying lever 73 strikes against the stop pin 56 instantly stopping the forward movement of the carrying lever 73.

On the forward portion 73' of the carrying lever 73 is a lever 88 pivoted on a stud 111 extending through its opening 89 and into the opening 93 of the carrying lever and there is also pivoted on the outer portion of this stud 111 and against the lever 88 a hub 98 having a pin 100 made as shown in Figs. 21 and 22 and normally held in contact against the raised portion 96 of the lever 88 by a spring 94 attached at one end to its head 95 and at the other end to the stud 90 at the opposite outer end of the lever 88. Also attached to this stud 90 is a spring 91 attached at its other end to the stud 92 of the carrying lever 73 so that the lever 88 has its upper end 96 normally held in its uppermost position while the opposite end which carries the stud 90 is normally held downward against the stud 78 extending outward from the carrying lever 73. The end of the lever 88 having the raised portion 96 is also inclined or beveled away as at 97 so as to easily and quickly throw out the swinging arm 62 when the carrying lever moves forward by force of its spring 76 as the stud pin 75 goes up the incline 110 of the cam 109 and the lever



84 carries forward one position the wheel 41 and this swinging arm is thrown out only a short time, that is while the lower portion 66 is passing up the incline 97 and over the raised portion 96 when it is immediately thrown into locking position to meet the tooth 49' and prevent over-rotation, so that the wheel 41 can only be moved one place on each full movement of the carrying lever 73 moved by the cam 109 on its next adjoining wheel 41. It is also readily seen that as the carrying lever 73 is moved backward that the downward extending portion of the swinging arm 62 comes in contact with the pin 100 and the pin is forced forward and against the force of its spring 94, the pin pushing the head 96 of the lever 88 forward against the force of its spring 91 which spring carries backward the lever 88 and the pin 100 as soon as the swinging arm has cleared the head 96. The pin 100 has a wider face (see Fig. 22) than the raised portion 96 of the lever 88 (see Fig. 18) and is wider than the swinging movement of the outer end of the arm 62 so that when the carrying lever 73 is moving backward step by step (having ten distinct backward movements corresponding to the ten movements of the wheel 41 carrying the cam 109 that operates it) and reaches the point when the lower portion 66 of the throw pin 64 strikes against the pin 100 and presses this pin 100 and the lever 88 forward against the force of the spring 91, that even though the wheel 41 has by movement of the driving shaft 44 reached its series of toothed disks, and its swinging arm 62 has been moved to the right by the throw bar 45 acting upon the throw pin 64 the portion 66 will still be pressing the pin 100 forward. This is necessary, because if the pin 64 had been pushed by the throw bar 45 to the right, while the carrying lever was at this place, and then thrown in by coming in contact with the finger 48, the portion 66 might strike upon the head of the portion 96 remaining there so that the detent 65 would not reach the tooth 49 and prevent over-rotation.

The shaft 42 is cut away as at 102 to receive the pawl 105 attached to the wheel by a screw passing through its opening 106 and into the wheel and normally held in a downward position by a spring 107 and this pawl 105 is adapted to fall into the slot 102 of the meter shaft 42 so that its respective wheel 41 will be carried backward to its initial position when the lever 40, shown in Fig. 5 and explained in my previous patent, is operated.

Between every plate 51 and the wheel 41 to its right upon the shaft 42 is the plate 103 having a cut away portion 108 with beveled edges 104 slanting inward to the opening towards said plate 51, which opening is adapted to receive the pawl 69, which has its sides inclined or curved as shown in Fig. 16 so that this plate 103, which is turned by the shaft 42 will slide the lever 69 up onto it thus throwing the lever 69 to the right against its spring 71 and throwing the swinging arm 62 and its throw pin 64 to the right so that the teeth of the wheel 41 will be released and allowed to be turned to its initial position by the lever 40, so that all of the figures "naught" of the several wheels of the meter will show upon the reading line. I have also provided a spring 28, attached to the plate 50 extending upward and adapted to prevent backward rotation of the meter 41.

In a machine made under my said Letters Patent the meter 41 in its revolutions around the inner peripheries of the disks 38, when rotated by its driving shaft 44, would first reach the teeth of the units disks, then the teeth of the tens disks, then the teeth of the hundreds disks, and so on; but in a machine made under my said patent and using a carrying-up device as shown in the drawings, I preferably have the meter 41 first meet the teeth of the disks of highest denomination, so that the last teeth to be met would be the teeth of the units disks, and it is thus seen that the teeth shown in Fig. 5 would be the teeth of the tens disks. It is preferable to have the several series of disks follow this order so that, if the forward movement of the carrying lever 73 is slower than the movement of the meter when revolved by its driving shaft and rotated by its teeth 49 meshing with the teeth 37 of the disks, there will be no lost movement caused by a partial movement of the carrying lever while the wheel 41, to which a number was being carried by the lever, is being rotated by the teeth of the disk.

It is understood that my invention is not limited to the specific details of construction shown in the accompanying drawings, but that said details may be varied in the practical carrying out of my invention. It is also to be understood that the combinations specifically set forth in the several claims are intended to be separately claimed without limitation to the use in connection therewith of other features and details of construction illustrated.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:—

1. A calculating-meter having a plurality of wheels, locking means for the wheels, segments having inwardly-projecting teeth arranged to be projected as desired, a driving shaft without the meter for swinging it in a circle against the teeth, and means adjoining the teeth for releasing the locking means while the wheel is being operated by the teeth.

2. A calculating-meter comprising several indicator wheels, locking means for each wheel, several sets of toothed segments, a driving shaft without the meter for swinging it against the teeth and a throw bar adjoining each set of segments for throwing out the locking means of the wheel to be operated by that set of segments.

3. In a calculating-machine, a meter having a plurality of wheels, rotating means for the wheels of the meter, a driving shaft without the meter for swinging it in a circle around the driving shaft and against the rotating means, locking means for each wheel of the meter, means adjacent to each rotating means for throwing out of contact the locking means of the wheel to be operated and means for throwing in the same locking means immediately after the wheel has been operated.

4. In a calculating-machine, a meter having a plurality of wheels, a swinging arm for each wheel for locking the wheel against rotation, a series of toothed segments, means for operating the segments, a shaft without the meter for swinging it against the operated segments, and means adjacent to the teeth of the segment for operating the swinging arm and allowing free rotation of the wheel.

5. In a calculating-machine an epicycle meter having a plurality of wheels, inwardly-projected teeth to be met by the meter as it revolves, a swinging arm adjacent to each wheel of the meter for locking the wheel, a plate adjoining the teeth, a throw-bar attached to the plate for disengaging the swinging arm of the wheel to be operated, said throw-bar having its lower edge inclined, a finger projecting from its upper edge and a slot adjacent to the finger, substantially as shown and described.

6. In a calculating-machine an epicycle meter having a plurality of wheels, inwardly-projected toothed disks to be met by the meter as it is revolved, a carrying lever for



- each wheel of the meter, a cam for each lever carried by the next lowest wheel, and a stud projecting from each lever whereby that lever may be operated by the cam of the next lowest wheel while the meter is being revolved around the inner peripheries of the disks.
7. In a calculating-machine, an epicycle meter having a series of indicator-wheels, resetting means for rotating the wheels forward to initial position and swinging arms acting as positive stop motions for preventing over-rotation of the wheels under the impulse of the resetting means.
8. In a calculating-machine, a shaft provided with a slot, a meter having a series of indicator-wheels, a pawl on each wheel, a swinging arm for each wheel for locking it against rotation, a lever for each arm for unlocking the arm and a plate locked upon the shaft for each lever and adapted to operate the lever as the shaft is revolved whereby each wheel may be reset to initial position by its pawl coacting with the slotted shaft, substantially as shown.
9. In a calculating-machine, a meter having a series of indicator-wheels, segments having inwardly-projecting teeth arranged to be projected as desired, a driving shaft without the meter for swinging it in a circle against the teeth and positively acting swinging arms acting as stops upon each wheel for preventing over-rotation under the impulses caused by said meter being swung by its driving shaft against the toothed segments.
10. In a calculating-machine, an epicycle meter having a series of indicator-wheels, carrying mechanisms for the wheels of the meter, a series of toothed segments against one or more of which the meter is adapted to be rotated after they have been operated, positively acting swinging arms acting as stops upon each wheel for preventing over-rotation under the actuations caused by the carrying mechanisms or under the impulses caused by said meter being rotated against the toothed segments.
11. In a calculating-machine, an epicycle meter having a plurality of wheels, means for operating the meter, carrying mechanisms for the wheels, resetting means, positively acting swinging arms acting as stops upon each wheel for preventing over-rotation under impulse of the operating means or under actuations caused by the carrying mechanisms or resetting means.
12. In a calculating-machine, one or more series of disks provided with one or more teeth in their inner peripheries each series having their teeth in a different position from each of the other series on the inner peripheries of the disks, means for throwing in the teeth of one or more disks as desired, a meter having a plurality of wheels and adapted to be revolved around the inner peripheries of the disks against the teeth of the operated disks, means for independently locking each wheel of the meter, means for unlocking each wheel as it reaches the series of the teeth that would operate it and allowing it to be operated by the teeth, means for resetting the locking means as soon as the wheel has passed this series of teeth, a carrying lever for each wheel of the meter, a cam on each wheel of the meter for operating a carrying lever, means on each carrying lever for unlocking its wheel to allow free movement of the wheel in carrying up, means for resetting the meter to zero, and means for unlocking the meter while it is being reset.
13. In a calculating-machine, a driving-shaft, a frame carried by the shaft, a meter journaled in the frame, swinging arms carried by the frame acting as positive stops for preventing over-rotation, and springs carried by the frame for throwing the arms into engagement.
14. In a calculating-machine, a driving-shaft, a frame carried by the shaft, a meter journaled in the frame and having a plurality of wheels, plates carried by the frame and separating the wheels of the meter, swinging arms pivoted on each plate for preventing over-rotation, cam plates carried by the shaft, a lever carried by each arm and adapted to actuate the arm when it is operated by the cam plate, and a spring attached to the plate for keeping the lever in engagement with the cam plate.
15. In a calculating-machine, a driving-shaft, a frame carried by the shaft, an epicycle meter journaled in the frame and having a plurality of wheels, carrying-levers pivoted on the plates, studs projecting from the carrying-levers, cams carried by the wheels of the meter in contact with the adjoining studs, springs for the carrying-levers carried by the plates adapted to throw up the carrying-levers after they have been moved by the cams to their extreme downward positions and a spring pressed lever pivoted to each carrying-lever for forcing one of the meter wheels forward as desired, substantially as shown.
16. In a calculating-machine, a series of toothed segments, a driving shaft, a frame carried by the shaft, a meter on the shaft provided with a plurality of wheels, carrying levers pivoted on the frame for each wheel of the meter, swinging arms provided with detents acting as stops upon each wheel for preventing over-rotation, a spring pressed lever, a pivoted lever having a head and inclined edge, and a pivoted pin adapted to press against the head all carried by the carrying-lever, as and for the purposes described.
17. In a calculating-machine, a driving-shaft, a frame carried by the driving-shaft, a meter journaled in the frame and having a plurality of wheels, toothed disks, means for operating the disks to be met by the meter as it is rotated around the inner edge of the disks by its driving-shaft, swinging arms carried by the frame and provided with fingers to stop over-rotation of the meter wheels; throw bars for each set of toothed disks, a throw pin on each swinging arm to be met by the bar as the meter is rotated by the driving-shaft, a spring carried by the frame for throwing the finger into engagement with a tooth of the meter wheel and keeping the throw pin in its normal position, a carrying-arm pivoted to the frame, a stop-pin for the forward movement of the carrying-arm, a spring pressed lever pivoted to the carrying-arm and a pivoted spring pressed lever for throwing out the swinging arm sufficiently on the upward movement of the carrying-arm to allow the lever to rotate the meter wheel one position, substantially as shown and described.
- In testimony whereof I affix my signature in presence of two witnesses.
- EMORY S. ENSIGN.
- Witnesses:  
CHARLES F. A. SMITH,  
SADIE E. POWERS.