

No. 622,470.

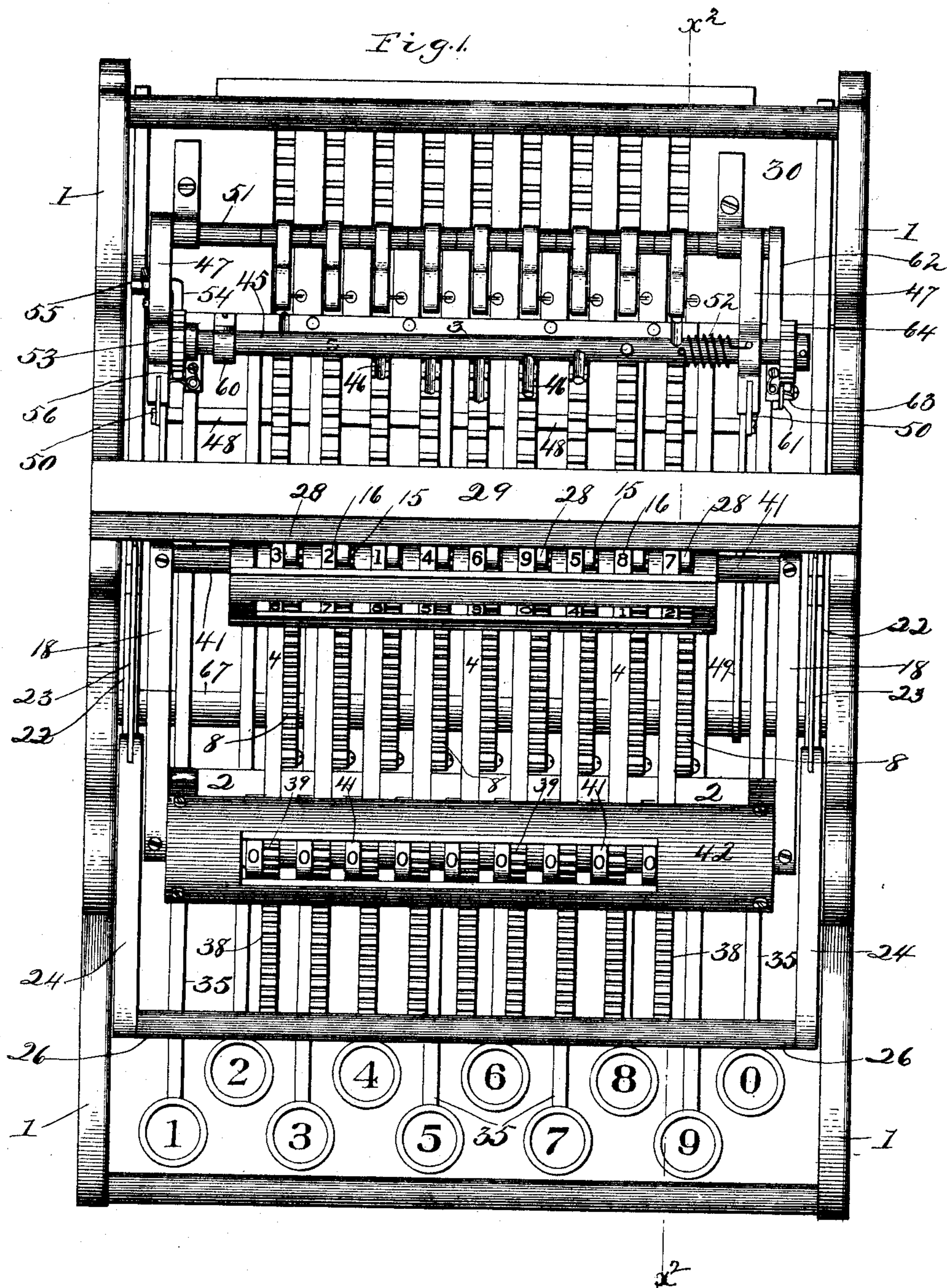
Patented Apr. 4, 1899.

H. HOLLERITH.
ADDING AND RECORDING MACHINE.

(Application filed Mar. 2, 1895.)

(No Model.)

7 Sheets—Sheet 1.



Witnesses:

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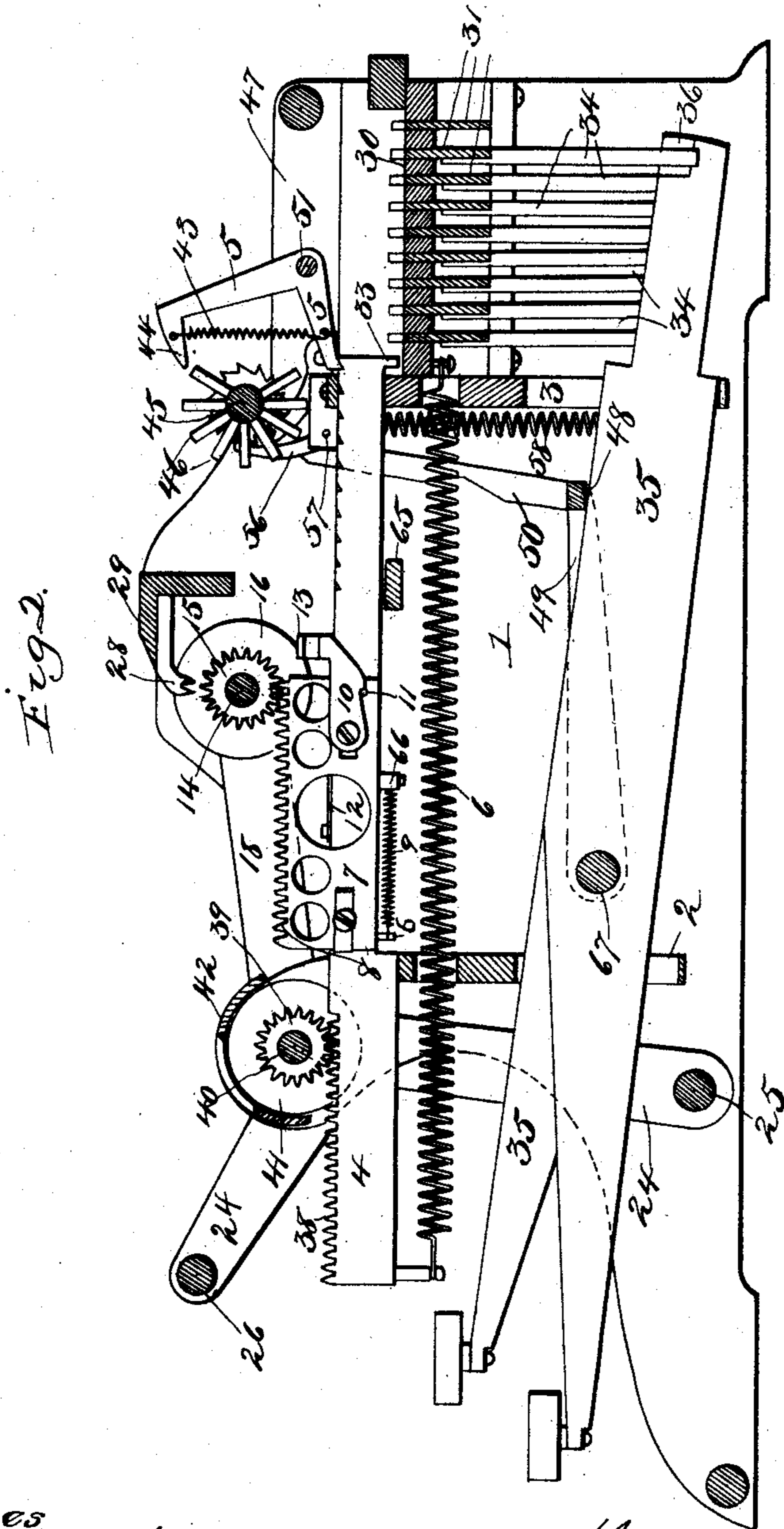
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7 Sheets—Sheet 2.



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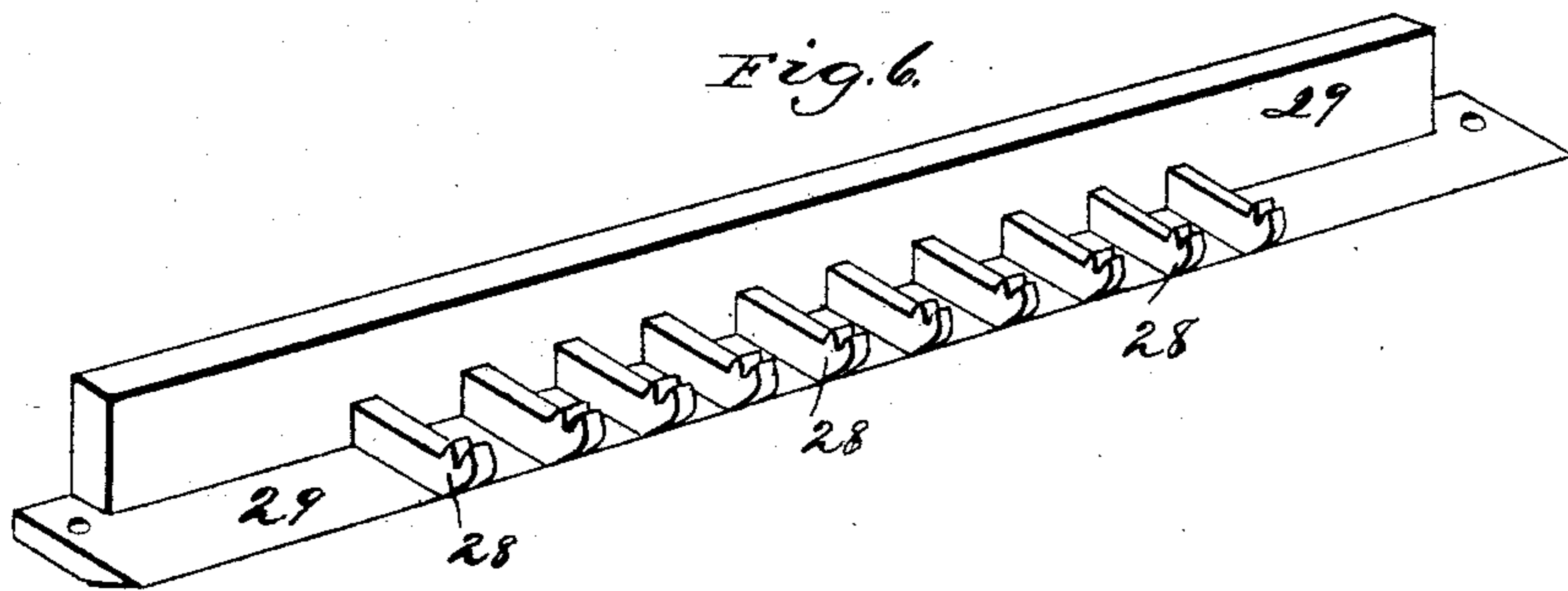
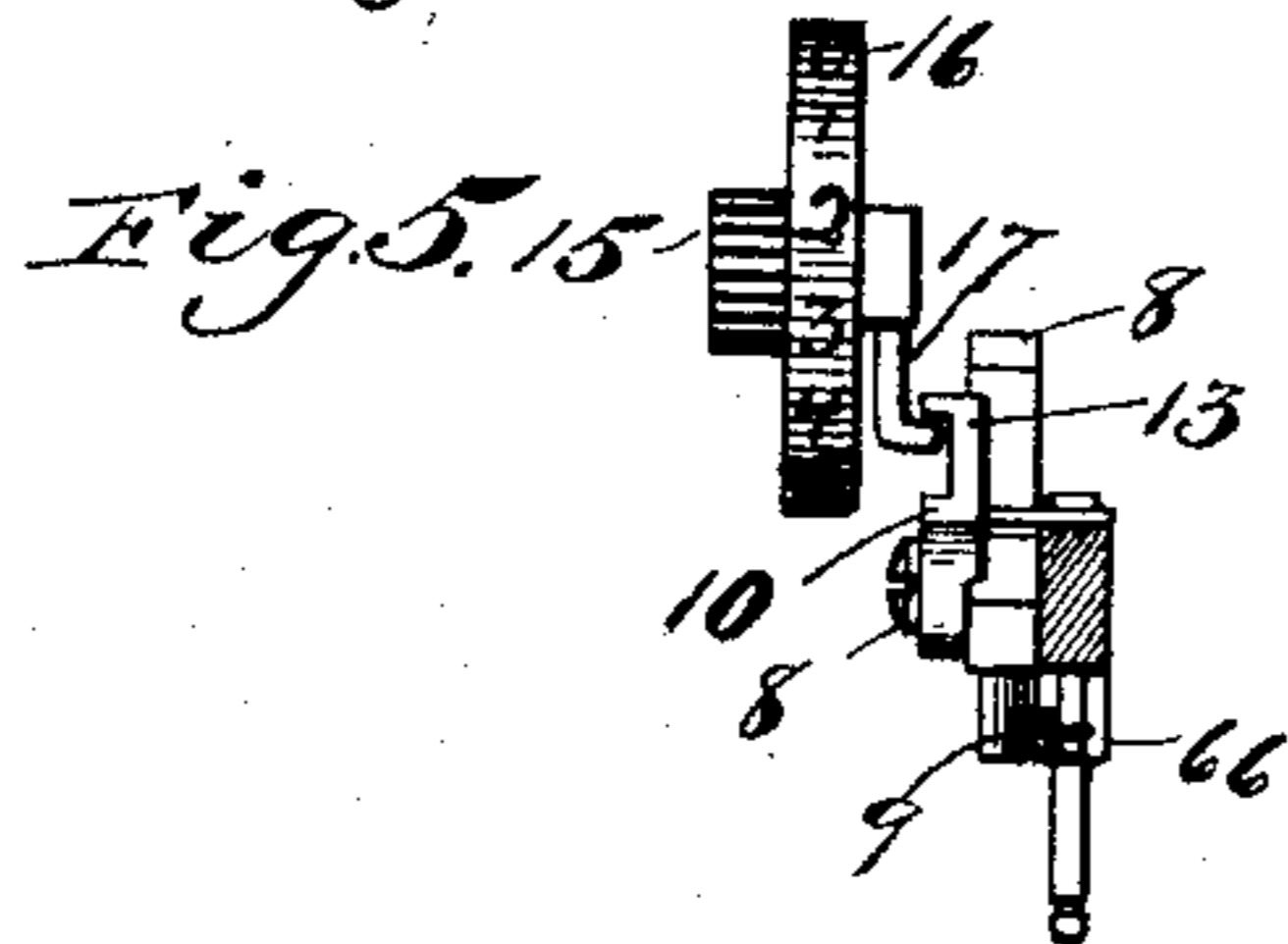
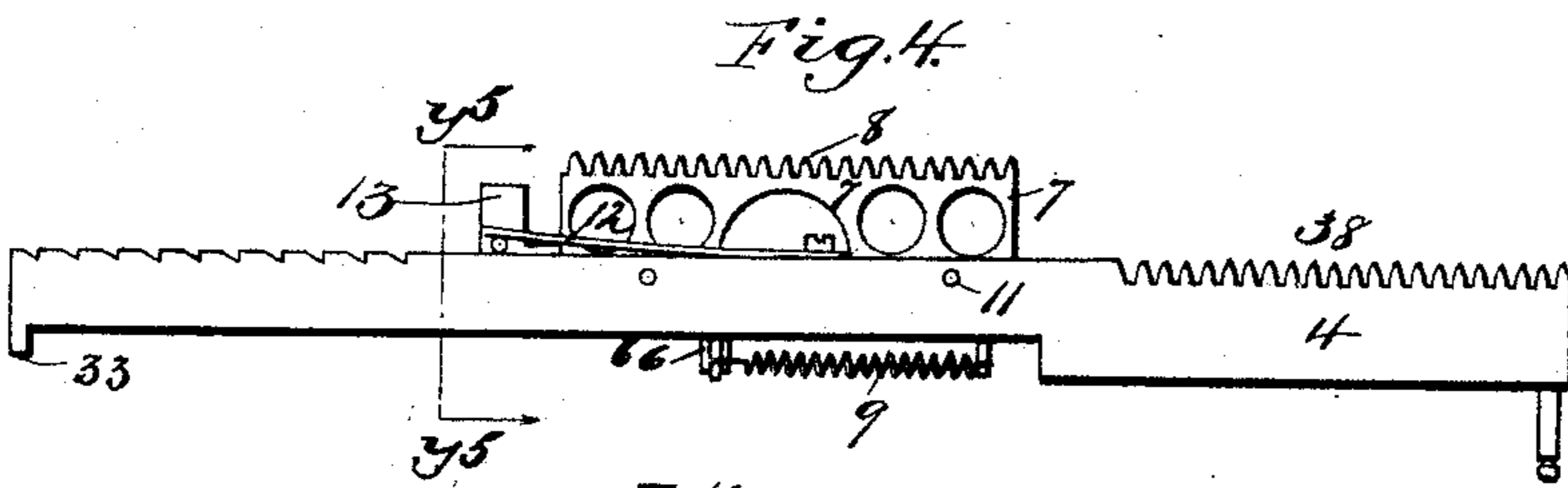
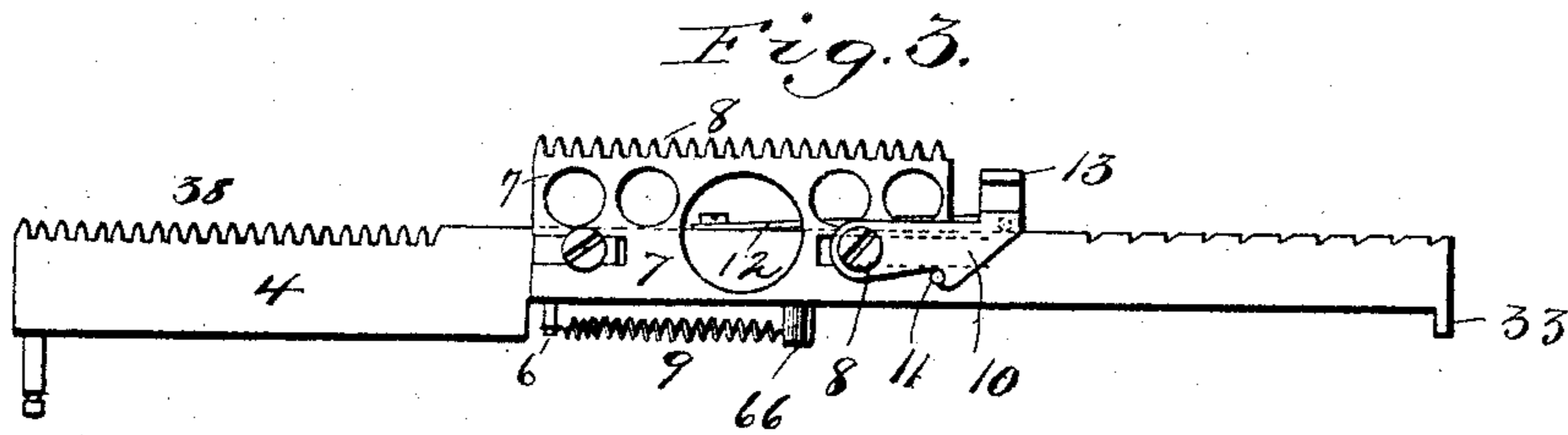
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(No Model.)

7 Sheets—Sheet 3.



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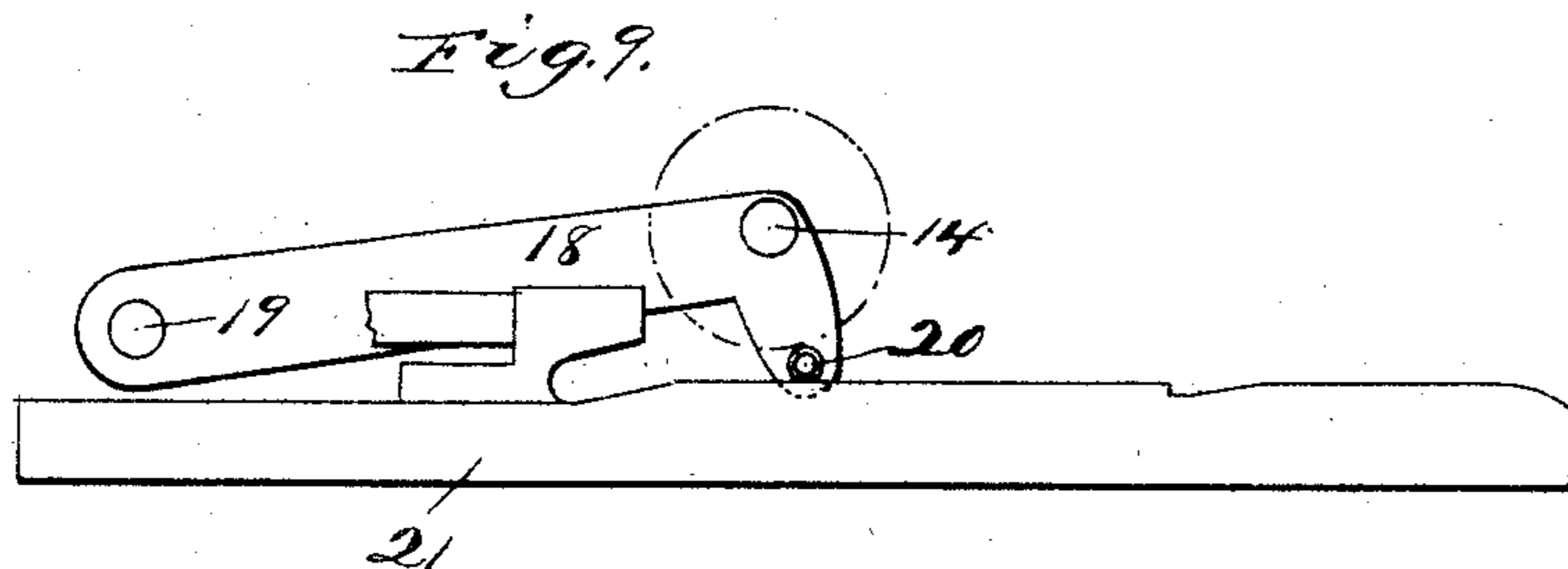
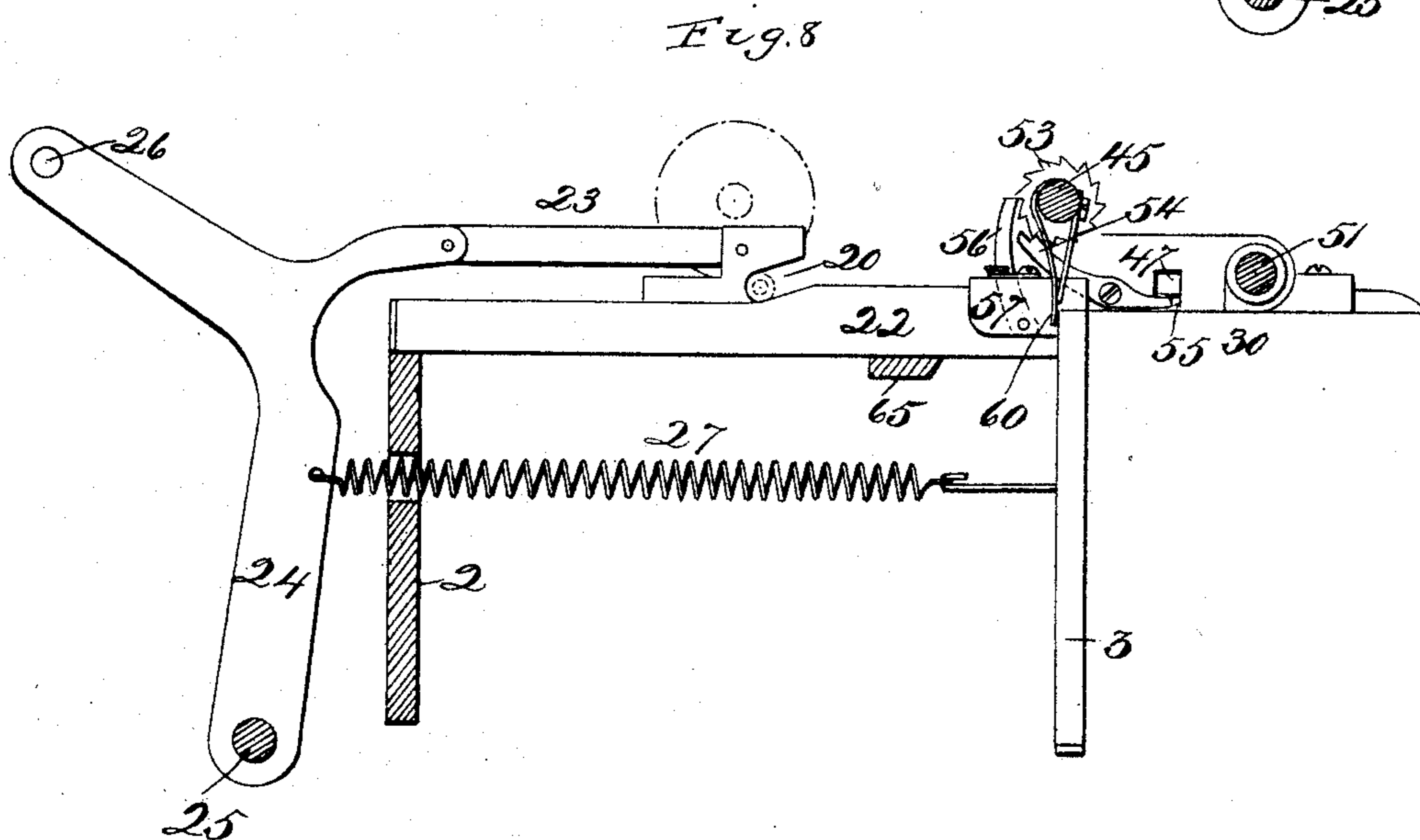
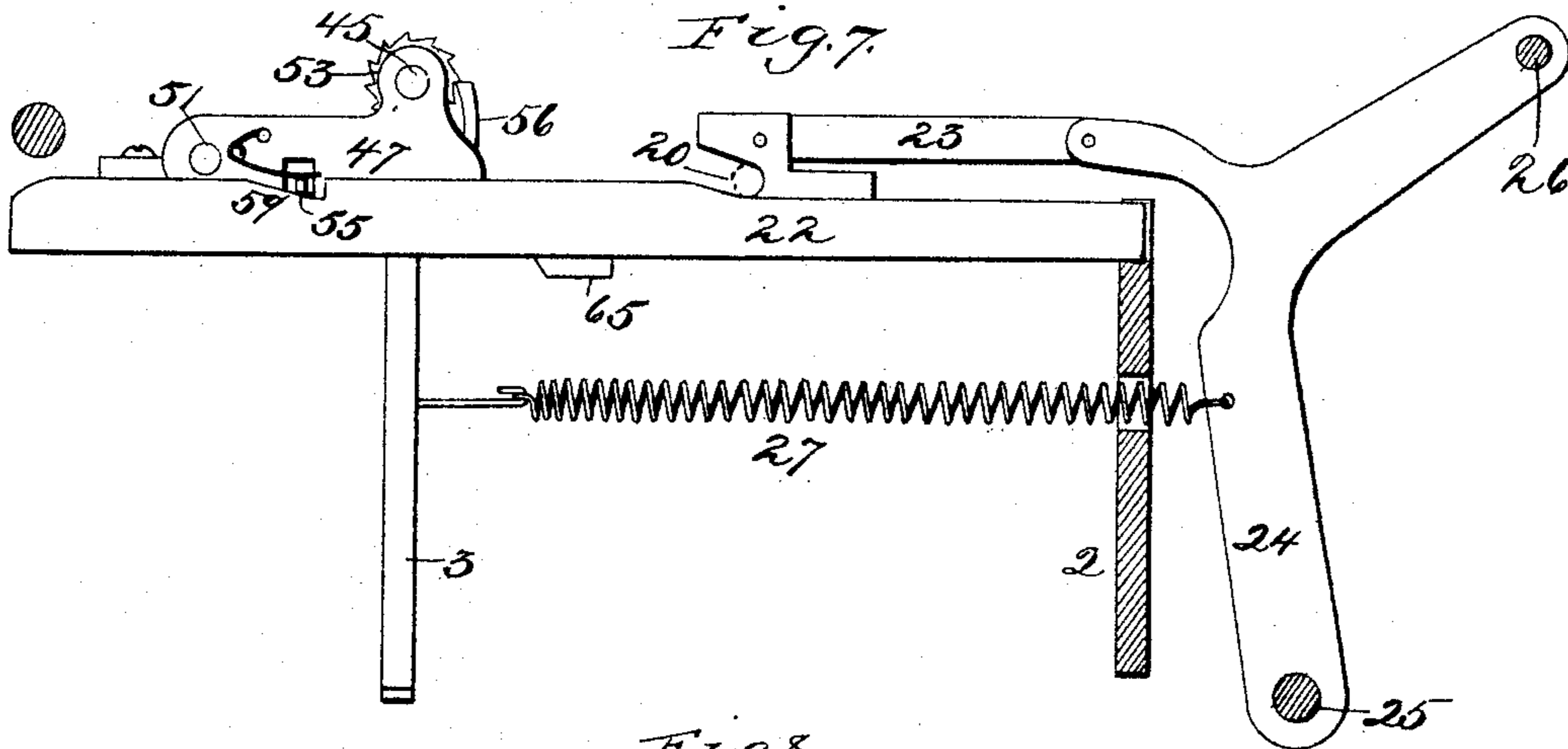
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(Application filed Mar. 2, 1895.)

(No Model.)

7 Sheets—Sheet 4.



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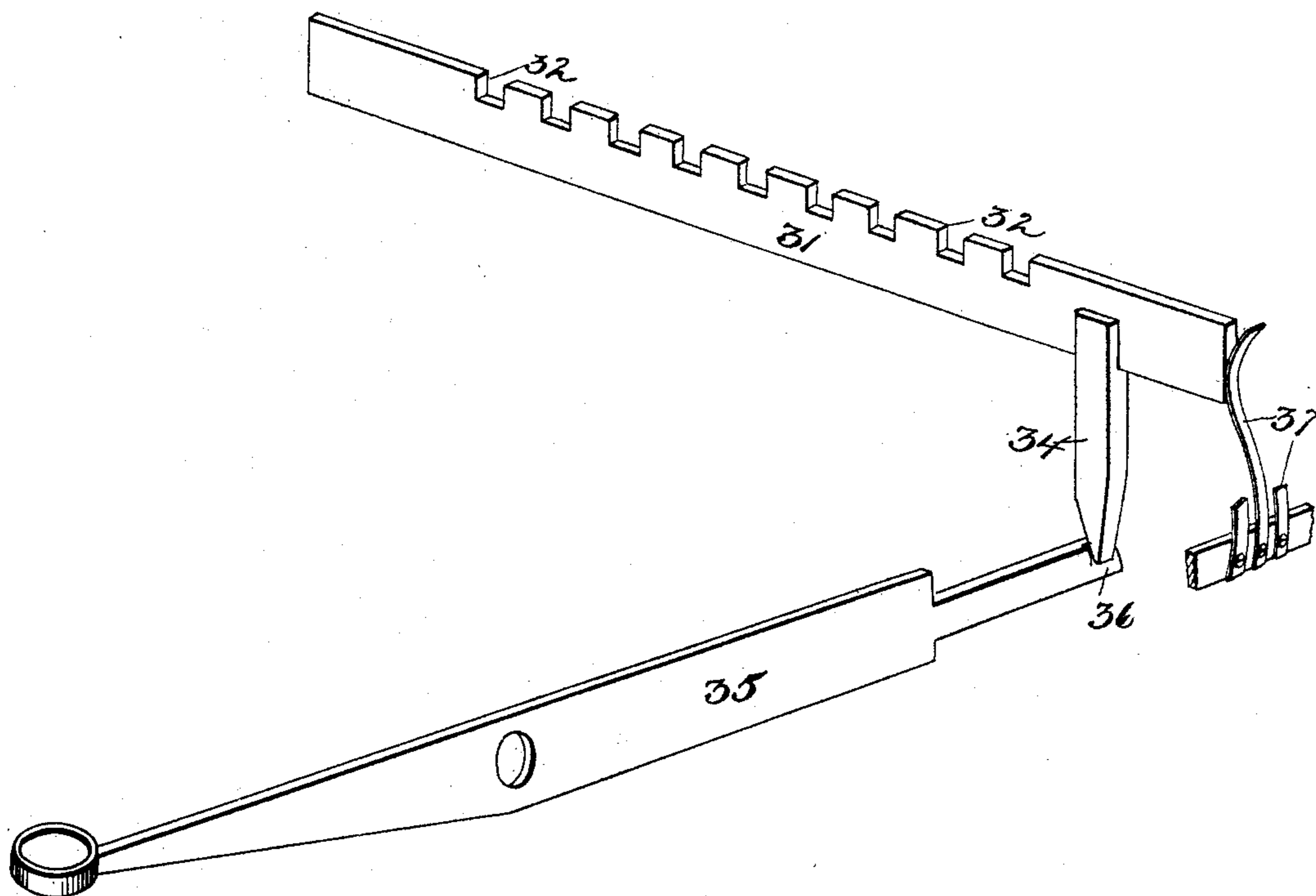
H. HOLLERITH.
ADDING AND RECORDING MACHINE.

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7 Sheets—Sheet 5.

Fig. 10.



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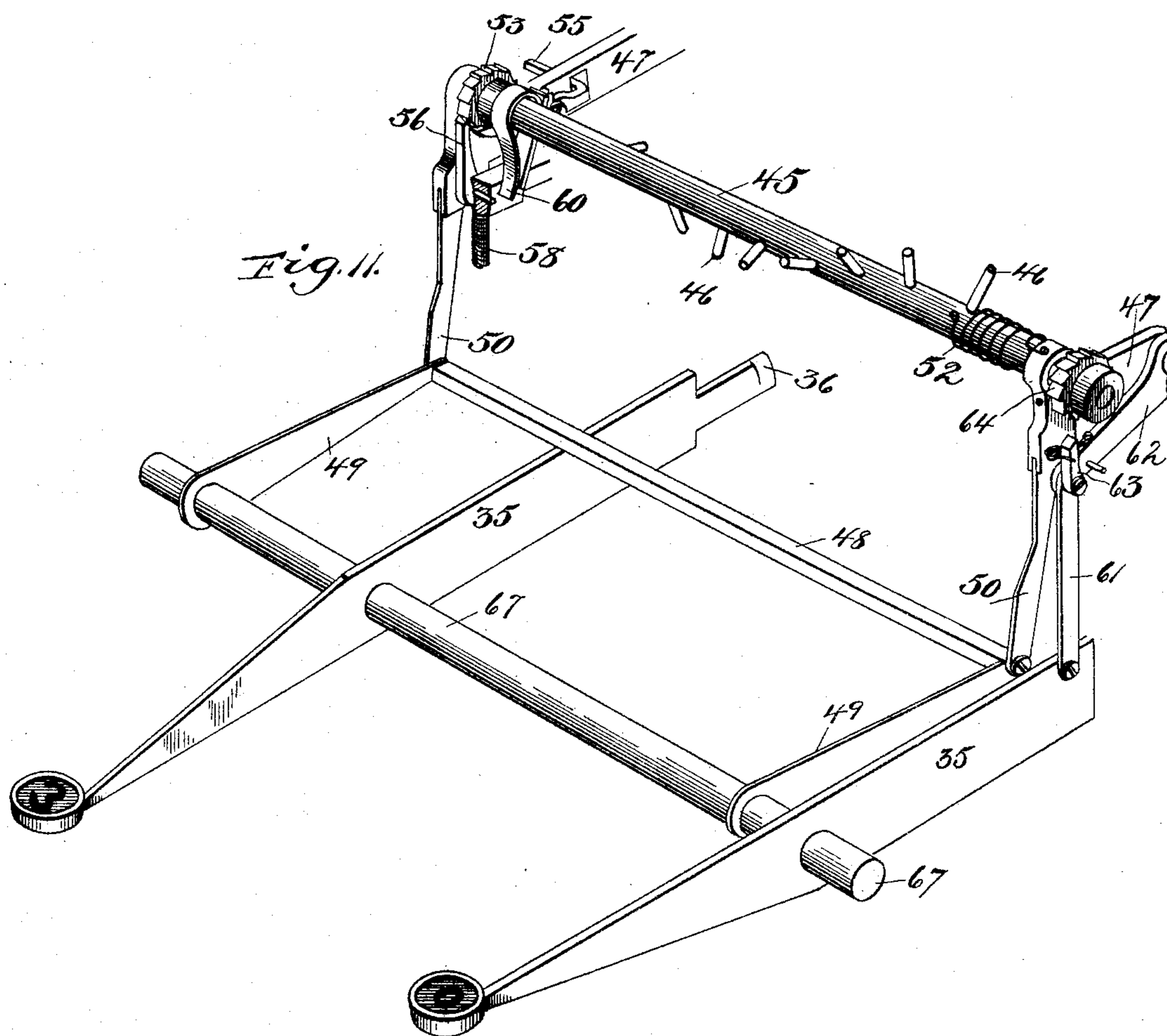
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ADDING AND RECORDING MACHINE.

(Application filed Mar. 2, 1895.)

(No Model.)

7 Sheets—Sheet 6.



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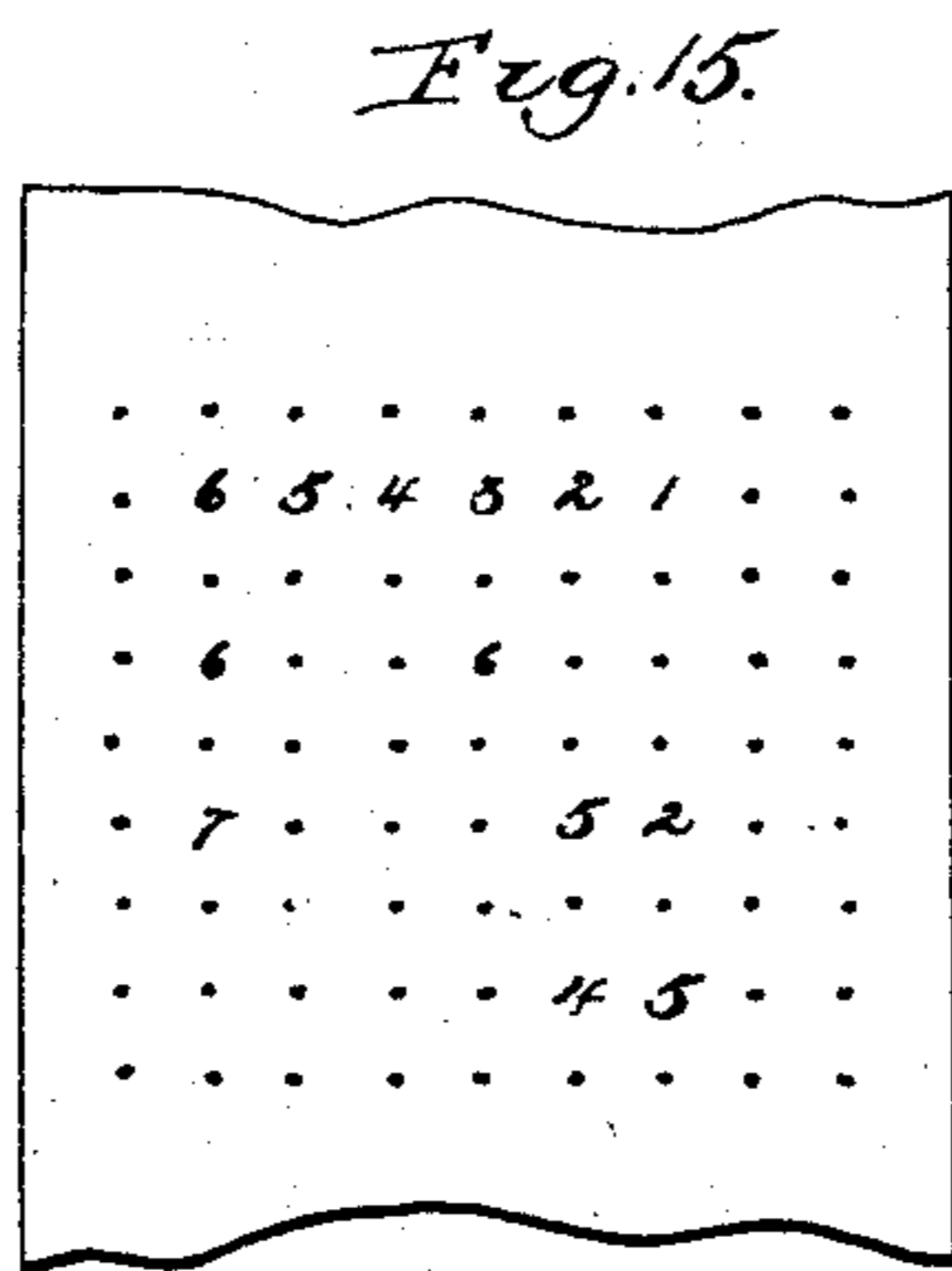
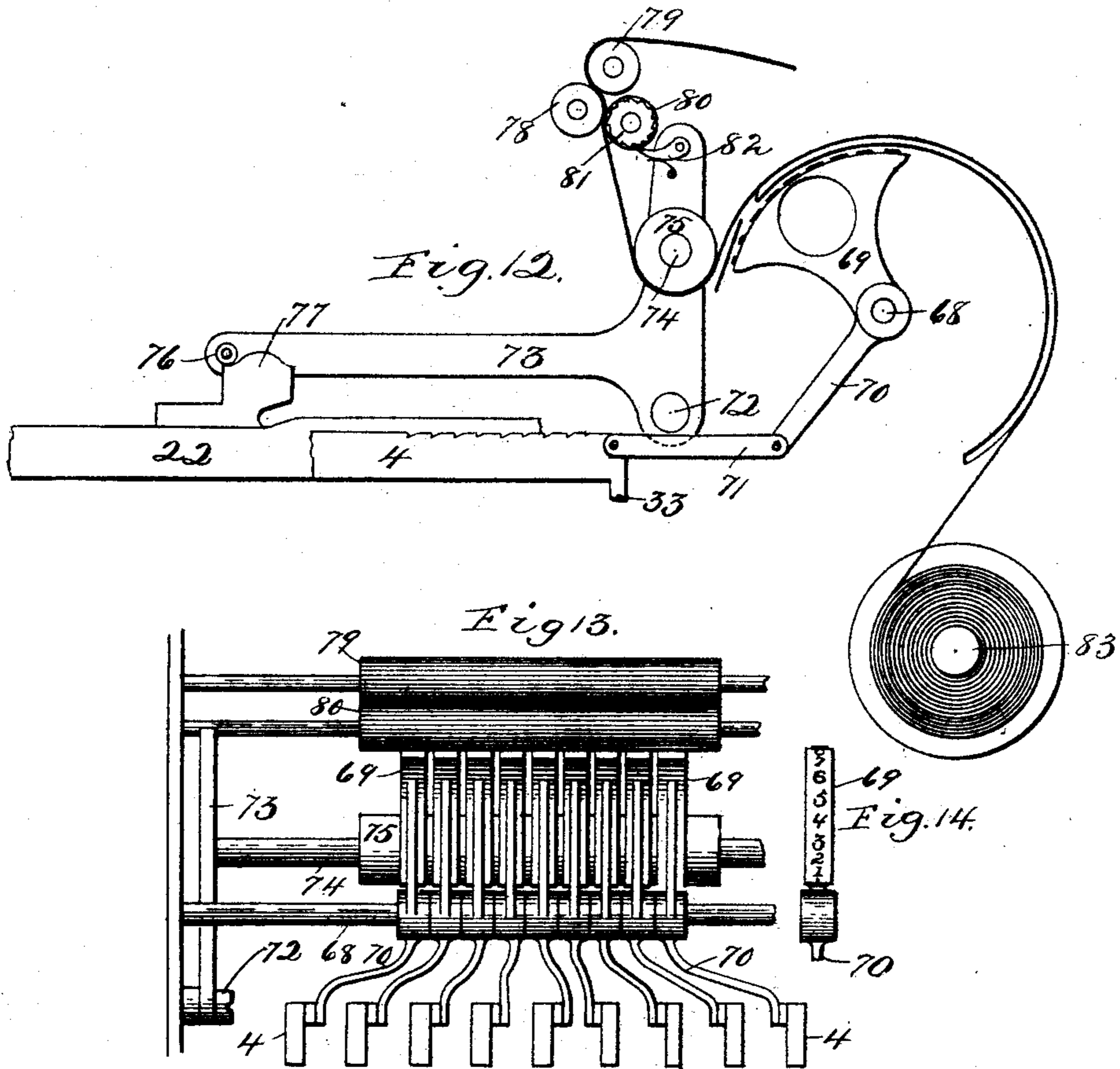
Patented Apr. 4, 1899.

H. HOLLERITH.
ADDING AND RECORDING MACHINE.

(Application filed Mar. 2, 1895.)

(No Model.)

7 Sheets—Sheet 7.



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UNITED STATES PATENT OFFICE.

HERMAN HOLLERITH, OF WASHINGTON, DISTRICT OF COLUMBIA.

ADDING AND RECORDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 622,470, dated April 4, 1899.

Application filed March 2, 1895. Serial No. 540,310. (No model.)

To all whom it may concern:

Be it known that I, HERMAN HOLLERITH, of Washington, District of Columbia, have invented certain new and useful Improvements in Adding and Recording Machines; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, and to the figures of reference marked thereon.

My invention relates particularly to that class of adding-machines in which a single series of keys controls successively a number of sets of indicating and registering wheels dealing, respectively, with units, tens, hundreds, &c.; and it consists in certain novel improvements relating to the indicating and adding mechanism proper, as well as to mechanism for recording the indicated numbers, which will be first described at length, and then pointed out particularly in the claims at the close of this specification.

Referring to the accompanying drawings, Figure 1 represents a top plan view of the machine. Fig. 2 is a longitudinal section taken on the line x^2x^2 , Fig. 1. Fig. 3 is a side view of one of the actuating-bars and attached parts. Fig. 4 is a similar view of the same, taken from the opposite side. Fig. 5 is a sectional view taken on the line y^5y^5 , Fig. 4, and showing also one of the registering-wheels, its pinion, and tripping-arm. Fig. 6 is a view of the fixed pawls for engaging the pinions of the registering-wheels when the latter are thrown out of engagement with their cooperating racks. Figs. 7 and 8 are elevations showing particularly the tripping-shaft and a portion of its tripping mechanism and the resetting devices. Fig. 9 is a detail view of the means for raising and lowering the registering-wheels. Fig. 10 is a perspective view showing one of the stop-bars and the manner in which the same is operated by one of the finger-keys. Fig. 11 is a perspective view of the tripping-shaft and mechanism for operating the same. Fig. 12 is a side elevation showing particularly the printing attachment. Fig. 13 is a rear view of the same. Fig. 14 is a face view of one of the printing-segments, and Fig. 15 is a plan view of a portion of one of the printed record-strips.

Similar numerals of reference in the several figures indicate the same parts.

The machine consists of two side frames 1 1, Fig. 1, connected together by two cross-plates 2 and 3. (Shown in cross-section in Fig. 2.) Sliding in suitable grooves in these cross-plates are a series of actuators or actuating-bars 4, the number of these actuating-bars depending upon the capacity of the machine, one such bar being required for each order. I will hereinafter refer to these bars as "units-bar," "tens-bar," "hundreds-bar," &c., according to the position of the bar. These actuating-bars are normally held in position by the pawls 5. Below each bar there is a spring 6, one end of which is secured to a pin projecting downward from the forward or outer end of the bar, the other end being secured to a fixed point of the main portion of the machine. Mounted alongside of each actuating-bar is a small rack-bar 7. This rack-bar, which because of its functions may be termed a "tens-carrying" bar, is capable of a limited motion alongside of the main actuating-bar 4, such motion being equivalent to one unit, or, in the present instance, two of the rack-teeth 8. The rack-bar 7 is normally held against the tension of the spring 9 by the pawl 10, secured to the actuating-bar and engaging the pin 11, secured to said rack-bar 7. The construction of the main actuating-bar and rack-bar is more particularly shown in Figs. 3, 4, and 5. A flat spring 12 engages a projection from the pawl 10 to hold the same normally depressed. Pawl 10 is formed with a projection 13, extending sidewise, as shown more particularly in Fig. 5. Above the rack-bars 7, Fig. 2, and extending from one side of the machine to the other is a shaft 14. Loosely mounted on this shaft are a series of pinions 15, engaging with the teeth 8 of the rack-bars. Mounted alongside and secured to these pinions are the numbered wheels 16 and the tripping-pins 17, Fig. 5. These tripping-pins 17 are so arranged that as the pinions 15 rotate they engage with the projections 13 of the pawls 10, so as to release the pin 11, Fig. 3, which allows the spring 9 to move the rack-bar 7 forward a distance equivalent to two teeth. The relations of the numbered wheel 16, tripping-pin 17, and pawl 10 are such that the pawl is

tripped as the numbered wheel of the next lower order passes from "9" to "0." The shaft 14 is held at its ends in the arms 18, which are pivoted on suitable pivots 19, as shown in Fig. 9. Secured to these arms are the projections or cam-rollers 20, which engage with and are operated by the cam-bars 21 and 22. (Shown in Figs. 1, 7, and 8.) These cam-bars 21 and 22 are mounted in the cross-plates 2 and 3, Figs. 1 and 2, and are secured by the links 23 to the reset-levers 24. These reset-levers are secured to a shaft 25, which is mounted in the main plates 1.

At a convenient point the reset-levers 24 are joined by a bail 26, as shown more particularly in Fig. 1. Springs 27 are secured to these reset-levers 24 for the purpose of keeping them in their normal position, as shown in Figs. 7 and 8. The cam-roller 20 and the cam-bars 21 and 22 operate in such way that as the reset-levers 24 are drawn forward the shaft 14, with its pinions and numbered wheels, are lifted, so that the pinions 15 are disengaged from the rack-teeth 8, the pinions being held securely in their elevated position by the fixed rack-fingers 28, Fig. 2. A series of these rack-fingers is secured to a suitable frame-piece 29, as shown in inverted plan view, Fig. 6. This frame-piece 29 is secured to the main frame-plates 1, as shown in Fig. 1.

Secured to the cross-plate 3 is a stop-block 30, Figs. 1 and 2, in which there are nine grooves at right angles to the actuating-bars 4 for accommodating the stops or stop-bars 31. These stop-bars are capable of a longitudinal motion. The arrangement of one such stop-bar is more particularly shown in Fig. 10. Each stop-bar is provided with notches 32, which when the bars are in normal position allow the projections 33, Fig. 2, of the actuating-bars 4 to pass freely. If, however, any such stop-bar 31 is moved longitudinally, it will arrest the passage of any of the actuating-bars 4. Connected to these stop-bars are depending cams 34, the construction of which is shown in Fig. 10. The key-levers 35 are mounted loosely on a shaft 67, Fig. 2, secured to the side frames. At the forward ends these key-levers are provided with suitable keys numbered from "0" to "9," as shown in Fig. 1. The rear ends of these key-levers are provided with cam-surfaces 36, Figs. 2 and 10, which engage with and operate the cams 34 and move the stop-bars 31 longitudinally against the tension of springs 37.

At the forward end of the actuating-bars 4 are the rack-teeth 38, which mesh with the pinions 39, loosely mounted on the shaft 40, Fig. 2. Secured to the pinions 39 are the numbered wheels 41, which show to the operator, through a suitable window in the casing 42, Fig. 1, the number added, enabling the operator to note any errors. These pinions 39 remain constantly in mesh with the rack-teeth 38, and as the actuating-bars 4 move

forward numbers are shown on the wheels 41 from "0" to "9," according to the forward motion of said bars 4.

As before stated, the actuating-bars are held against the tension of springs 6 by the pawls 5. These pawls are held in normal position by the springs 43, Fig. 2. Below and in front of the projections 44 of the pawls 5 and extending from one side of the machine to the other is the tripping-shaft 45. This tripping-shaft 45 is more particularly shown in Fig. 11 and is provided with a series of pins 46, arranged spirally or helically, as shown. The tripping-shaft 45 is mounted at its ends in the arms 47, which are pivoted to the stop-block 30, as shown in Fig. 1. A bar 48 rests across all the keys, except the one which stands for zero, as shown more particularly in Fig. 11, and is secured at its ends to links 49, loosely mounted on the shaft 67. The ends of this bar 48 are also connected by links 50 to the arms 47. From this construction it will be noted that the depression of any key from 1 to 9 will raise the tripping-shaft 45, Figs. 2, 7, and 8. The result of this is that, depending upon the position of the tripping-pins, one or another of the pawls 5 will be raised, so as to disengage the particular bar 4.

Mounted on the tripping-shaft 45 is a spring 52, one end of which is connected to the arm 47 and the other end to the tripping-shaft 45. The tension of this spring is to hold the shaft through the ratchet-wheel 53 against the retaining-pawl 54. (Shown more particularly in Fig. 8.) This retaining-pawl is constructed with a laterally-projecting arm 55, passing through the opening in the arm 47, as shown in Figs. 1, 7, and 11. A pawl 56 is secured to a block 57, attached to the cross-plate 3, Fig. 2. It will be noted that if the tripping-shaft 45, by means of any key from 1 to 9, is raised as it is retracted by the springs 58, secured at one end to the frame-plate 3 and at their other ends to the arms 47, Figs. 2 and 11, the ratchet-wheel 53 engages the pawl 56, thus rotating the tripping-shaft 45, so that the next pin 46 is brought in position under one of the pawls 5.

The projection 55 of the retaining-pawl 54 engages with and is operated by a cam 59 in the cam-bar 22, Fig. 7. The effect of this is that as the reset-levers 24 are depressed, drawing the cam-bars 22 forward, the arm 55, by means of the cam 59, is raised, thus releasing pawl 54, the projecting end of which also releases pawl 56. The tripping-shaft 45 thus being free the spring 52 rotates the same until the stop-arm 60 strikes against the cross-plate 3, in which position the tripping-pin 46 is opposite the projection 44 of the pawl 5 corresponding to the right-hand or units rack-bar.

The zero-key is loosely mounted on the shaft 67 and at its rear end is connected, by means of the links 61, to a lever 62, Fig. 11. This lever carries the pawl 63, which is adapted to

engage with and rotate the ratchet-wheel 64, thus rotating the tripping-shaft one point each time the zero-key is depressed. It will be noted that the depression of the zero-key does not lift the tripping-shaft 45, but does rotate it one point. The result of this is that it sets the tripping-shaft to position for operating the next higher order without operating any of the pawls 5 to release the bars 4.

Secured to the cam-bars 21 and 22 and extending across the machine below the rack-bars 4 is the reset-bar 65, Figs. 2, 7, and 8. As the bars 21 and 22 are drawn back this reset-bar 65 engages projections 66 on the bars 7. The result is that the bars 7 are first moved back relatively to the bars 4 until pawls 10 engage pins 11, the further motion of bar 65 moving the bars 4 into their initial position.

Having thus described the construction of the machine, I will proceed to describe the operation of addition by means of the same.

Let us assume that the machine is in its initial position, in which the "0's" show on the wheels 16 below the bar 29. Let us now add "249." The operation is first to depress the key 9. The result of this is that the transverse bar 31, which is the farthest back in the machine, is moved by the key-lever 9 longitudinally a sufficient distance to intercept any actuating-bar 4 that may move forward. Further depression of the key 9 raises the tripping-shaft 45, so that the tripping-pin 46 releases pawl 5 of the units-column. The spring 6 then rapidly draws the unit-bar 4 until the lip 33 strikes the bar 31. The result is that "9" shows on the indicator-wheel 41, and the summation or addition wheel 16 is also moved from "0" to "9." As the key 9 is released the pawl 5 holds the bar 4 in its new position, and as the tripping-shaft 45 is retracted by means of springs 58 the pawl 56 engages with ratchet 53 to move the tripping-shaft one point forward, so that the next tripping-pin 46 will be under the tens-pawl 5. Depressing the key 4 we now move the stop-bar 31, operated by that key, so as to arrest the tens actuator or bar after moving forward the distance of eight rack-teeth, or four units. Then the tripping-pin 46 trips the pawl 5, which releases the tens-bar. The spring 6 moves the tens-bar forward four points, indicating "4" on the tens-indicator wheel 41 and on the tens-summation wheel 16. As the key 4 is released the stop-bar 31 resumes its normal position through means of springs 37. The pawl 5 holds the tens-bar 4 in its new position. The pawl 56 again engages the ratchet 53 and moves the tripping-shaft one point, so that the pin 46 will be under the pawl 5, corresponding to the hundreds-column. Now depressing key 2, stop-bar 31, corresponding to this position, is set, pawl 5, holding the hundreds-bar, is operated to release the hundreds-bar, which moves forward two points, indicating "2" on the hundreds-indicator wheel 41 and on hundreds-summation wheel 16. The

operator now has added "249," and it is necessary to bring the machine back to its initial position, which is done by depressing the bail 26, which, through reset-levers 24 and links 23, moves the cam-bars 21 22 forward, so as first to lift the shaft 14 and its pinions 16 out of mesh with rack-teeth 8 and hold these pinions in the rack-fingers 28. Further motion of these reset-levers 24 operates, through the cam 59, the projection 55 of the pawl 54, which releases the ratchet-wheel 53, and thus allows the spring 52 to rotate the tripping-shaft until held in its initial position by the stop-arm 60 and against the plate 3. Further motion of the reset-levers brings the reset-bar 65 against the stops 66 of all such bars as have moved rearward, and draws these bars back into their initial position, where they are held by pawls 5. Drawing these bars back in this way rotates the pinions 39, so as to show "0's" on the indicator-wheels 41, or, in other words, to show that the bars have all been properly reset. Releasing the bail 26 the springs 27 retract the reset-levers 24, in which position the machine is again in its normal condition, the pinions 15 again meshing with the rack-teeth 8.

If now we add to the machine "101," we first strike key 1, which sets the stop-bar 31, disengages the units-pawl 5, and allows the units-bar 4 to move rearward one point. In so doing the units-wheel 16 passes from the position of "9" to "0," and the tripping-pin 17, while the wheel is passing from "9" to "0," comes in contact with the projecting lip 13 of the pawl 10, secured to the tens-bar. This releases the holding-pin 11, and the spring 9 of the tens-bar moves the rack-bar 7 rearward one point, thus moving the tens-wheel from "4" to "5," or, in other words, this operation carries "1" from the units to the tens bar. Now depressing key 0 we rotate the tripping-shaft again from the tens position to the hundreds position without, however, releasing the tens-bar. Touching the key 1 we set the corresponding stop-bar 31 and release the hundreds-bar, which thus adds "1" to the "2" already added on the hundreds-wheel. The summation-wheels thus show "350," or the sum of "249" and "101." Depressing the bail 26 the indicator-wheels are again set to "0" and the tripping-shaft brought to its initial position, when we are in position to proceed with the addition of the next number.

For purpose of convenience the complements of the numbers shown through the window directly below bar 29 are placed on the number-wheels 16 and show through a second opening, as shown in Fig. 1.

If it is desired to record on a strip of paper the numbers added, this can be done by applying to the machine already described the devices shown in Figs. 12, 13, and 14.

Loosely mounted on a shaft 68 are type-segments 69. Each of the type-segments has a depending arm 70, which is connected by

link 71 with the given actuating-bar 4. The face of the type-segment is provided with a series of numbers from "1" to "9," as shown in Fig. 14. In place of "0" I provide a dot, as shown. As any bar 4 moves forward through link 71 and arm 70 it rotates the type-segment in proportion to the rearward motion of the bar 4 or the amount added. Levers 73 are secured by pivots 72 to the side frame. These levers 73 have two arms, one extending upward and carrying the shaft 74, on which is mounted the impression-roller 75, the other or substantially horizontal arm being provided at its forward end with a cam-roller 76, which is adapted to engage with and be operated by a projection 77, secured to the cam-bars 21 and 22.

It will be noted that as the bar 22 is drawn forward the forward end of the horizontal arm of lever 73 is raised by means of the projection 77, thus bringing the impression-roller 75 against the type-segments. Mounted in the side frames are the feed-rollers 78, 79, and 80. The feed-roller 80 is provided with a ratchet-wheel 81, which is adapted to be engaged with and operated by the pawl 82, which is mounted on the upper arm of lever 73. As the end of lever 73 through cam-roller 76 is oscillated this pawl 82 engages the ratchet 81, and thus moves the feed-roller. Mounted on a shaft 83 is a suitable spool bearing a strip of paper which passes around the impression-roller 75 and between the feed-rollers 78, 79, and 80.

The operation of this printing attachment is as follows: Touching the keys in succession from the units, tens, &c., the different actuating-bars 4 move forward according to the amount added. These bars, through the links 71, thus bring opposite the impression-roller 75 the figures on the segment 69 corresponding to the amount added. When the bail 26 is drawn down to reset the machine, the first motion of this bail, through cam 77, presses the impression-roller 75 against the type, thus making an impression on the paper strip. On the retraction of the reset-levers the cam 77 again operates the impression-roller, and if the machine has been properly reset a line of dots is printed, thus showing that the machine has been properly reset, the paper at each operation being suitably moved forward by means of the pawl.

In Fig. 15 I have indicated the general appearance of a strip on which the amounts added have been recorded. The advantage of printing a series of dots is to show any improper resetting of the machine. A record of the amounts added and of any failure to properly reset the machine is thus secured.

Having thus described my invention, what I claim as new is—

1. The combination with a series of registering-wheels, of a series of spring-impelled toothed actuating-bars for operating the registering-wheels, a series of keys, a series of stops controlled by the keys for determining

the throw of the bars when released, a series of pawls coöperating with the teeth of the actuating-bars for holding said bars in check and a tripping device operated by the keys for tripping the pawls progressively so as to successively release the bars; substantially as described.

2. The combination with a series of registering-wheels, of a series of movable toothed actuating-bars for operating the series of wheels, a series of keys, a series of pawls coöperating with the teeth of the actuating-bars, a series of stops operated by the keys for determining the throw of the bars when released and a rotary disengaging device actuated by the keys for tripping the series of pawls or detents progressively from the actuating-bars so as to successively release the said bars.

3. The combination with a series of registering-wheels, of a series of spring-impelled toothed actuating-bars for operating upon the registering-wheels, a series of keys, a series of stops controlled by the keys for determining the throw of the bars when released, a series of pawls coöperating with the teeth of the actuating-bars for holding the bars in check, a rotary tripping-shaft operated by the keys having a series of tripping projections arranged spirally or helically thereon for progressively tripping the pawls so as to disengage them from the actuating-bars and successively release said bars; substantially as described.

4. The combination with a series of registering-wheels, of a series of movable actuating-bars carrying racks independently movable in the same direction in which the actuating-bars move for operating the series of registering-wheels, a series of keys, a series of pawls for restraining the actuating-bars, a series of stops operated by the series of keys for determining the throw of the bars when released, a tripping device operated by the keys for tripping the pawls progressively so as to release the bars and resetting devices for returning the bars to the normal position in engagement with their pawls, substantially as described.

5. The combination with a series of registering-wheels, of a series of movable actuating-bars normally geared to said series of registering-wheels so as to actuate the same, a series of keys, a series of pawls for normally holding the actuating-bars, a series of stops operated by the series of keys for determining the throw of the bars when released, a tripping device operated by the keys for tripping the pawls so as to successively release the bars and resetting mechanism for restoring the actuating-bars to their initial positions and automatically disengaging the registering-wheels from their actuators; substantially as described.

6. The combination with a series of registering-wheels, of a series of actuating-bars normally geared to said series of registering-

wheels so as to actuate the same, a series of keys, a series of pawls for the actuating-bars, a series of stops operated by the series of keys for determining the throw of the bars when released, a tripping device operated by the keys for tripping the pawls so as to successively release the actuating-bars, a resetting mechanism for restoring the actuating-bars to their initial positions and automatically disengaging the registering-wheels from their actuators during the resetting movement and means for locking the registering-wheels from movement while disengaged from their actuators; substantially as described.

7. The combination with a series of movable actuators, racks mounted on said actuators and having a limited movement independently of said actuators, a series of registers each connected with and operated by one of said actuators, means for releasing said actuators successively, a series of keys, a series of stop-bars each connected with and operated by one of said keys and common to all the actuators for arresting said actuators at different points of their travel and resetting mechanism for resetting said actuators to their initial positions and for automatically disconnecting the registers from the actuators; substantially as described.

8. The combination with a series of movable actuators, of racks mounted on said actuators and capable of a limited movement independently of said actuators, a series of registers each connected with and operated by one of said actuators, means for arresting said actuators at different points of their travel, a series of keys and a translating device for establishing an operative connection between said keys and said actuators progressively, substantially as described.

9. The combination with a series of movable actuators, of rack-sections mounted thereupon and having a limited independent movement in the same direction as the movement of the actuators, means for locking the rack-section to the actuators, devices for releasing the locking means and permitting the independent movement of the rack-sections, a series of registers connected with and operated by said rack-sections, a series of keys, and a translating device for automatically establishing an operative connection progressively between said keys and said actuators; substantially as described.

10. The combination with a series of movable actuators, of rack-sections mounted thereupon and having a limited independent movement in the same direction, a series of pinions in engagement with the movable rack-sections, means for imparting the independent movement to said rack-section, a series of registers connected with and operated by said rack-sections, a series of keys, and a translating device for automatically establishing an operative connection progressively between said keys and said actuators; substantially as described.

11. The combination with a series of movable actuators, of rack-sections mounted thereupon and having a limited independent movement in the same direction, pinions normally in engagement with the rack-sections, devices for locking the rack-sections against independent movement, means for releasing them to permit of their independent movement, a series of registers connected with and operated by said rack-sections, a series of keys, and a translating device for automatically establishing an operative connection progressively between said keys and said actuators, substantially as described.

12. The combination with the series of movable actuators of the movable rack-sections mounted thereupon so as to have a limited independent movement in the same direction, springs for keeping said movable rack-sections under tension and detents for holding the said rack-sections in check against the tension of the springs, a series of registers connected with and operated by said rack-sections, a series of keys, and a translating device for automatically establishing an operative connection progressively between said keys and said actuators; substantially as described.

13. The combination of a movable actuator, a rack-section mounted thereupon so as to have a limited independent movement in the direction in which the actuator moves, a detent for holding the said rack-section and means for releasing said detent, a series of registers connected with and operated by said rack-sections, a series of keys, and a translating device for automatically establishing an operative connection progressively between said keys and said actuators; substantially as described.

14. The combination with the movable actuators, the movable rack-sections mounted thereupon so as to have an independent movement in the direction in which the actuators move with their springs and detents, of the series of registering-wheels having pinions for engaging the rack-sections and trips for acting upon the rack-section detents, a series of registers connected with and operated by said rack-sections, a series of keys, and a translating device for automatically establishing an operative connection progressively between said keys and said actuators; substantially as described.

15. The combination with a series of registering-wheels having pinions and trips as described, of a series of spring-impelled actuating-bars, carrying movable rack-sections with their controlling springs and detents, a series of keys, a series of stop-bars each controlled by one of the keys and common to all the actuators for determining the throw of the actuating-bars when released, a series of pawls for holding the bars in check, and a tripping device operated by the keys for tripping the pawls so as to successively release the bars, substantially as described.

16. The combination with a series of spring-impelled actuating-bars, of pawls for holding the same in check, a tripping-shaft having a series of spirally or helically arranged tripping-pins, a series of finger-keys, and devices for moving the tripping-shaft toward and from the tripping projections of the pawls and for partially rotating said tripping-shaft upon the operation of a key; substantially as described.
17. The combination with a series of spring-impelled actuating-bars, pawls for holding them in check, a rotatable tripping-shaft mounted in swinging arms for tripping the pawls, a series of finger-keys, connections whereby upon the operation of any key, the tripping-shaft is vibrated and a pawl is tripped and means for giving intermittent rotation to the tripping-shaft each time the same is vibrated; substantially as described.
18. The combination with a series of actuating-bars, a series of pawls for holding the same in check, a rotatable vibratory tripping device provided with means for progressively tripping the series of pawls, a series of keys and mechanism intermediate the tripping device and the keys for causing the tripping device to be vibrated toward and from the pawls and partially rotated upon the operation of a key; substantially as described.
19. The combination with a series of actuating-bars, a series of pawls for holding the same in check, a rotatable vibratory tripping-shaft provided with tripping-pins arranged spirally or helically to trip the series of pawls progressively as the shaft is rotated, a series of keys and intermediate mechanism for causing the tripping-shaft to be vibrated toward and from the pawls and partially rotated upon the operation of a key; substantially as described.
20. The combination with the movable actuating-bars and the pawls for holding the same in check, of the tripping-shaft and its pins, a series of keys, means for rotating the shaft step by step as each key is operated, and means disengaging the pawls to reset the tripping-shaft to normal position; substantially as described.
21. The combination with the rotatable vibratory tripping-shaft and its pins, the swinging arms on which said shaft is mounted, the series of keys, and connections between the same and the swinging arms whereby the said arms are vibrated upon the operation of any one of the keys to move the tripping-shaft toward and from the pawls, the ratchet on the tripping-shaft, the actuating and retaining pawls cooperating therewith, means for tripping the retaining-pawl, and means for rotating the tripping-shaft to normal position; substantially as described.
22. The combination with the series of movable actuating-bars and the springs for impelling the same, the stop-bars extending transversely of the series of actuating-bars and having the depending cams, the springs operating on said stop-bars, and the finger-keys having the cam-surfaces upon their inner ends for engaging with the cam projections of the stop-bars, substantially as described.
23. The combination with the movable actuating-bars and their impelling-springs, the spring-pressed pawls engaging with said bars and normally holding them in check, the vibratory rotatable tripping-shaft having the spirally or helically arranged tripping-pins for engaging the spring-pressed pawls, the series of finger-keys and mechanism for causing the vibration and partial rotation of the tripping-shaft upon the operation of a key; substantially as described.
24. The combination with the series of movable actuating-bars, the pawls for holding the same in check, the series of keys, a series of stops operated by the keys and common to all the actuating-bars for determining the throw of the bars when released, the tripping-shaft and its tripping-pins, connections for vibrating and intermittently rotating the tripping-shaft, and independent connections controlled by the zero-key for partially rotating the tripping-shaft without vibrating it; substantially as described.
25. The combination with a series of indicating-wheels, of a series of movable toothed actuating-bars geared to said indicating-wheels, a series of keys, a series of pawls cooperating with the teeth of the actuating-bars, a series of stops for determining the throw of the bars when released, and a tripping device operated by the keys for acting upon the series of pawls progressively to successively release the actuating-bars; substantially as described.
26. The combination of a series of indicating-wheels, a series of movable toothed actuating-bars cooperating with the series of indicating-wheels, a series of registering-wheels with their pinions and tripping-pins, movable rack-segments carried by the actuating-bars and the springs and detents cooperating with said movable rack-segments, a series of keys, a series of pawls cooperating with the teeth of the actuating-bars, a series of stops operated by the keys for determining the throw of the bars when released, and a tripping device operated by the keys for acting upon the series of pawls progressively to successively release the actuating-bars; substantially as described.
27. The combination with a series of movable actuating-bars and their racks, of a series of registering-wheels and their pinions mounted on a common shaft, swinging arms carrying said shaft, sliding cam-bars operating when moved in one direction to lift the swinging arms and simultaneously raise the pinions of all of the registering-wheels out of engagement with the racks on the actuating-bars and when moved in the other direction to depress said arms and simultaneously hold the pinions in engagement with the racks; substantially as described.
28. The combination with the movable ac-

tuating-bars and their racks, of the registering-wheels and their pinions movable toward and from the racks, the fixed pawls for locking against rotation the registering-wheel pinions when disengaged from the racks and resetting devices for raising and depressing the said pinions and wheels simultaneously; substantially as described.

29. The combination with the movable actuating-bars and their racks, of the registering-wheels and their pinions carried by the swinging arms, the fixed pawls, and the resetting cam-bars for raising and depressing the said swinging arms; substantially as described.

30. The combination with a series of movable actuating-bars, mechanism for releasing and arresting them and a resetting mechanism for returning the actuated bars to normal position, of a series of movable printing-surfaces and a vibratory impression device common to all the printing-surfaces, operated by the resetting mechanism, substantially as described.

31. The combination with the series of movable actuating-bars, mechanism for releasing and arresting them and a resetting mechanism for returning the actuated bars to normal position, of a series of movable printing-segments means for operating said printing-segments, from the actuating-bars, an impression device and a carrier therefor and means operated by the resetting mechanism for actuating said carrier both before the actuating-bars are reset, to make a record of the figure indicated by each bar, and after said bars have been reset, to indicate any failure to properly reset the bars; substantially as described.

32. In a machine, such as described, the combination of a series of keys, a series of movable spring-impelled actuating-bars, devices for holding the bars in check, stops operated by the keys for determining the throw of the bars when released, tripping mechanism actuated by the keys for acting upon the bar-holding devices to release the bars, resetting mechanism for bringing the actuated bars back to initial positions, printing-surfaces connected to the movable bars, and impression devices operated by the resetting mechanism to print the numbers exposed at the printing-points before the actuating-bars are shifted by the resetting mechanism; substantially as described.

33. In a machine, such as described, the combination of a series of keys, a series of movable spring-impelled actuating-bars, devices for holding the bars in check, stops operated by the keys for determining the throw of the bars when released, tripping mechanism actuated by the keys for acting upon the

bar-holding devices to release the bars, resetting mechanism for bringing the actuated bars back to initial positions, printing-surfaces connected to the movable bars and impression devices, operated by the resetting mechanism to print the characters exposed at the printing-point both before and after the actuating-bars are reset; substantially as described.

34. In a machine such as described the combination of a series of keys, a series of actuating-bars, devices for holding the bars in check, stops operated by the keys for determining the throw of the bars when released, tripping-mechanism actuated by the keys for acting upon the bar-holding devices to release the bars, resetting mechanism for bringing the actuated bars back to initial positions, a series of printing-segments corresponding to the series of actuating-bars, an impression device, a vibratory carrier upon which said impression device is mounted operated by the cams on the slides of the resetting mechanism, substantially as described.

35. The combination with the series of movable actuator-bars, of the series of printing-segments connected to said bars, means for guiding and feeding the paper strip, the impression-roller, the vibratory carrier on which said impression-roller is mounted and the sliding bars of the resetting mechanism provided with the cams for operating the said vibratory carrier; substantially as described.

36. The combination with a series of actuators and a series of registers, of a series of pawls for holding said actuators, mechanism for operating on such pawls, one at a time, and mechanism for positioning said pawl-operating mechanism; substantially as described.

37. The combination with a series of keys, a series of actuators and a series of registers, of a series of pawls for holding said actuators, tripping devices for tripping one of said pawls on the downstroke of the key and mechanism for positioning or advancing said tripping devices on the upstroke of said key; substantially as described.

38. In a machine such as described, the combination with a series of actuators, a series of registers, pawls for holding said actuators, means for releasing said pawls progressively upon the operation of any key except a zero-key and means for positioning said releasing mechanism without releasing any pawl on the operation of the zero-key; substantially as described.

HERMAN HOLLERITH.

Witnesses:

THOMAS DURANT,
MELVILLE CHURCH.