H. BILGRAM.

TAPPING MACHINE.

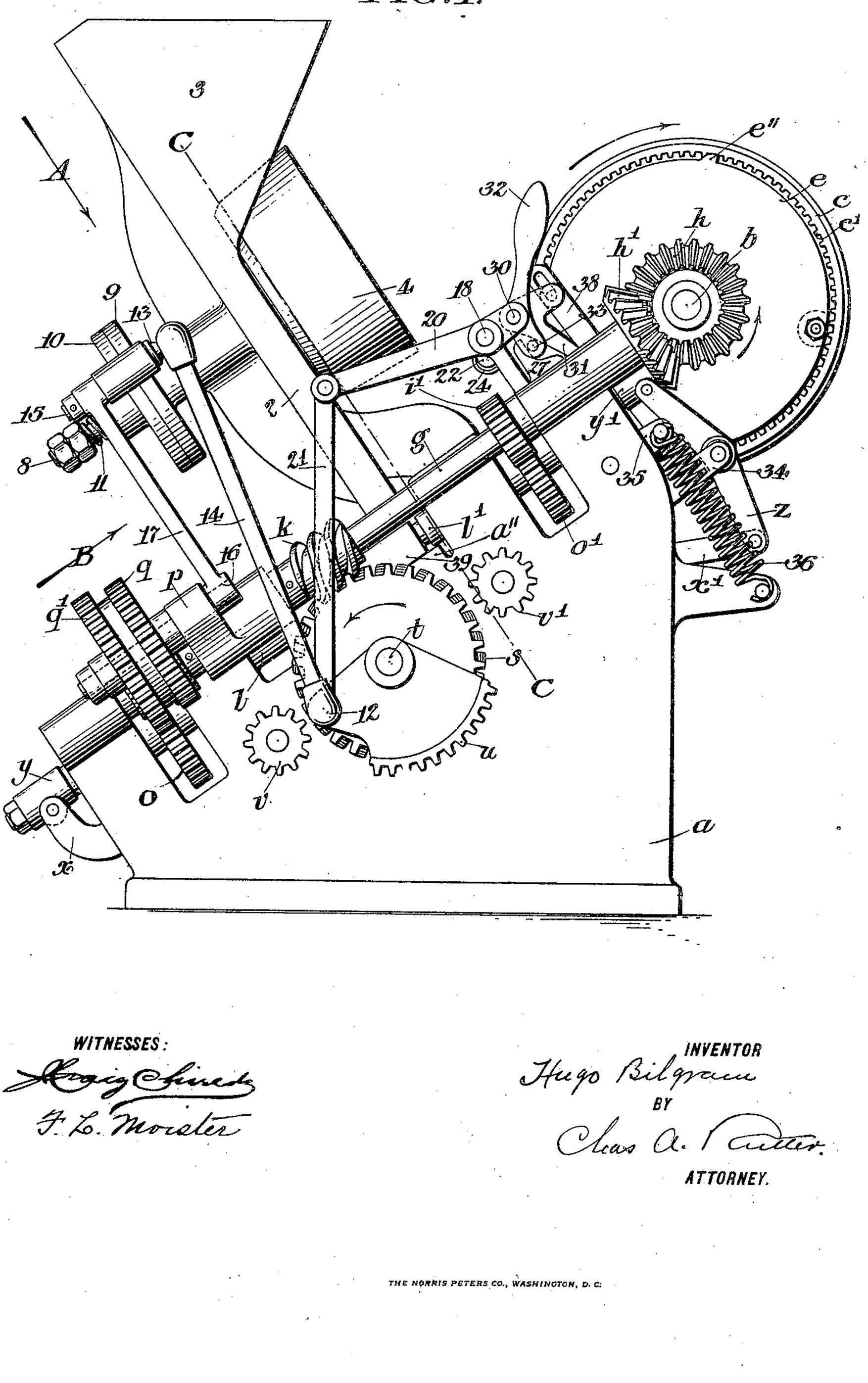
APPLICATION FILED MAR. 3, 1905.

922,248.

Patented May 18, 1909.

5 SHEETS—SHEET 1.

FIG. 1.



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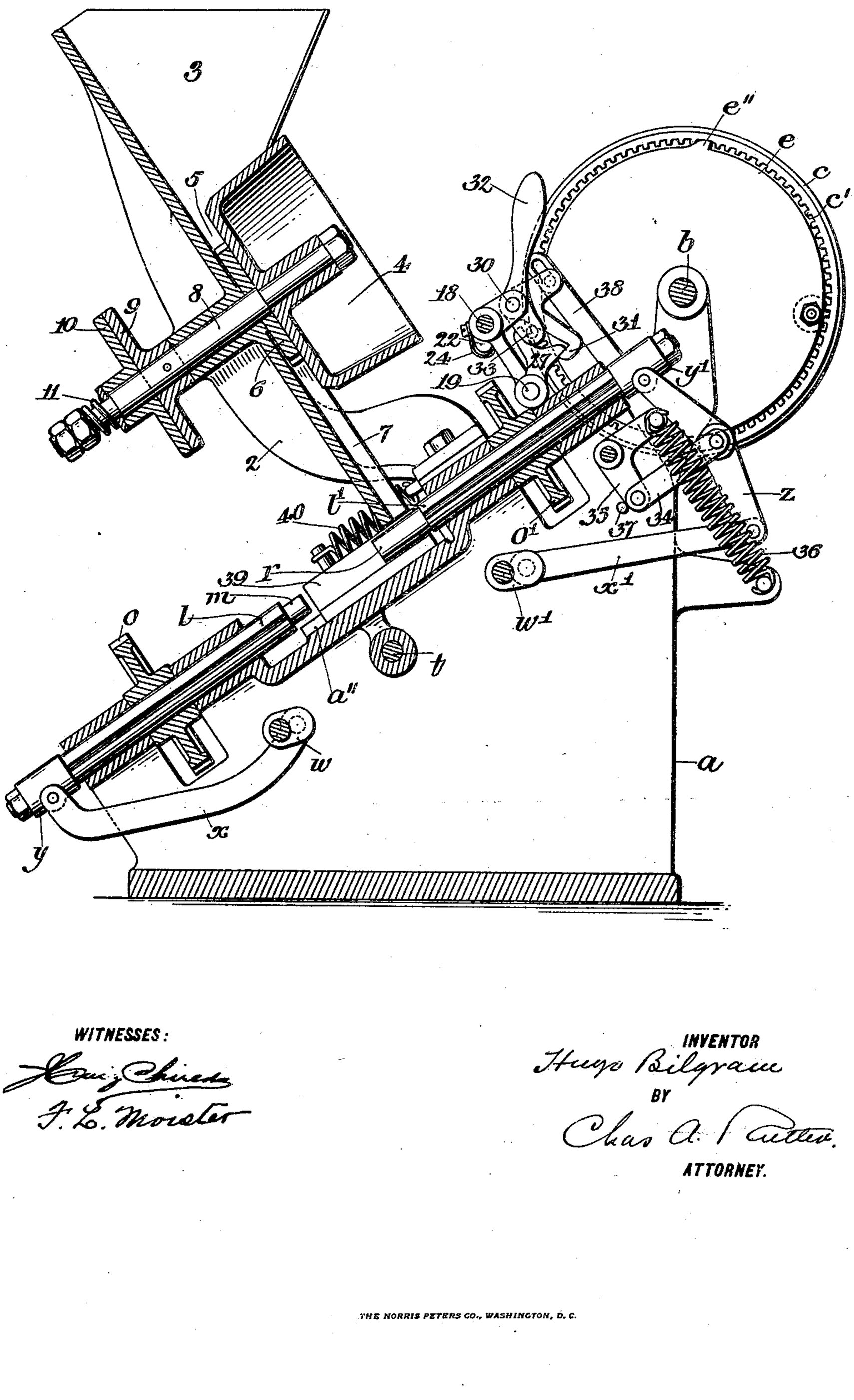
5 SHEETS—SHEET 2.

FIG. 2.



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5 SHEETS—SHEET 3.

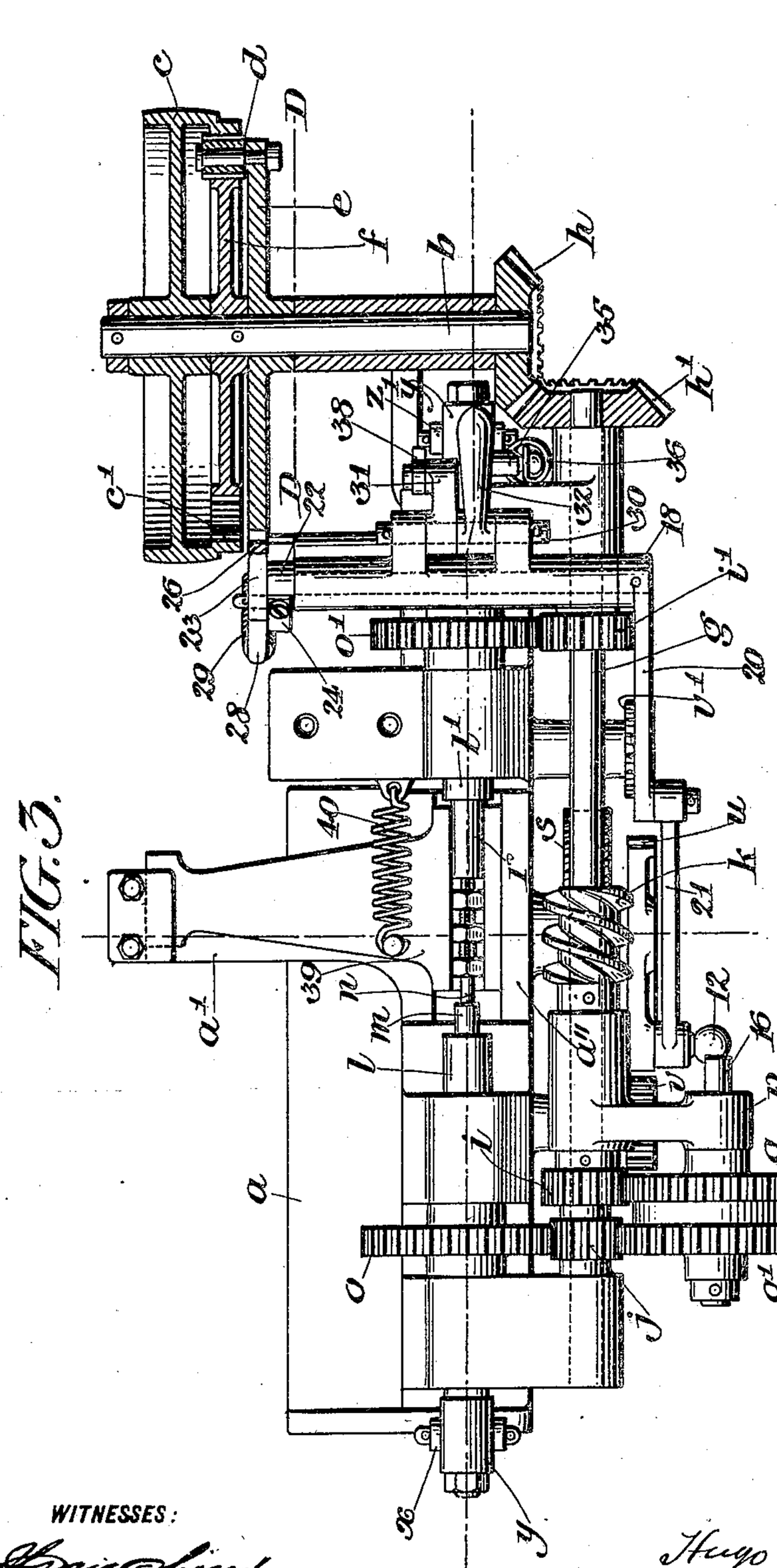

FIG. 3.

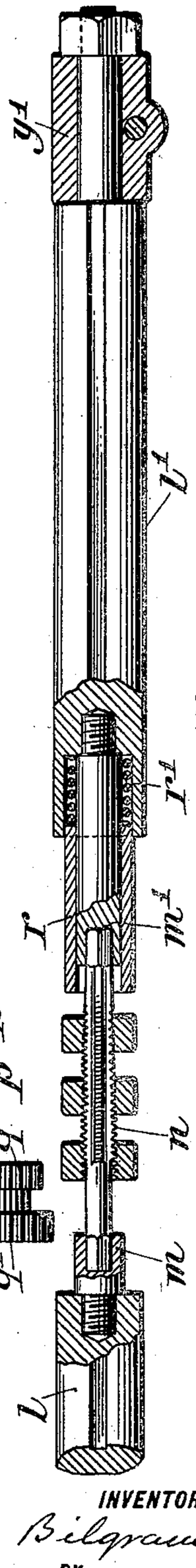

FIG. 4.

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5 SHEETS—SHEET 4.

FIG. 4.

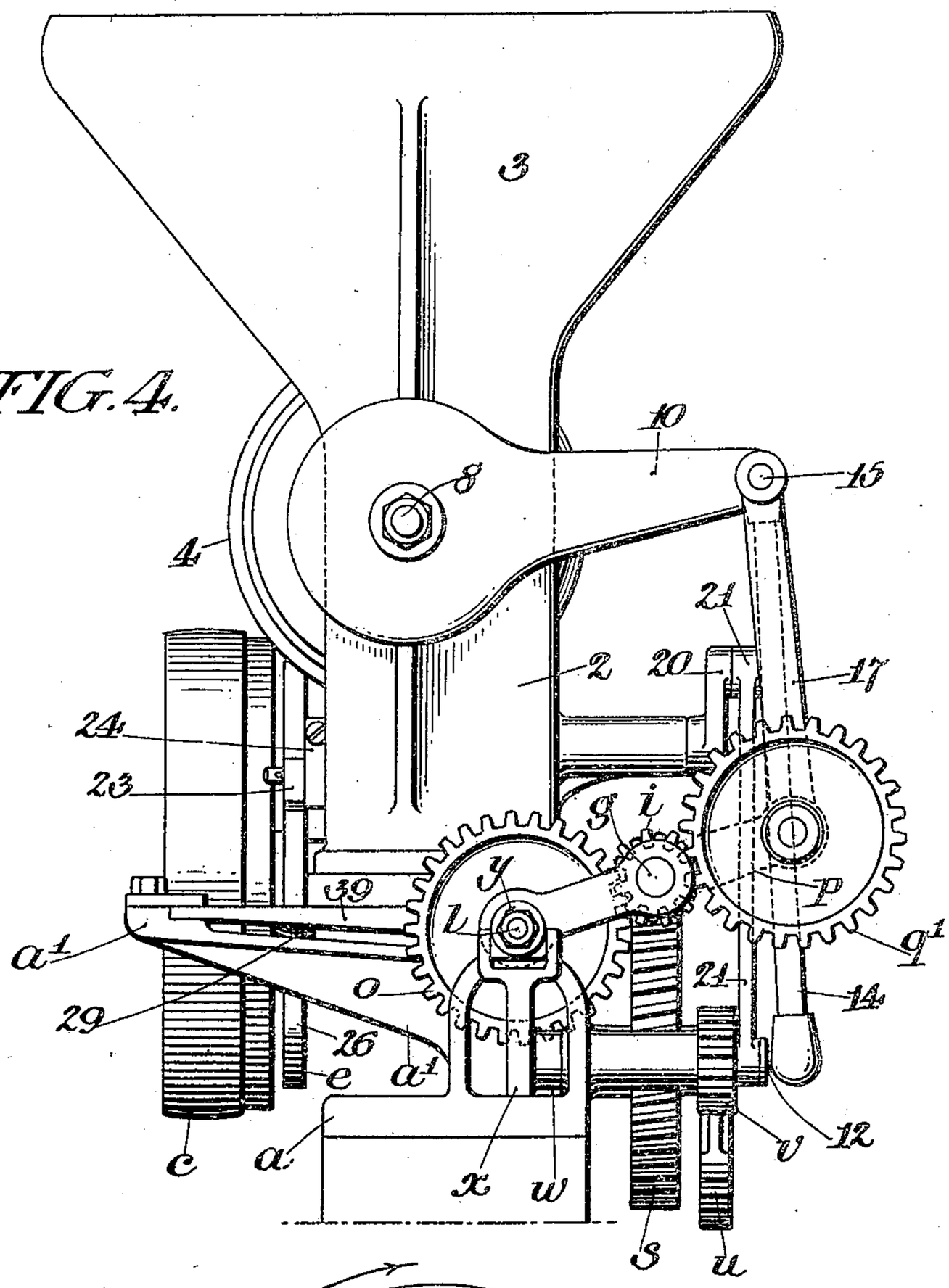
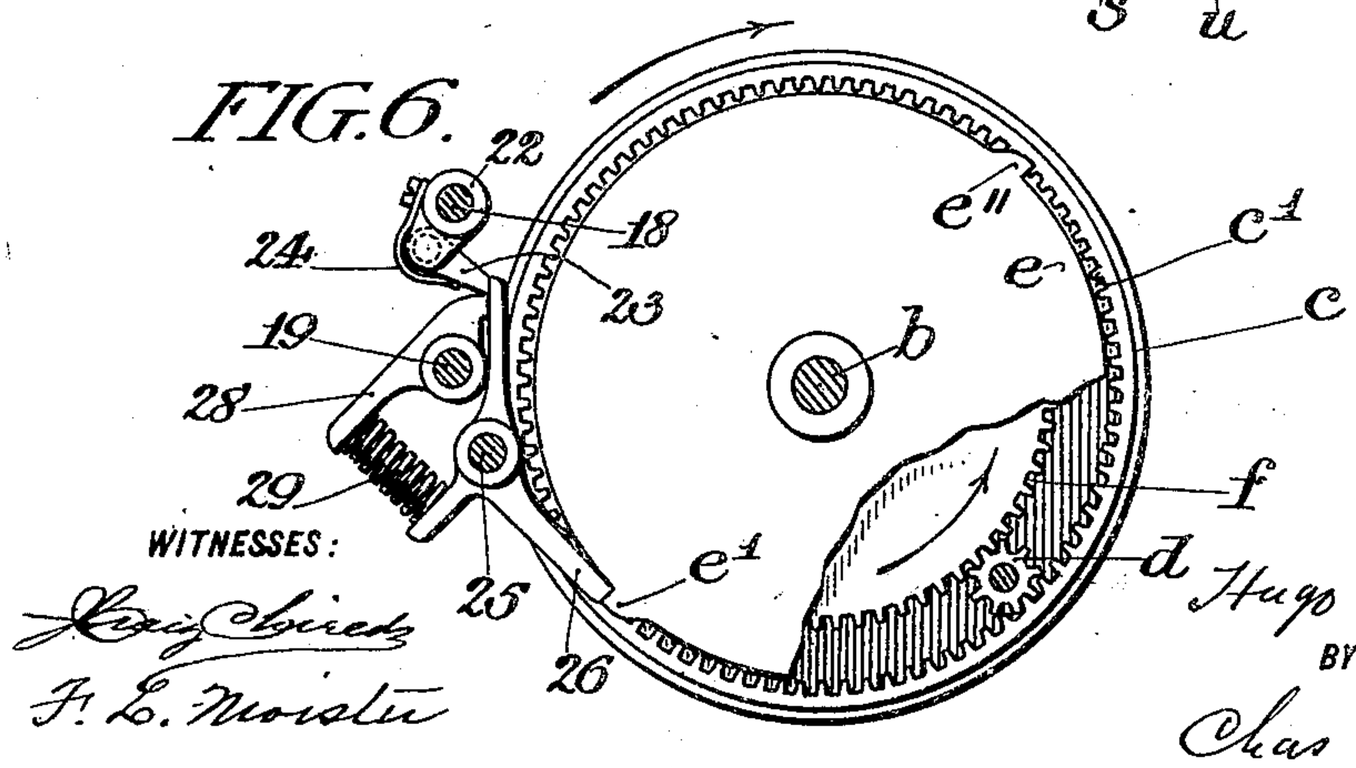


FIG. 6.



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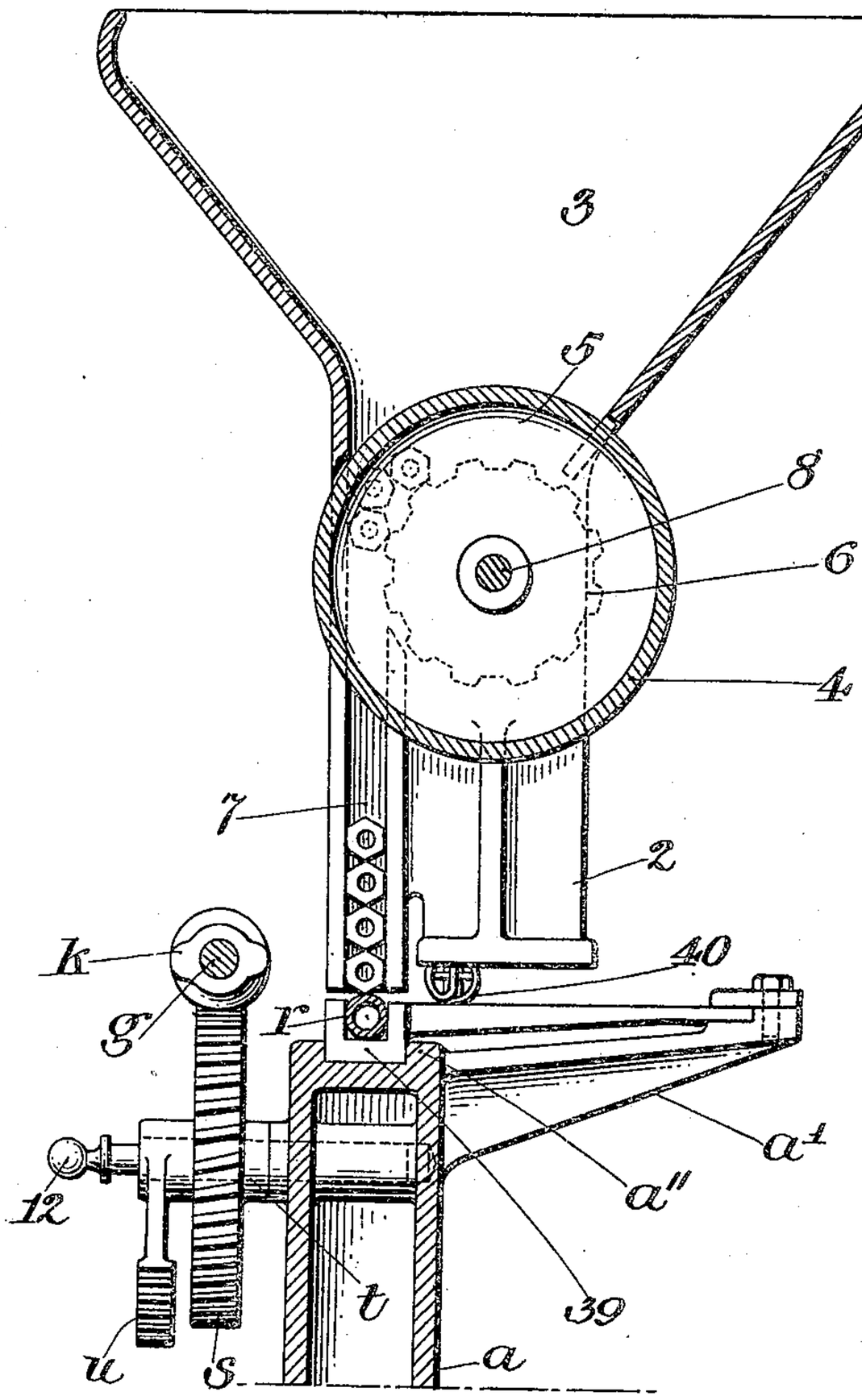
5 SHEETS—SHEET 5.

FIG. 5.



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UNITED STATES PATENT OFFICE.

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TAPPING-MACHINE.

No. 922,248. Specification of Letters Patent. Patented May 18, 1909.

Application filed March 3, 1905. Serial No. 248,192.

To all whom it may concern:

Be it known that I, HUGO BILGRAM, a citizen of the United States, and a resident of the city and county of Philadelphia, State of Pennsylvania, have invented certain new and useful Improvements in Tapping-Machines, of which the following is a specification.

My invention relates to improvements in nut tapping machines of that type in which the tap is held on two points of its length by two clutches which are alternately released for the purpose of permitting the nut blanks to pass over the tap while the said nut blanks are held by a wrench; the motive power being transmitted either to the tap by means of the said clutches, the wrench holding the nut blanks from rotation, or to the nut blanks by means of the said wrench, the tap being prevented from rotation by the said clutches.

The main object of my invention is to overcome certain mechanical difficulties that arise in the practical working of machines of this type. The principal difficulties are twofold: first those arising from the fact that both clutches are under strain while simultaneously engaged, for which reason the disengagement and re-engagement of either clutch is liable to displace the tap from its proper position; and second, those arising from the fact that the nut blanks, in the process of tapping, must be forced through the wrench and there encounter a resistance seriously interfering with the process of tapping. My method for overcoming the first of these difficulties consists in causing the strain existing between the tap and the clutches to be alternately transferred from one clutch to the other so that when the time arrives for either one of the clutches to be disengaged and re-engaged, the entire strain will be on the clutch that is to remain engaged. The second named difficulty is obviated in my invention by giving the wrench that holds the nut blanks freedom to move in the direction in which the nut blanks travel during the process of tapping, and by periodically relieving the strain between the nut blanks and the wrench in order to permit the said wrench to be returned to its initial position by a spring or its equivalent. Besides these improvements, my invention also embraces devices for automatically stopping the machine if an imperfect nut blank is accidentally fed to the machine, and also devices for facilitating the automatic feeding of nut blanks.

The accompanying drawings show the application of my improvements to a tapping machine substantially like that described in the United States Patent No. 774,357, granted to George A. Hoffman, on November 8th, 1904.

In these drawings, in which similar letters and numerals of reference indicate similar parts throughout the several views:—Figure 1 is a front view of the improved tapping machine; Fig. 2 is a practically central section, corresponding with Fig. 1, with the tap removed. Fig. 3 is a plan, partly in section, of the machine, with the hopper and the connecting rods 14 and 17 removed, viewed in the direction indicated by the arrow A, Fig. 1. Fig. 4 is an end view in the direction indicated by the arrow B, Fig. 1. Fig. 5 is a section of part of the machine, substantially on line C C, Fig. 1, viewed downward. Fig. 6 is a section on line D D, Fig. 3, viewed outward. Fig. 7 shows the two socket arbors l and l' and the tap n, drawn to a larger scale.

The body a of the machine carries the driving shaft b, on which is supported the loose belt pulley c. The rim of this pulley is provided internally with teeth, c', Figs. 1, 2, 3 and 6, which mesh with the idler pinion d, Figs. 3 and 6, that is supported by the disk e which is rotatably supported by the driving shaft b. The gear wheel f, engaging the said idler pinion d, is fast on the shaft b, adapted to transmit the motive power.

The pinion shaft g, Figs. 1 and 3, is connected with the driving shaft b by means of the miter wheels h and h' and carries the fast pinions i and i', the loose pinion j, and the worm k. Parallel with the pinion shaft g, and in line with one another, are the two socket arbors l and l', shown enlarged in Fig. 7, provided with the sockets m and m'. The tap n has both ends squared, the said ends fitting into the correspondingly square sockets m and m'. The gear wheels o and o', meshing respectively with the pinions i' and j, encompass the socket arbors l and l', to which they are united by means of feathers and grooves, and are thus adapted to transmit rotation to the said arbors while still permitting the latter to be moved longitudinally.

The idler lever p, Figs. 1, 3 and 4, is held loosely by the pinion shaft g, and carries the idlers q and q' which are concentrically fastened together but are otherwise free to rotate on their supporting stud. The idler q

engages the fast pinion i, while the idler q', which is slightly larger than the idler q, engages the loose pinion j.

The diameters of the wheels i, i', q, q', j, o and o' are so selected that the ratio of transmission from wheel i through wheels q, q' and j to wheel o is identical with the ratio of transmission from wheel i' to wheel o'.

The socket m', Fig. 7, of the upper socket shaft l', is surrounded by the sleeve r, which is rendered resilient by the spring r'.

The worm k above referred to meshes with the worm wheel s, Figs. 1, 3, 4 and 5, rotatably supported by stud t. To this worm wheel is secured the toothed sector u alternately engaging the pinions v and v', to each of which it transmits one complete revolution in passing. These pinions are secured to the shafts of the cranks w and w', Fig. 2, to which cranks are jointed the connecting rods x and x', the former being pivoted directly to the sleeve y, while the latter is connected to the sleeve y' through the intervention of the angle lever z. The sleeves y and y' are rotatably supported by the socket arbors l and l' and are adapted to transmit longitudinal motion to the said arbors.

To the frame a is bolted the hopper stand 2 carrying the hopper 3. The bottom of the hopper is formed by the round surface of the drum 4, the flat base of which has a distance from one side of the hopper slightly exceeding the thickness of the nut blanks, leaving the space 5, Figs. 2 and 5. Secured to the flat base of the said drum 4 is the serrated wheel 6. Tangential to this wheel 6 is the nut channel 7, adapted to convey the nut blanks downward to the tap.

The drum 4 is secured to the drum shaft 8, to which also the friction plate 9 is fastened. The same shaft 8 carries the loose rocker arm 10, best shown in Fig. 4, provided with a plate corresponding to the friction plate 9 and pressed against the same by the spring 11, Figs. 1 and 2.

The toothed sector u carries the ball stud 12 which is linked to the ball stud 13 of the rocker arm 10 by the ball and socket connecting rod 14. The rocker arm 10 carries the stud 15 linked to stud 16 of the idler lever p by the connecting rod 17, Figs. 1 and 4.

The body a of the machine carries the trip shaft 18 and the stop shaft 19, Figs. 2 and 6. One end of the trip shaft 18 carries the lever 20, Figs. 1, 3 and 4, which is linked to the shank of the ball stud 12 by means of the connecting rod 21. The other end of the trip shaft 18 carries the pawl lever 22, Fig. 6, to which is hinged the pawl 23 which is supported by spring 24. The stud 25, carried by the body of the machine, supports the check lever 26, the lower end of which is adapted to intercept the projections e' and e'' of the disk e.

The stop shaft 19 carries on one end the latch lever 27, Fig. 2, and on the other the stop lever 28, Fig. 6. The spring 29 is adapted to hold the check lever 26 engaged with the lugs e' or e'' of the disk e whenever the stop lever 28 is locked in its normal position, namely when the latch 31 engages the latch lever 27, as shown in Fig. 2. But when the latch 31 is disengaged from the latch lever 27 and the stop lever 28 is free to move, the said spring 29 will tend, by its reaction upon the lever 28, to disengage the check lever 26 from the lugs e', e''.

The handle pin 30, Figs. 1, 2 and 3, serves to support the latch 31 and the stop handle 32. The handle stud 33, Fig. 2, forming part of the handle 32, is adapted to engage the latch 31 when moved in one direction and the latch lever 27 when moved in the other direction.

The fulcrum of the angle lever z, Fig. 2, is carried by the link 34 which is pivoted to the bell crank 35. By the action of the spring 36 the bell crank 35 is held against the stop 37, and by means of the connecting rod 38 a connection is effected between the bell crank 35 and the latch 31. The upper end of the connecting rod 38 has an elongated hole, to permit an independent upward movement of the latch 31.

Beneath the tap n and parallel to it the body of the machine is provided with a channel a'', Fig. 5, to which the wrench 39 is fitted. The jaw of the said wrench is adapted to the size of the nuts to be tapped. The arm of this wrench is supported by the bracket a' extending from the body of the machine in such a way as to permit a movement of the wrench parallel to the axis of the tap. The spring 40 tends to hold the wrench in its uppermost or initial position.

The operation of the machine is as follows. The motive power being applied to the belt pulley c, the internal gearing c', engaging the idler pinion d, will transmit motion to the driving gear f, the disk e, carrying the said idler pinion d being held in a fixed position by the check lever 26. This method of transmitting motion is known in the arts as an "epicyclic train". The motion so imparted to the driving shaft b is transmitted to the pinion shaft g through the bevel wheels h and h'. The pinion i', carried by the shaft g and meshing with the gear wheel o', transmits rotation to the arbor l'. The pinion i, carried by the shaft g, imparts rotation to the lower arbor l through the train consisting of the idlers q and q', the loose pinion j and the gear wheel o. The rotation of the arbors l and l' is transmitted to the tap n through the sockets m and m'. The worm k, carried by shaft g, engages with and causes the worm wheel s to slowly rotate, and to impart an oscillating movement to the rocker arm 10 through the ball stud 12 and the connecting rod 14. This oscillation is

transmitted to the drum 4 and the serrated wheel 6 which form the bottom of hopper 3. The nut blanks thrown into the hopper 3 will thereby be agitated and fall into the space 5. Some may at once descend into the nut channel 7, the width of which equals the short diameter of the nuts. If a nut falls diagonally over the upper mouth of the nut channel 7, it will not enter at once, but the serrated wheel 6, as it moves, will turn the nut sufficiently to cause it to finally enter the channel. In the event of a temporary jamming of the nuts in the hopper or at the upper mouth of the nut channel, the rocker arm 10 will slip on the friction plate 9, preventing a breakage of the machine. By the ensuing reversal of the motion of the drum 4, caused by the oscillating movement of the arm 10, the jamming will then be relieved.

The toothed sector u, being secured to the worm wheel s, will in its motion encounter the pinion v' and by imparting to it the one revolution corresponding to the length of the arc, will, through connecting rod x', angle lever z and sleeve y', cause the crank w' to operate upon the arbor l', first withdrawing it from the upper end of the tap n and then returning it to its original position. When the arbor l' is in its highest position, the sleeve r is withdrawn so far that the lowest nut in the nut channel 7, which until this time has been resting upon the said sleeve r, will fall into the jaw of the wrench 39 and be pushed over the tap n by the resilient sleeve r of the returning socket arbor l'. During this time the lower socket m imparts rotation to the tap n.

As the toothed sector u proceeds in its path, it will also encounter the lower pinion v, to which will likewise be imparted one complete revolution. This is transmitted to the crank w which in turn imparts a reciprocating movement to the arbor l, through the connecting rod x and the sleeve y. By the temporary withdrawal of the socket m from the tap the lowest one of the nut blanks, of which there are several on the tap in process of being tapped, is permitted to fall off. During this time the upper socket m' imparts rotation to the tap n.

One complete cycle of these operations consists of four periods: first, that of the disengaging and reëngaging of the upper socket m', for the purpose of feeding a new nut blank to the tap; second, an intervening period throughout which both sockets remain engaged with the tap, at least as regards their longitudinal position; third, that of the disengaging and reëngaging of the lower socket m, when a finished nut is discharged from the tap; and fourth, an intervening period similar to the second.

During the process of these operations the oscillating motion of the rocker arm 10 is transmitted, through the connecting rod 17, to the idler lever p, causing the idlers q and q' to oscillate about the axis of the pinion shaft g. Because of the difference of the diameters of the wheels q and q' this oscillating movement peculiarly modifies the motion actually transmitted to the arbor l. This modification can best be understood if the machine is assumed to be at rest, the connecting rod 17 removed and the idler lever p oscillated by hand. This procedure will reveal the fact that the arbor l thereby receives a similar but less extensive oscillation or reciprocating rotation, the train of wheels as arranged operating as differential gear wheels. If now, in addition to the oscillations of the idler lever p, the pinion shaft g is set in motion, as by starting the machine, both arbors l and l' will be rotated simultaneously, and, apart from the peculiar effect now under consideration, at an equal speed, but in relation to the upper arbor l', the lower arbor l will partake of the corresponding oscillations before observed. While the upper arbor is moving uniformly, the lower arbor will alternately run ahead and lag behind the motion of the upper arbor l'. The motion of the lower arbor l will be alternately accelerated and retarded, in unison with the oscillations transmitted to the idler lever p, although, in the long run, it will make the same number of revolutions as the arbor l'. The effect of this peculiar movement is as follows: While the lower arbor l runs ahead of the upper one, the socket m will assume the entire strain necessary to rotate the tap n, relieving the upper socket m'. On the other hand, when the lower arbor l lags behind, the upper socket m' is made to take the strain, relieving the lower socket m from duty. For the purpose of preventing a binding of one socket against the other, the square holes of the sockets m and m' are formed to allow the square ends of the tap n a little play. By again replacing the connecting rod 17, previously assumed as removed, the oscillations of the idler lever p are rendered automatic, and they are so timed in the machine that while one of the sockets is being withdrawn from and returned to the tap, the entire strain is borne by the other socket, the transfer of strain taking place during the second and fourth periods above referred to. The danger of a longitudinal displacement of the tap is thereby effectively met.

While being tapped, the nuts are held from rotation by the wrench 39. The strain of tapping causes them to firmly bind in the jaw of the said wrench which being free to move longitudinally,—barring the slight tension of the spring 40,—will follow downward with the nuts at a rate governed by the pitch of the tap. At intervals the wrench is again restored to its upper or initial position by the following means.

Through the connecting rod 21 the stud 12 transmits an oscillating movement to the lever 20, which movement is transmitted, through the trip shaft 18, to the pawl lever 22 and pawl 23, Fig. 6. The latter, in its oscillations, engages the upper end of the check lever 26, causing the lower end of the same to release its hold on the lug e' of the disk e. At the moment of this release, the pawl 23, being freed of its load, will be thrown upward by the tension of the spring 24 and will permit the check lever 26 to resume its original position, by virtue of the spring 29. But the lug e' of the disk e having once been released, the disk e will begin to rotate, and since the idler pinion d is no longer held stationary, the motion of the belt pulley can no longer be transmitted to the driving gear f. The machine will come to a standstill and the strain of the nuts in the jaw of the wrench is released. In the absence of this strain the tension of the spring 40, Figs. 2 and 3, will suffice to draw the wrench to its highest or initial position. The stoppage of the machine will however last only for an instant, namely until the disk e has made one half revolution, when the lug e'' will be intercepted by the lower end of the check lever 26. The disk e will then come to a standstill and the motion of the belt pulley c will again be transmitted to the driving shaft b, as before described.

If it should happen that a defective nut blank is fed to the machine, the upper arbor l', in its descent, will be unable to push it upon the tap and will accordingly encounter a resistance that will re-act upon the fulcrum of the lever z. Through the intervention of the link 34, Fig. 2, the bell crank 35 will thereby be moved against the tension of the spring 36, and by means of the connecting rod 38 the latch 31 will be raised. This will release the latch lever 27, and the spring 29, Fig. 6, in re-acting upon the stop lever 28, will cause a persistent disengagement of the check lever 26 from the lug e' of the disk e. This disk being then free to rotate, the belt pulley will no longer be able to transmit motion to the driving gear f, and the machine will come to a persistent standstill, the pulley c running loosely on the driving shaft b. After the removal of the defective nut the machine can again be started by pushing the handle 32, Fig. 2, toward the right, when the handle stud 33, engaging the latch lever 27, will push the latter into its normal position in which it will then be held by the latch 31.

For stopping the machine, the stop handle 32 is moved by hand toward the left, when the handle stud 33 will engage the latch 31 and by disengaging the latch lever 27 will cause a stoppage of the machine as before described.

The improvements described are applicable to all forms of nut tapping machines coming within the range of the type described at the beginning of this specification, whether the tap is alternately clutched by sockets or by other forms of clutches, and whether the tap or the nut is rotated. The methods of accomplishing the end will in all cases be substantially the same.

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

1. In a nut tapping machine, in combination, a tap, two clutches, engaging said tap on two points of its length, means for alternately disengaging and reëngaging said clutches and said tap for the purpose of permitting the passage of the nuts in the process of tapping, and mechanism inserted between the source of power and one of the said clutches adapted to transmit to the said clutch a motion which, in relation to the other clutch, is one of reciprocating rotation.

2. In a nut tapping machine, in combination, a tap, two clutches engaging said tap on two points of its length, means for alternately disengaging and reëngaging said clutches and said tap for the purpose of permitting the passage of the nuts in the process of tapping, means for transmitting rotation from a driving shaft to one of said clutches, said means consisting of a pinion secured to said driving shaft, an idler wheel meshing with said pinion, a second idler wheel concentrically fastened to the first idler wheel and having a slightly differing pitch diameter, a pinion meshing with the second idler wheel and rotatably supported by the said driving shaft, a gear wheel meshing with the said loose pinion and adapted to transmit rotation to the said clutch, means for imparting an oscillating motion about the driving shaft to the fulcrum of the said idler wheels, a pinion secured to the said driving shaft and meshing with a gear wheel adapted to transmit rotation to the other clutch, and said gear wheel.

3. In a nut tapping machine, in combination, a tap, two clutches engaging said tap at two points of its length, means for alternately disengaging and reëngaging said clutches and said tap for the purpose of permitting the passage of the nuts in the process of tapping, a slidably mounted wrench adapted to hold the nuts while being tapped, means for temporarily disengaging the machine from the source of power for the purpose of relieving the strain between the said nuts and the said wrench, and means for returning the said wrench to its initial position during the brief interval of rest.

4. In a nut tapping machine, in combination, a tap, two clutches engaging said tap on two points of its length, means for alternately disengaging and reëngaging said clutches and said tap for the purpose of per-

mitting the passage of the nuts in the process of tapping, a slidably mounted wrench adapted to hold the nuts while being tapped, means for temporarily disengaging the machine from the source of power for the purpose of relieving the strain between the said nuts and the wrench, and a spring adapted to return said wrench to its initial position during the brief interval of rest.

5. In a nut tapping machine, in combination, a tap, two clutches engaging said tap on two points of its length, means for alternately disengaging and reëngaging said clutches and said tap for the purpose of permitting the passage of the nuts in the process of tapping, a slidably mounted wrench to hold the nuts while being tapped, an epicyclic train interposed between the source of power and the driving shaft of the machine, means for holding the epicyclic train in a fixed position, means for intermittently and temporarily releasing this hold for the purpose of temporarily disconnecting the machine from the source of power, and means for returning said wrench to its initial position during the brief interval of rest.

6. In a tapping machine, in combination, a tap, two clutches engaging said tap on two points of its length, means for alternately disengaging and reëngaging said clutches and said tap for the purpose of permitting the passage of the nuts in the process of tapping, a two armed lever supported upon a movable fulcrum interposed between one of the said clutches and the source of the disengaging and reëngaging motion to be transmitted to said clutch, means interposed between the driving power and the clutches admitting of disconnection, and means connecting said fulcrum and said disconnectible means and adapted for operation by the movable fulcrum in the event of a forced movement of said fulcrum.

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