No. 719,569. PATENTED FEB. 3, 1903.

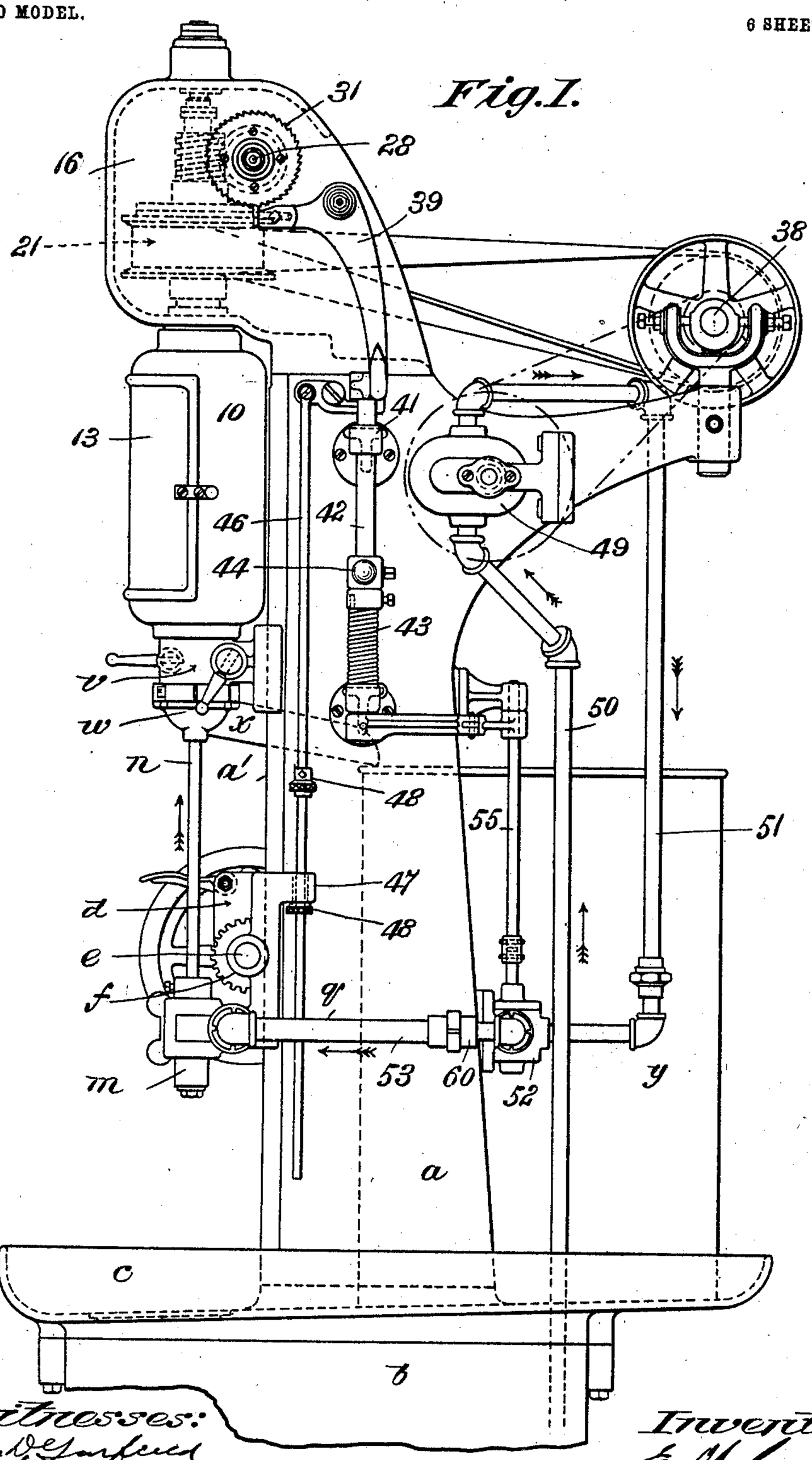
E. M. COUCH.

DRILLING MACHINE.

APPLICATION FILED AUG. 1, 1902.

NO MODEL. 6 SHEETS—SHEET 1.

Fig. 1.



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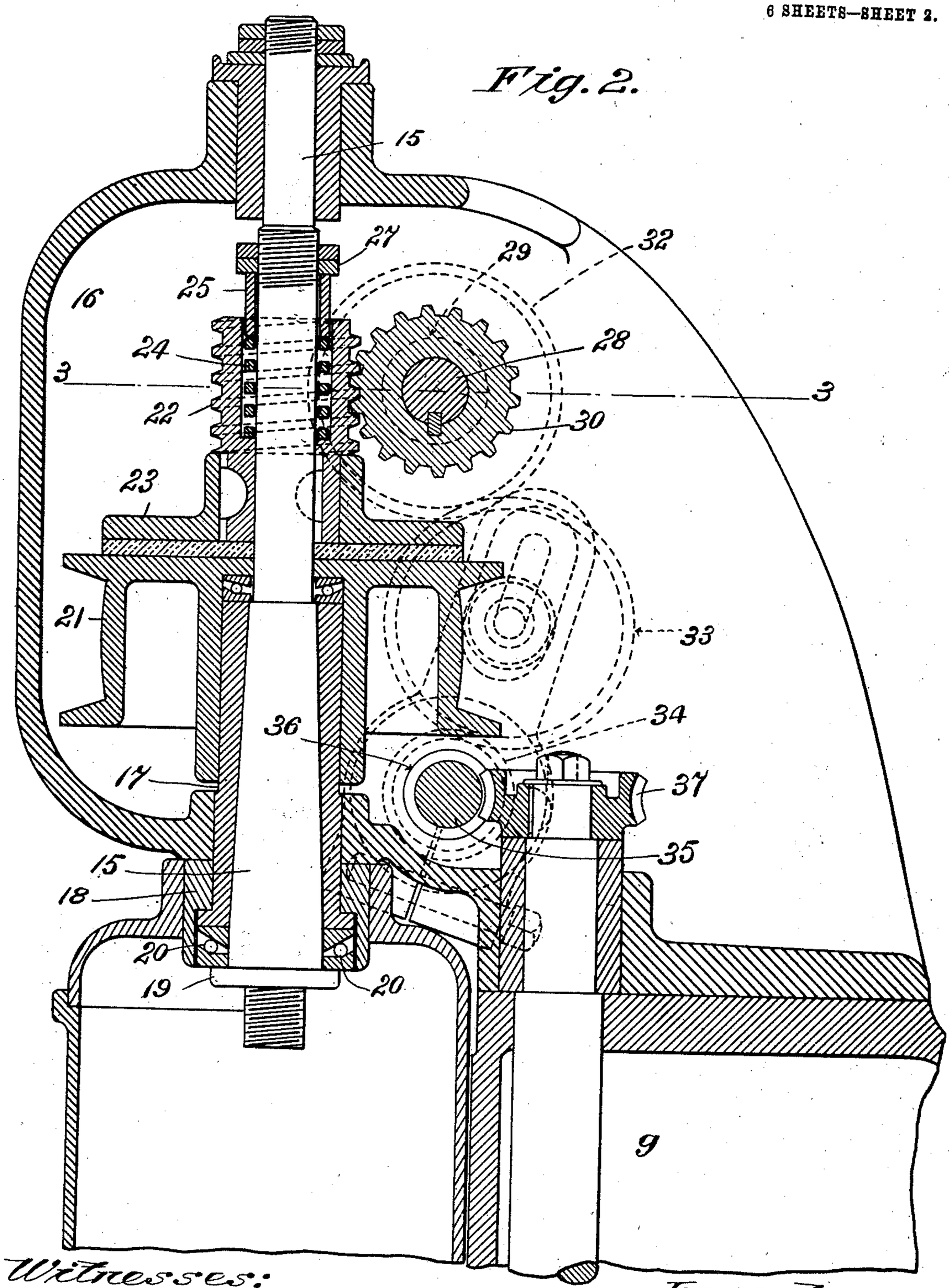
NO MODEL. 6 SHEETS—SHEET 2.

Fig. 2.



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NO MODEL. 6 SHEETS—SHEET 3.

Fig. 3.

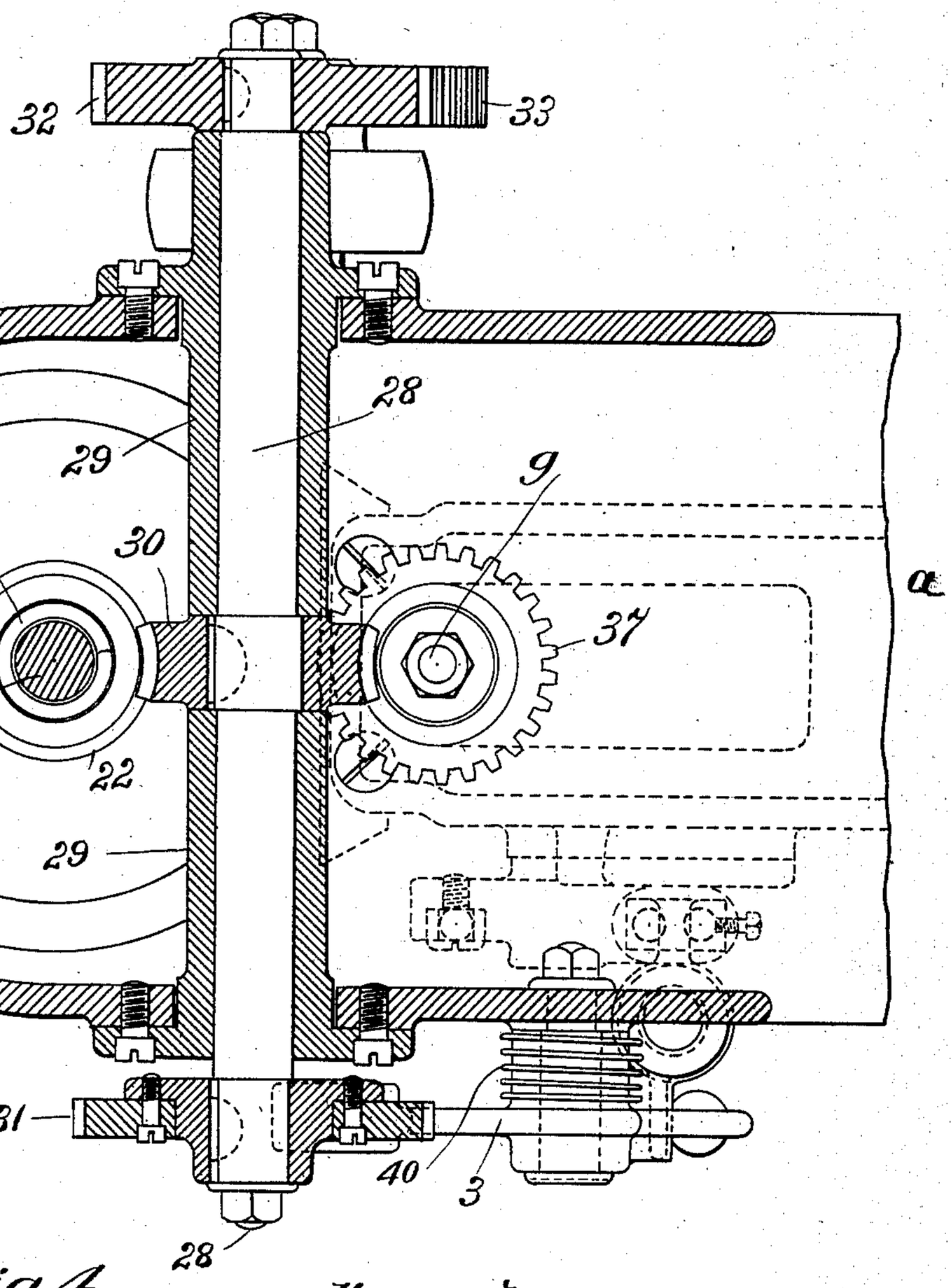
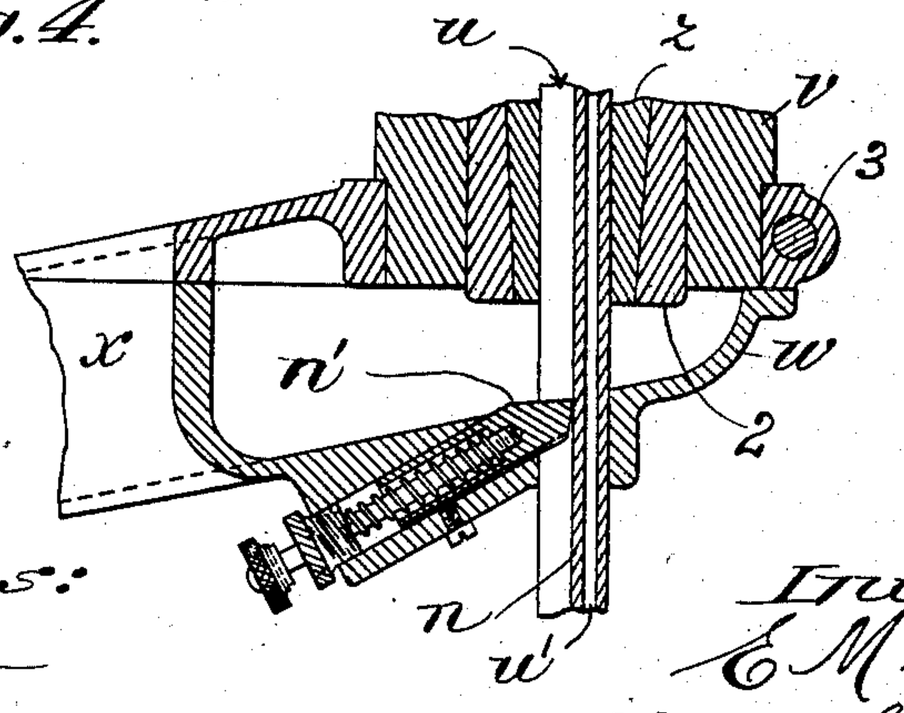


Fig. 4.



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NO MODEL. 6 SHEETS—SHEET 4.

Fig. 5.

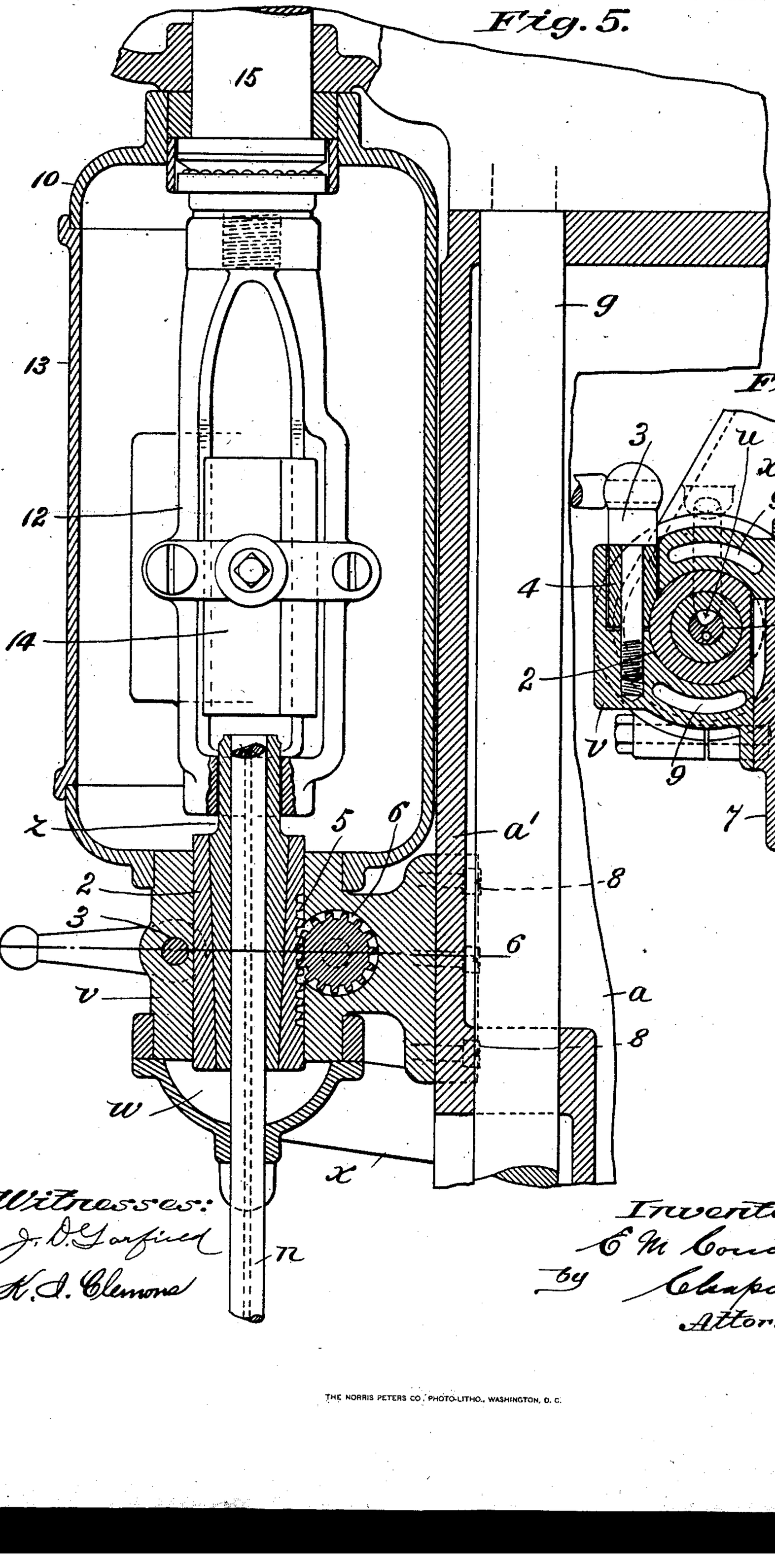

Fig. 6.

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NO MODEL. 6 SHEETS—SHEET 5.

Fig. 7.

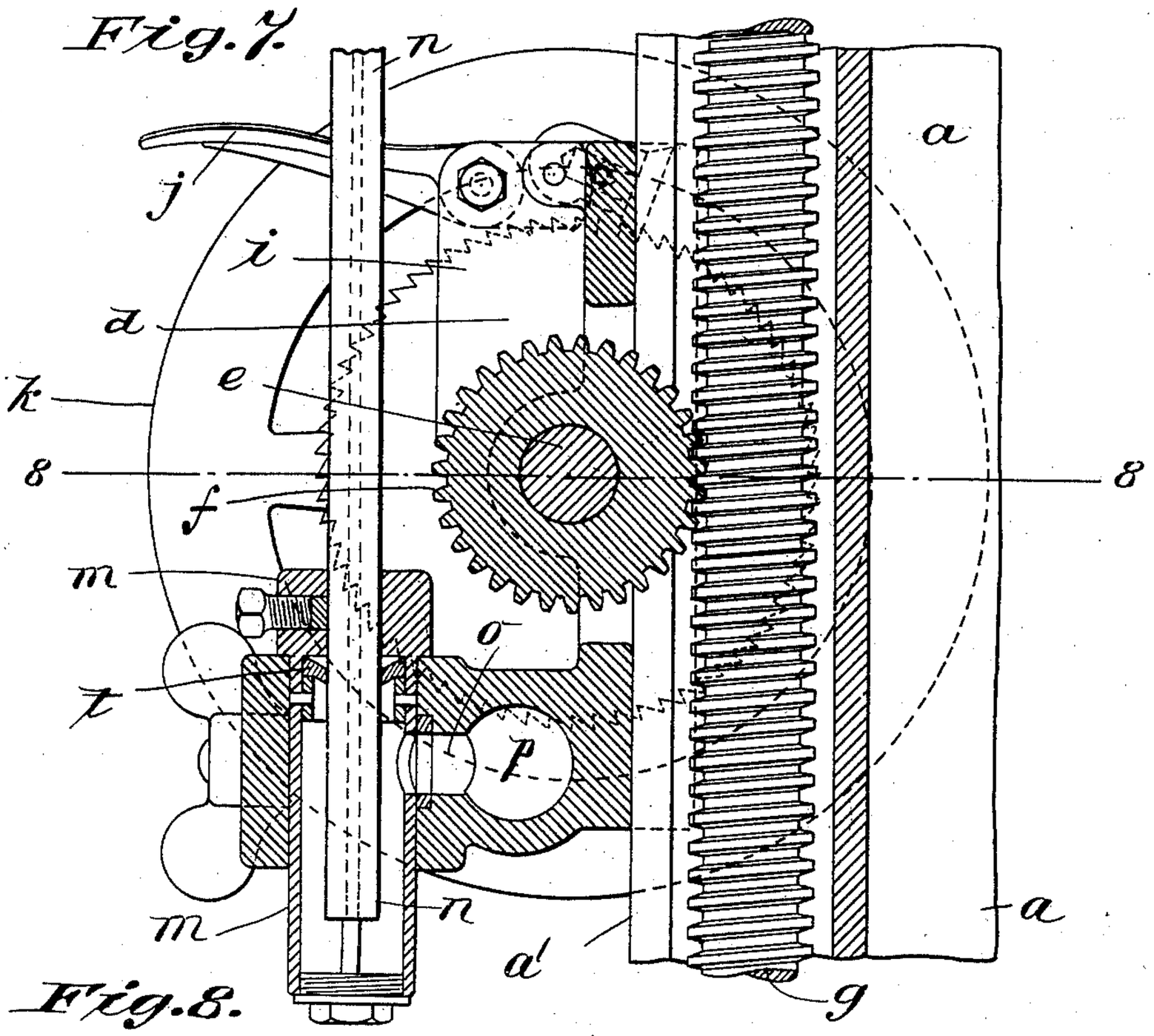
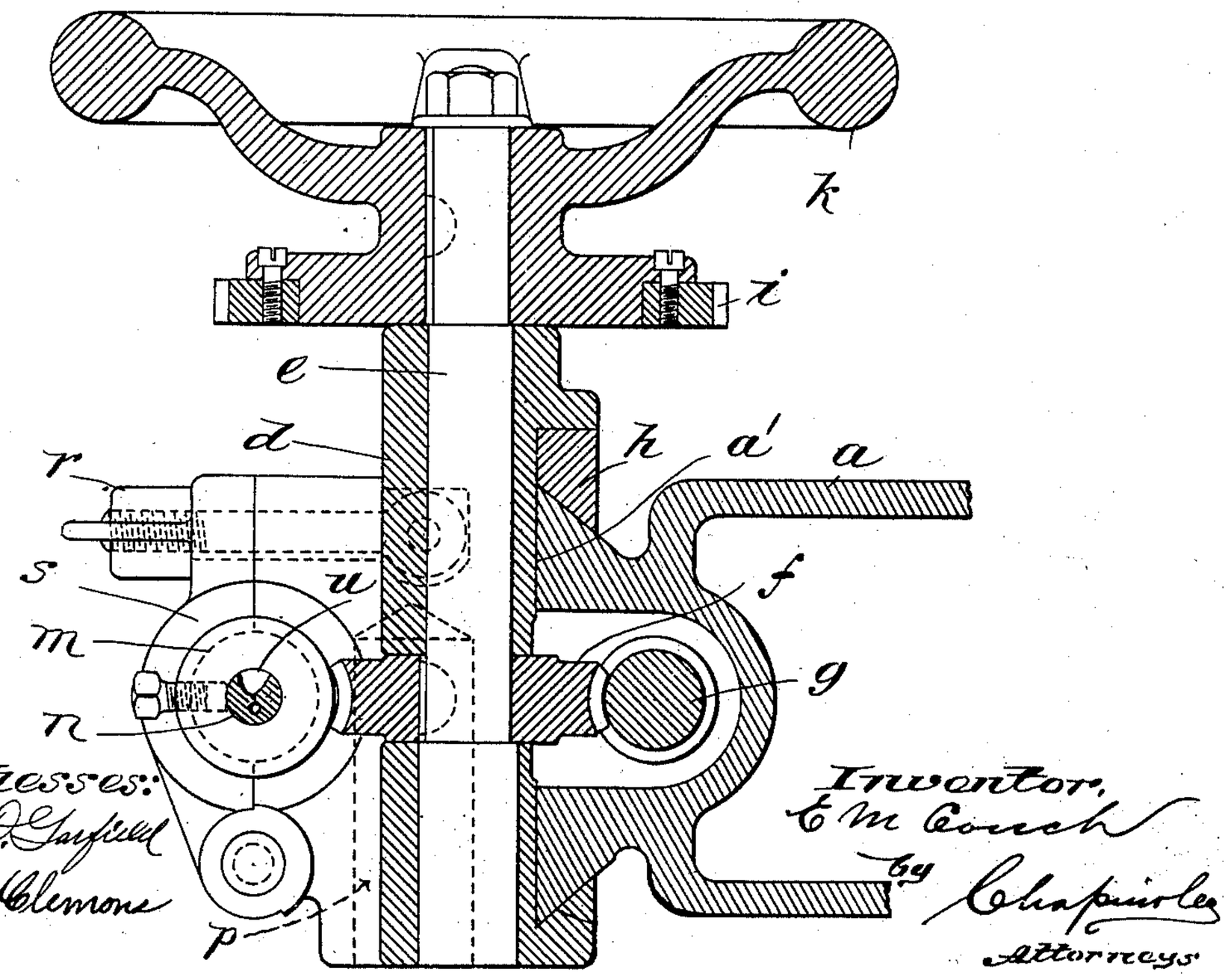


Fig. 8.



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NO MODEL. 6 SHEETS—SHEET 6.

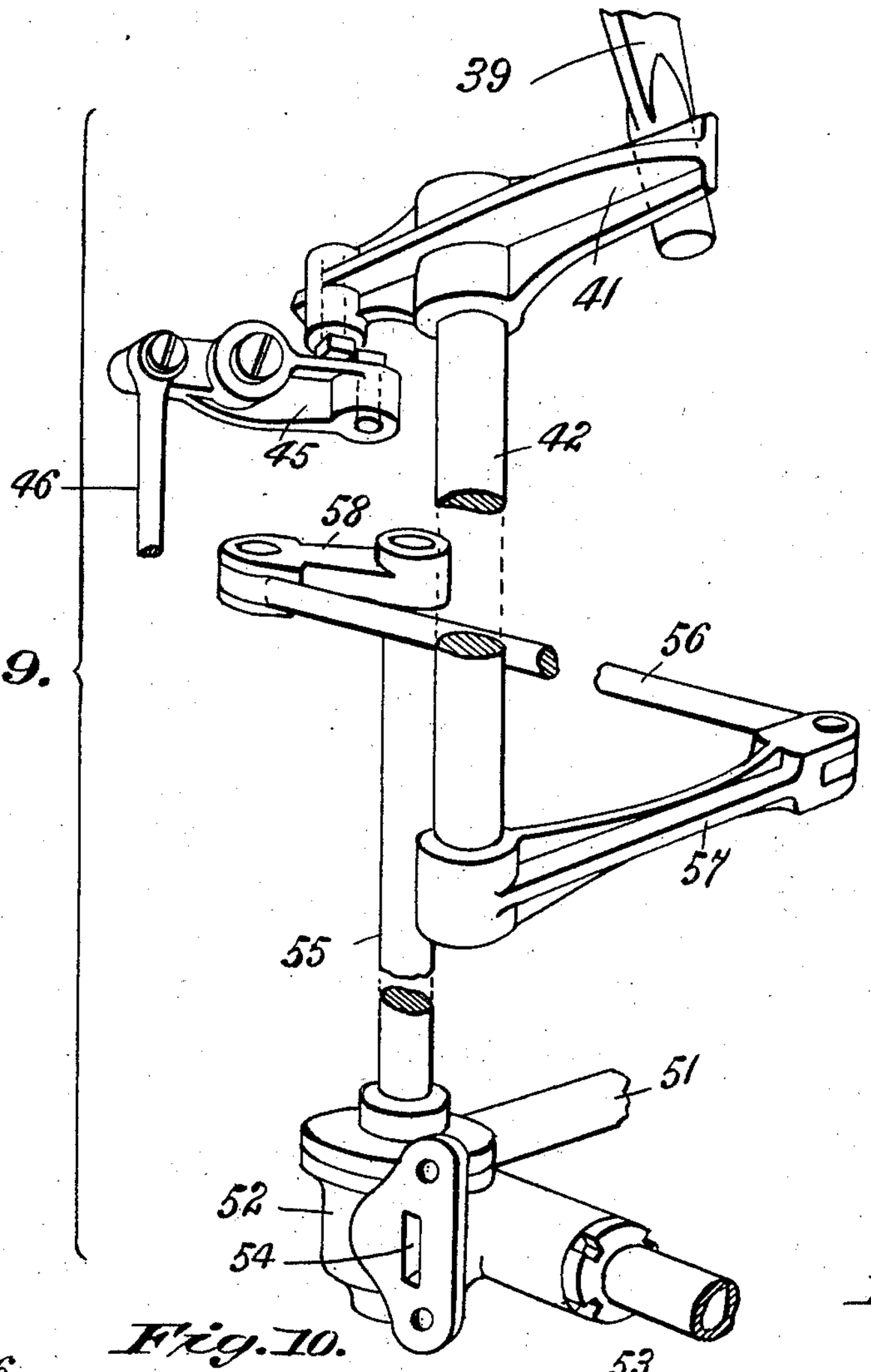
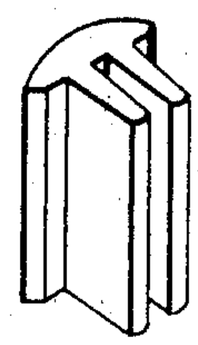
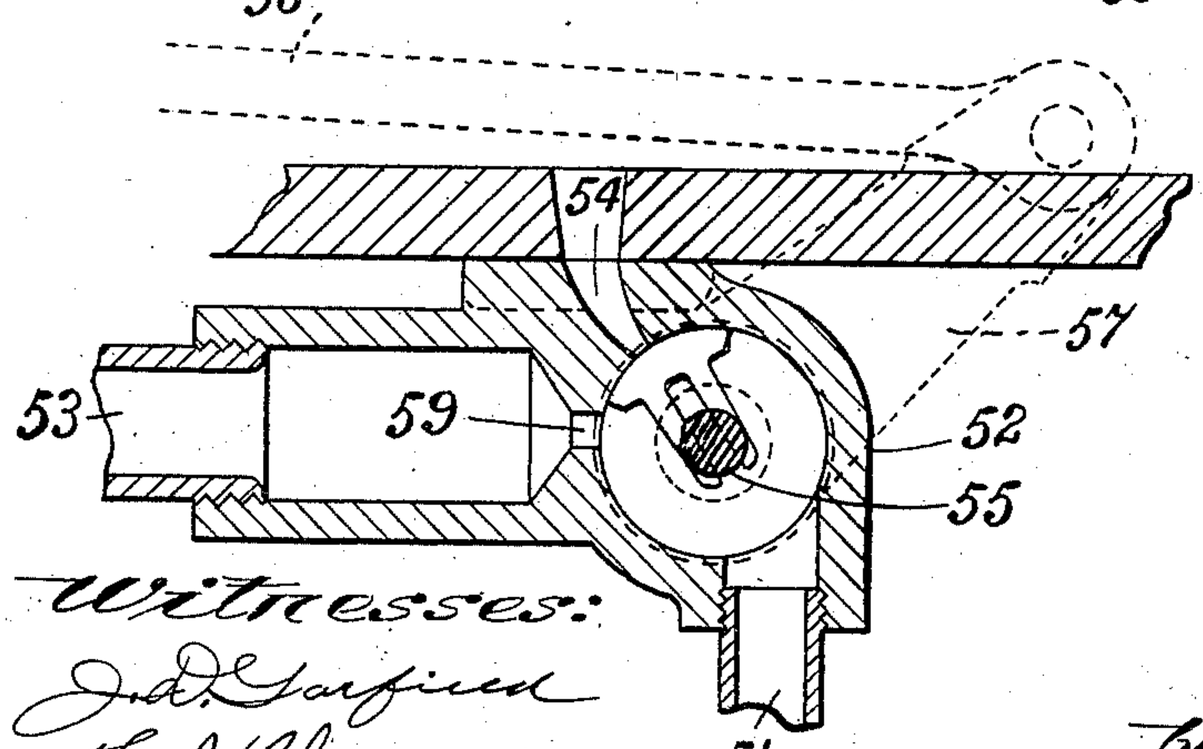


Fig. 9.

Fig. 10.

Fig. 11.





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UNITED STATES PATENT OFFICE.

ELBERT M. COUCH, OF HARTFORD, CONNECTICUT, ASSIGNOR TO WHITNEY MANUFACTURING COMPANY, OF HARTFORD, CONNECTICUT, A CORPORATION OF CONNECTICUT.

DRILLING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 719,569, dated February 3, 1903.

Application filed August 1, 1902. Serial No. 117,922. (No model.)

To all whom it may concern:

Be it known that I, ELBERT M. COUCH, a citizen of the United States of America, residing at Hartford, in the county of Hartford and State of Connecticut, have invented new and useful Improvements in Drilling-Machines, of which the following is a specification.

This invention relates to drilling-machines, and has for its object the provision of a machine whereby great accuracy of bore is obtained, both as to alinement, diameter, and depth, a further object being to provide devices of improved construction whereby a drill may be lubricated by means of oil forced to the point of the drill through a channel in the latter; and a still further object lies in the construction and combination, with other improvements, of a device for stopping the feed movement of the drill at any desired point, whereby a hole may be bored to its exact predetermined depth.

Other improvements in the construction incidental to the above features also form part of this invention, all of which will be fully described farther on and properly summarized in the claims.

In the drawings forming part of this application, Figure 1 is a side elevation of a drilling-machine embodying my invention. Fig. 2 is a vertical sectional elevation, on a larger scale than Fig. 1, showing the driving-head of the machine. Fig. 3 is a horizontal sectional view on line 3 3, Fig. 2. Fig. 4 is a sectional elevation of a portion of a drill, a portion of the drill-guide, and oil-conduit. Fig. 5 is a sectional elevation, taken on same plane as Fig. 2, showing the construction of the work-holding fixture, its casing, the drill-guide, and a portion of the drill. Fig. 6 is a horizontal sectional view in the plane of the line 6 6, Fig. 5. Fig. 7 is a sectional elevation of devices for feeding the drill against the work and for adjusting the drill. Fig. 8 is a horizontal sectional view of the mechanism shown in Fig. 7, said section being in the plane of line 8 8. Fig. 9 is a perspective view of devices for arresting the feed movement of the drill at a predetermined point and including also a three-way valve actuated by said devices. Fig. 10 is a horizontal sectional view of the three-way valve shown in Fig. 9 in its position on the frame of the machine. Fig. 11 is a perspective view of the rotatable wing in said three-way valve.

Referring to the drawings, *a* indicates the standard of the machine, the broadened base (a portion of which shows in Fig. 1) being hollow and serving as an oil-reservoir. This part is indicated by *b*. Surrounding the upper part of this base *b* of the standard is an oil basin or table *c*, having an upturned flange for catching the oil which drains through a strainer into the reservoir *b*, as usual in machines of this type.

On the front side of the frame or standard *a* there is provided a slideway *a'*, on which certain parts of the machine may have a vertically-sliding movement, as will more fully appear farther on.

In this machine the drill is stationary and is fed against the work, which revolves, and the drill is mounted upon a carriage, which is indicated by *d* and is shown in Fig. 1 in side elevation and in Figs. 7 and 8 in vertical and horizontal sections. On this drill-carriage is a shaft *e*, on which there is keyed a worm-gear *f*, which engages with a feed-screw *g*, which is located in a channel in the standard, which opens through the front face of the latter, as shown in Figs. 7 and 8. The carriage *d* has a vertically-sliding movement on the slideway *a'*. This carriage is actuated by the feed-screw *g* acting on the worm-gear *f*, the latter during the feeding movement being held stationary and having the same functions as a nut, through which the shaft *e* might pass. This shaft *e*, on which the worm-gear *f* is mounted, is prevented from rotating by the engagement with the teeth of a ratchet *i*, keyed on the shaft of a pawl-lever *j*, (shown in Fig. 7,) which is mounted on a portion of the carriage *d* and is adapted to swing thereon into and out of engagement with the teeth of said ratchet *i*. During the continuance of this engagement the shaft *e* will be non-rotatable, and the worm-gear *f* will serve as a nut, whereby the carriage *d* may be elevated by the rotation of the feed-screw *g*.

When it is desired to effect a rapid adjust-

ment of the drill vertically, the pawl-lever *j* may be operated to release the ratchet *i*, and then by turning the hand-wheel *k*, fixed on the shaft *e*, the gear *f* may be rotated to move the carriage *d* rapidly up or down, the feed-screw in this case serving as a rack, and this adjustment may be made whether the feed-screw *g* be rotating or not.

On the lower portion of the carriage *d* an arm projects outwardly therefrom, in which there is clamped a hollow drill-support *m*, the body of which constitutes an oil-reservoir for the drill, (which is shown in Figs. 1, 7, and 8,) on the upper end of which is a head to receive a set-screw for locking the drill in said support, the drill being indicated by *n*. The bottom of said support *m* is closed by a screw-plug, thus permitting the drill to be drawn down through the support to remove it as desired. Through the side of the support there is an oil-channel *o*, leading into another channel *p*, lying at right angles thereto, which latter is in direct communication with the oil-supply pipe *q*, the description of which will be taken up later on. The drill-support *m* is removably supported in the carriage *d* in a sort of compression-chuck, and it may be readily removed therefrom by unscrewing the nut *r* and swinging the clamping-jaw *s* outward. Just under the head of the drill-support, through which the set-screw passes, as shown in Fig. 7, there is a packing-washer *t*, which prevents the oil in the body of the drill-support from escaping upward around the drill or through the channel *u* in the side thereof, the washer having a tongue thereon for closing said channel. The tongue of this washer *t* does not show clearly in the drawings; but it is formed by cutting a central aperture through the said washer which conforms to the cross-sectional view of the drill as shown in Fig. 8.

The drill is of that well-known type which is provided with an oil-duct *u'*, extending from the shank to a point near the cutting-lip of the drill, through which oil or other lubricant may be forced to supply the point of the drill with the lubrication necessary in certain classes of work.

Mounted upon the slideway *a'* of the frame is the vertically-movable drill-rest *v*, upon the lower end of which there is secured a semi-spherical oil-receptacle *w*, from which a spout *x* may conduct oil and chips into a can *y* or other suitable receptacle placed alongside of the standard on the basin *c*, as shown in Fig. 1. Within this can is the usual strainer for catching chips, the oil flowing out of an opening in the lower part of the can into the flanged basin *c* and from thence into the reservoir, as described. The drill *n* passes through said receptacle *w* centrally thereof and up through a tapered drill-guide *z*, which fits into a similarly-tapered sleeve 2, which is locked against rotation in the drill-rest *v* by a screw 3, whose inner end is threaded into a hole in the drill-rest and which serves to force a sliding block 4 against the side of the sleeve 2, as shown in Fig. 6, whereby the said sleeve is held firmly in whatever position it may be adjusted to in the drill-rest. At that point where the drill passes through the receptacle *w* the channel *u* in the drill *n* is closed by a plunger *n'*, the nose of which is spring-pressed into said channel. (See Fig. 4.) This plunger may be made of any suitable material which may be forced into the channel to make a substantially oil-tight joint between the latter and the wall of said receptacle.

Means are provided for moving the sleeve 2 and the tapered drill-rest carried thereby endwise, which means consist in a rack 5, cut on the rear side of said sleeve and engaging gear-teeth 6, cut on the inner end of a short rotatable shaft lying transversely to the axis of the drill in the drill-rest, the outer end 7 of which projects beyond the side of the drill-rest to receive a handle or some form of wrench, whereby it may be rotated. The object of this adjustment is to permit the upper end of the drill-guide to be moved up into close proximity to the work, whereby the point of the drill may be steadied when it first comes in contact with the work, as in this class of machines it is not customary nor always practicable to provide a center point for the guidance of the drill. Means are provided for securing the drill-rest *v* in any desired position on the slideway *a'*—as, for example, the screws 8, (indicated in dotted lines in Fig. 5,) which are adapted to screw a gib up against the back side of the slideway to lock the drill-rest in place. The latter requires no powerful means for holding it in position, as no strain is brought thereon when the drill is in operation, all of the thrust of the feed being taken up on the drill-carriage.

Extending vertically through the drill-rest *v* are one or more openings 9, constituting passages for the oil and chips, whereby they may be carried away from the casing 10, the oil flowing into the receptacle *w*, thence out through the spout *x*. The casing 10 has no function except to inclose the rotatable work-holding fixture, which is indicated by 12 and which may vary in form according to the dimensions of the work. Said casing is provided with a door 13, whereby access may be had to the fixture 12 for securing a piece of work therein.

The fixture and the work shown in the drawings may be considered as purely conventional, the work being indicated by 14. The lower end of the fixture, in all cases where it is practicable, should be adapted to receive the upper end of the drill-guide *z*, the upper end of this work-holding fixture being screwed onto the spindle 15, which is shown in Fig. 2 and a portion thereof in Fig. 5. This spindle rotates the work, the work-holding fixture being screwed up against a shoulder on the lower end thereof solidly. This spindle is rotatably supported on the standard in a hollow head 16, (see Fig. 2,) which is open at its

rear side, the upper end of the spindle being threaded and provided with a suitable nut whereby it may be supported in axial alinement with the drill and whereby vertical adjustments thereof may be effected. At the lower end of the spindle there is mounted thereon a sleeve 17, the lower end of which is flanged and bears against a shoulder formed on the inner surface of a ring 18, which bears against the under side of the head 16. Between a shoulder on the spindle formed by the flange 19 and the lower end of the sleeve 17 is arranged a row of balls 20, which provides for the easy rotation of the spindle against the upthrust brought thereagainst during the operation of the machine, which thrust is directly against the head 16. The sleeve 17 is fixed in its position in the head 16 in any suitable way, and on the upper end thereof there is mounted a driving-pulley 21, which turns freely on said sleeve, there being, preferably, a ball-bearing for the pulley between it and the inner end of the sleeve 17, as shown in Fig. 2 of the drawings.

On the spindle 15 above the pulley 21 is the worm 22, which is rotatable with but slidable on the spindle, the lower end of said worm being provided with a relatively long hub, on which is mounted the friction-disk 23, which is rigidly secured on said hub by a key or otherwise. The face of this disk lies in close proximity to the upper side of the pulley 21 and preferably is provided with a facing of leather. The worm 22 is counterbored from the upper end thereof toward the other to provide an annular chamber for the reception of a spiral spring 24, and above the worm there is located a sleeve 25, against the lower end of which the spring 24 bears, a nut 27, screwed onto the spindle, serving as an abutment for the upper end of said sleeve and also as a means of adjustment for moving the sleeve relative to the spring to increase or diminish the tension of the latter. Mounted in the head 16 transversely to the axis of the spindle is a shaft 28, which is seen in section in Fig. 2 and in plan in Fig. 3. This shaft is mounted in two long bearings 29, each extending from the side of the head 16 to which they are bolted inward nearly to the center of the shaft, and on the latter, between the ends of said bearings, there is keyed a worm-gear 30 in mesh with the worm 22. On one end of said shaft 28 there is nonrotatably secured a ratchet 31. On the opposite end of the shaft is fixed a gear 32, which meshes with an intermediate gear 33, (shown only in Fig. 2,) which in turn meshes with a gear 34 on the end of a shaft 35, lying parallel with the shaft 28, and on said shaft 35 is a worm 36 in mesh with a worm-gear 37, keyed to the upper end of the feed-screw *g*. All this is clearly shown in Fig. 2, and it is only in this figure that the gears whereby movement is transmitted from the shaft 28 to the feed-screw are shown in dotted lines. As usual, where transmission-gears are employed in this manner the intermediate gear 33 is preferably mounted in a slotted arm, whereby some other gear of different diameter may be substituted to increase or diminish the speed of rotation of the feed-screw.

The driving-pulley 21 on the spindle 15 is rotated by a belt running from a suitable pulley on a counter-shaft 38, preferably mounted on brackets integral with the standard *a*, as shown in Fig. 1, and the pulley 21, as stated, runs idly on the sleeve 17 until the friction-disk 23 is forced down against its upper side by the spring 24, as above described.

The shaft 28, on which is the worm-gear 30, is, as stated, provided with a ratchet-wheel 31 on one end thereof, and supported on the frame of the machine is an elbow-lever 39, one arm of which is adapted to swing into engagement with the teeth of said ratchet-wheel and arrest abruptly the rotation of the shaft 28. Fig. 2 shows the driving-pulley 21 in operative engagement with the friction-disk 23, and assuming that the parts are rotating in this position the worm 22 will rotate the shaft 28 and through its gear connections referred to impart rotary movement to the feed-screw *g*, which effects the upfeed of the drill, as heretofore described. The sudden engagement of the lever 39 with the ratchet-wheel 31 immediately converts the worm-gear 30 from a driving member for the feed-screw *g* into what is, in effect, a stationary nut, and therefore the continued rotation of the pulley 21 immediately effects the separation of the disk 23 therefrom, for the worm 22, acting on the worm-gear 30 as on a nut, lifts the disk 23 out of driving engagement with the pulley 21. This upward movement of the worm effects the compression of the spring 24, so that as soon as the lever 39 is swung out of engagement with the ratchet-wheel 31 the spring instantly forces the disk 23 again into driving engagement with the pulley 21, the power of the spring being sufficient to rotate the work carried by the spindle against the drill.

The devices whereby the lever 39 is swung automatically into and out of engagement with the ratchet-wheel 31 will now be described, together with certain other parts of the machine coacting with the lever-operating means. On the hub of the lever 39, as shown only in Fig. 3, there is a spring 40, which operates to swing said lever 39 in the direction which will effect the engagement of the short arm thereof with the ratchet-wheel 31, this arm being held out of engagement with the ratchet-wheel by means of an arm 41, mounted transversely upon the upper end of a shaft 42, (see Fig. 9,) which shaft is rotatably supported in suitable bearings on the side of the frame *a*, as shown in Fig. 1, and which is provided with a coiled spring 43, against the tension of which this shaft may be rotated in one direction to cause the arm 41 to be swung against the end of the depending arm of the elbow-lever 39 to effect the disengagement of the other arm thereof from the ratchet-

wheel. This shaft 42 may be manipulated by any suitable hand-lever, as 44, and when it has been actuated, as described above, to operate the lever 39 the opposite end of the arm 41 to that which engages said lever moves into engagement with a trip-lever 45, which is pivoted to the machine to swing in a vertical plane, and hung from the opposite end of this lever is a rod 46, which extends downward through a boss 47 on the drill-carriage *d*, on each side of which boss are two adjustable collars 48, whereby the movements of the drill-carriage may operate this rod and the trip-lever 45 to release the arm 41, which by the spring 43 is then swung away from the end of the lever 39, whose spring 40 throws it up into engagement with the ratchet-wheel 31, as described, instantly stopping thereby further movement of the feed-screw *g*. It is thus seen that the drill may be arrested in its upward feed movement at any desired point with great accuracy.

While the machine is of necessity brought to a stop from time to time, either to insert new work or for various other means, it is desirable that the pump which supplies oil to the drill should remain in continuous operation, whereby the drill may be instantly supplied with oil upon the resumption of its work, and for this reason the oil-pump 49, which is shown in Fig. 1, is driven by an independent belt (indicated in dotted lines) from the counter-shaft 38, the pump being of that type which is usually employed in this class of work and spoken of generally as a "gear-pump." The suction-pipe thereof is indicated by 50 and the delivery-pipe by 51. This latter pipe is connected into a three-way valve 52, which is illustrated in detail in Figs. 10 and 12 and is also shown in Fig. 9, and in this last-named figure it is shown in its relation to the tripping devices, whereby when the feed movement of the screw is arrested the feeding of oil to the drill is also stopped, the stream of oil from the pipe 51 being diverted from the connection 53, extending from the drill-carriage to the three-way valve, and being turned by the operation of the valve through a by-pass port 54, which is shown in Fig. 9 and which communicates through a suitable opening in the frame with the oil-reservoir in the base *b*.

The stem of the valve 52 is indicated by 55, and it extends upwardly parallel with the shaft 42 and is connected with the latter by a connecting-rod 56, extending from an arm 57 on the shaft 42 to the arm 58 on the stem 55 of the three-way valve. By reason of these connections it is seen that the rotative movement of the shaft 42 will impart similar movements to the valve-stem 55, and when the machine is in operation the valve will cover the by-pass port 54, (see Fig. 10,) and when the shaft 42 is operated to arrest the feed movement of the drill the port 59, leading into the pipe connection 53, will be closed and the by-pass port opened. The valve is of the wing type and is movable radially on the stem 55, which it straddles, the pressure back of it within the valve-body keeping it to its seat. This wing is shown in perspective view in Fig. 11. The pipe connection 53 between the drill-carriage *d* and the valve must of necessity be an extensible one, and to this end it is made of two telescoping sections, one end of one section swinging on the drill-carriage and the end of the other section on the valve-body, these ends preferably being made in the form of union-joints and the two sections being provided with a packing-nut 60. In this way perfect freedom of movement is permitted to the drill-carriage without interference with its proper oil-supply. Obviously this may be replaced by a flexible tube, if desired.

The driving means for the drill-spindle and the means for driving the feed-screw *g*, together with the devices described for arresting instantly the shaft 28, have been described herein only as one of the component parts of the machine as a whole and will be claimed herein only in combination with such parts.

Having thus described my invention, what I claim, and desire to secure by Letters Patent of the United States, is—

1. A drilling-machine consisting of a spindle, a work-holding fixture rotated thereby, a drill, a continuously-rotating driving-pulley for the spindle, a clutch mechanism between the spindle and driving-pulley, a feed mechanism for the drill, and connections between the feed mechanism and the clutch mechanism whereby the feed mechanism may be driven and whereby the members of the clutch mechanism may be moved into and out of operative engagement.

2. A drilling-machine consisting of a spindle, a work-holding fixture on the spindle, a drill, a continuously-rotating driving-pulley on the spindle, a clutch mechanism between the spindle and driving-pulley, and a feed-screw for the drill; a worm on the spindle rotatable therewith and endwise movable thereon in connection with a member of the clutch mechanism, a worm-gear driven by the worm, and means for abruptly arresting the rotation of the worm-gear whereby the latter may serve as a nut or rack for the worm to effect the operation of the clutch mechanism.

3. A drilling-machine consisting of a spindle, a work-holding fixture rotated thereby, a drill, a drill-carriage, a continuously-rotating driving-pulley for the spindle, a feed-screw for the drill-carriage, and gear connections between the driving-pulley and the feed-screw to rotate the latter; a worm-gear on the drill-carriage in mesh with the feed-screw, and means for holding said gear against rotation whereby it may constitute a nut for the feed-screw, together with releasing means for the worm-gear whereby the feed of the carriage may be arrested.

4. A drilling-machine consisting of a work-rotating spindle, a drill, a drill-carriage and a

feed-screw for the latter; a continuously-rotating driving-pulley on the spindle, a clutch mechanism between the latter and the driving-pulley, a worm fixed on the movable element of said clutch mechanism; a shaft, a worm-gear thereon for engagement with said worm, and gear connections extending between said shaft and the feed-screw; a swinging lever on the machine, one end of which is adapted to be moved into engagement with said worm-gear shaft to arrest the latter, and means actuated by the movement of the drill-carriage to move said swinging lever to arrest said worm-gear shaft whereby said worm may constitute a screw, and said gear a nut to effect the separation of the engaging members of the clutch mechanism.

5. The combination of a spindle, a work-holding fixture thereon, a drill-carriage, and means for feeding the latter toward the spindle, a drill-rest movable in line with the drill-carriage, a drill-guide in said rest, through which the drill passes, the end of said guide having a bearing in said work-holding fixture, means for adjusting said drill-guide axially, and means for securing it in its adjusted position.

6. The combination of a spindle, a work-holding fixture thereon, a drill having an oil-duct extending longitudinally therethrough, means for supplying oil to the latter under pressure, a drill-rest, through which the cutting end of the drill passes, adjustable toward and from the work-fixture, a casing supported on said drill-rest, and inclosing said fixture, there being an oil-passage through the latter.

7. The combination with a work-rotating spindle, of a worm rotatable with the spindle and endwise movable thereon, a friction-disk to which the worm is secured, a driving-pulley, a spring for moving said disk against the pulley, a drill having an oil-duct extending lengthwise thereof, and means for forcing oil thereinto; a worm-gear and suitable connections between it and said drill for imparting feed movement to the latter, and means operated by the movement of the drill for abruptly arresting said worm-gear, whereby it may serve as a rack or nut for the worm; and devices actuated by the gear-arresting means for stopping the flow of oil to the drill.

8. The combination with a work-rotating spindle, of a worm rotatable with the spindle and endwise movable thereon, a friction-disk to which the worm is secured, a driving-pulley, a spring for moving said disk against the pulley, a drill having an oil-duct extending lengthwise thereof, and means for forcing oil thereinto; a worm-gear and suitable connections between it and said drill for imparting feed movement to the latter, and means operated by the movement of the drill for abruptly arresting said worm-gear, whereby it may serve as a rack or nut for the worm; and devices coacting with the gear-arresting means for stopping the flow of oil to the drill, and means for manually operating said gear-arresting means independently of the feed movement of the drill.

9. The combination with a work-rotating spindle, of a worm rotatable with and endwise movable on the latter; a driving-pulley freely rotatable about said spindle; a clutch-disk rotatable with and slidable on the spindle, a spring for moving said disk into operative engagement with the driving-pulley; a drill; a worm-gear rotated by the worm on the spindle, and suitable gear connections between said worm-gear and said drill for imparting feed movement to the latter, and means operated by the feed movement of the drill for arresting said worm-gear, whereby it may serve as a rack or nut for the worm to move the clutch-disk away from the driving-pulley, and thereby effect the compression of said clutch-operating spring.

ELBERT M. COUCH.

Witnesses:
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