(No Model.)

6 Sheets—Sheet 1.

H. S. BAILEY.

HAND ROCK DRILL.

No. 304,288.

Patented Sept. 2, 1884.

Fig. 1.

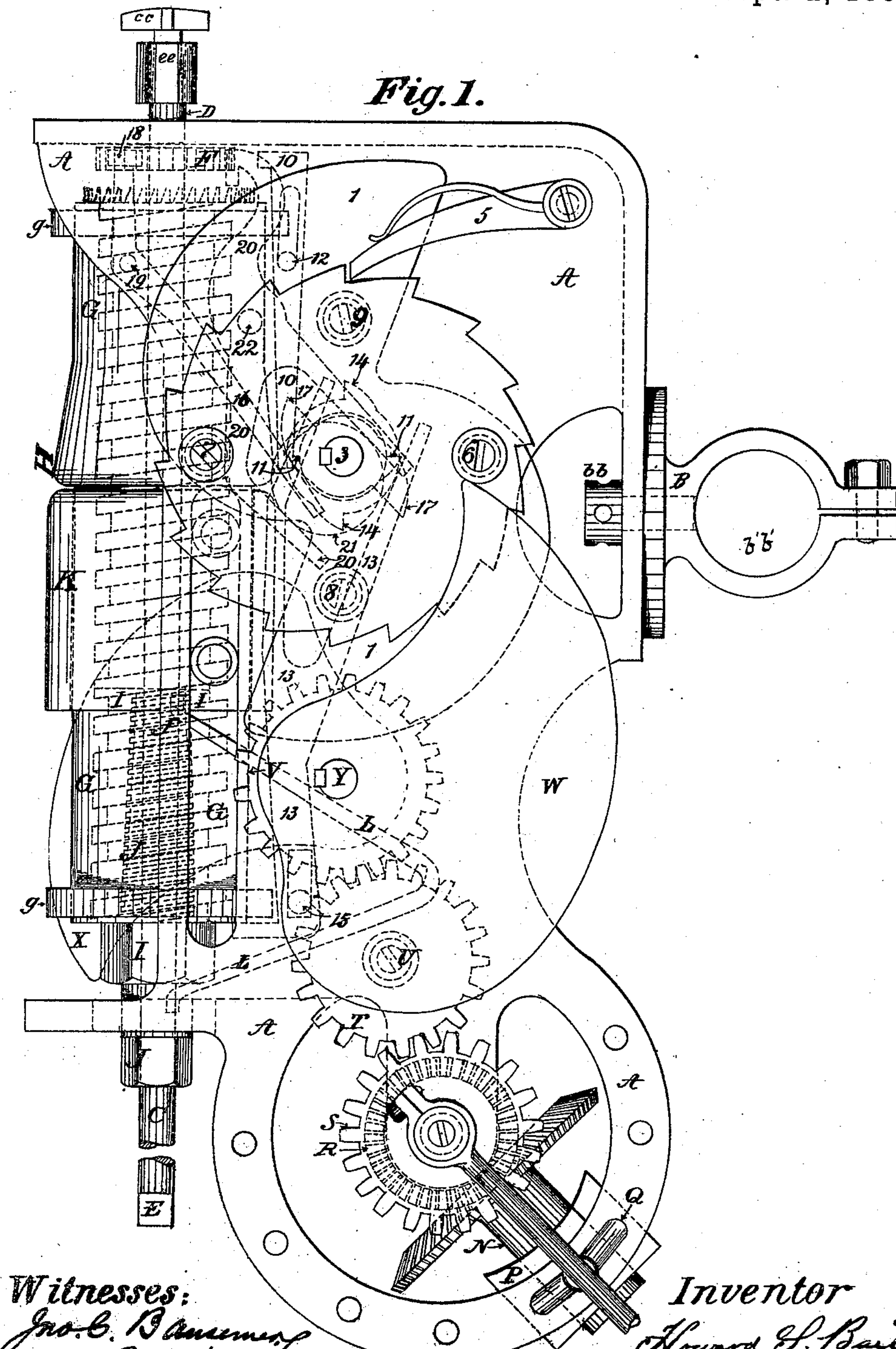

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Fig. 2.

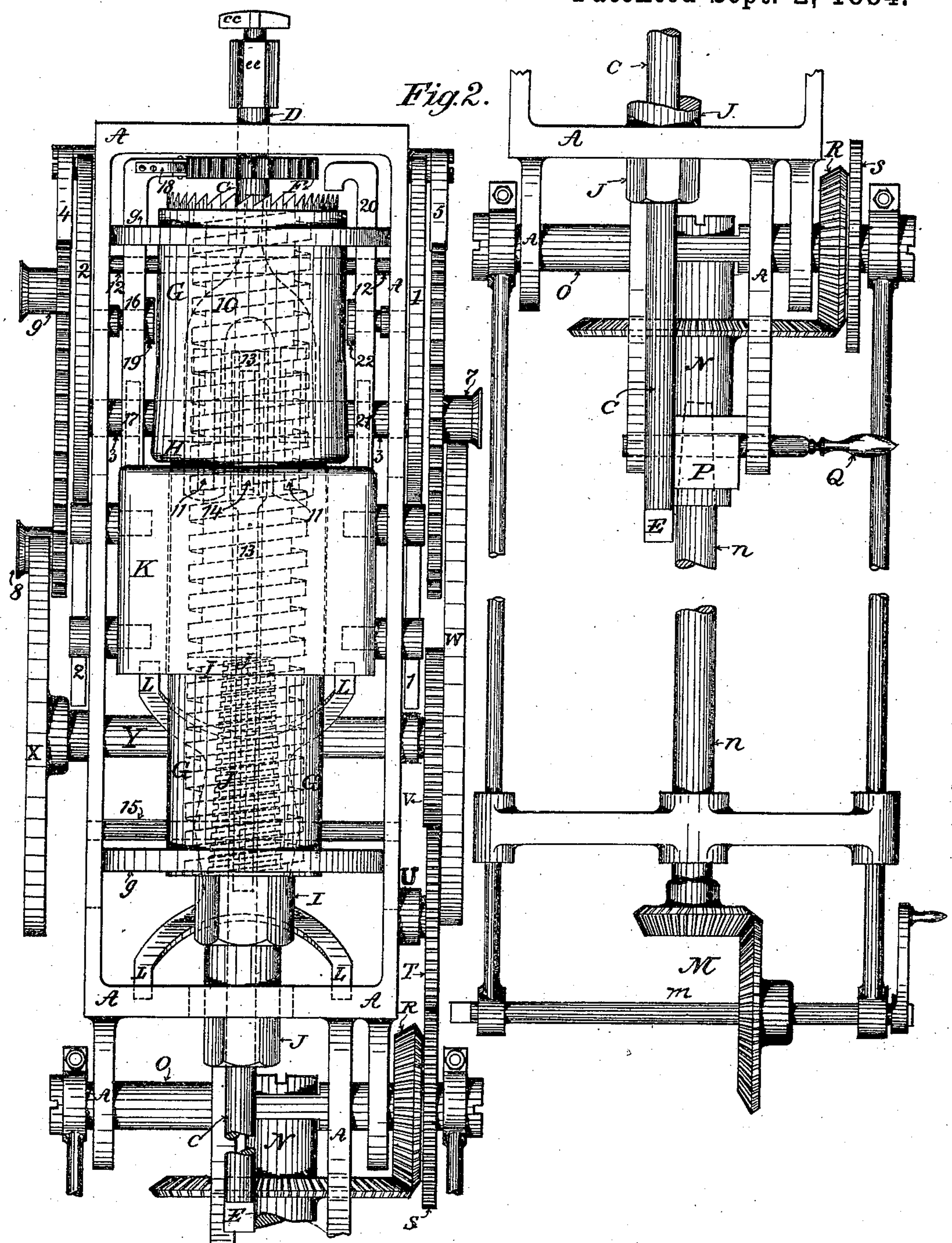

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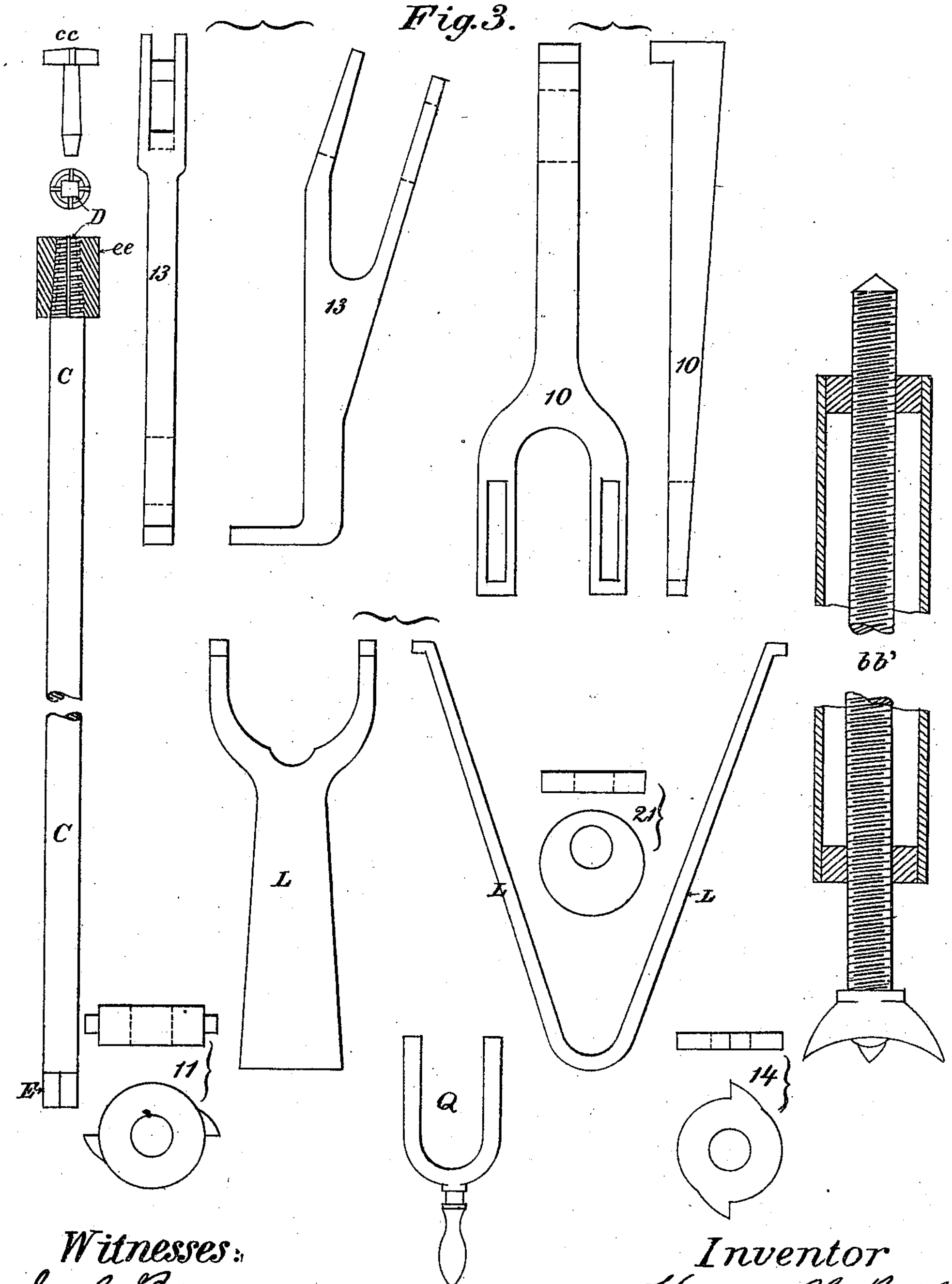
Fig. 3.



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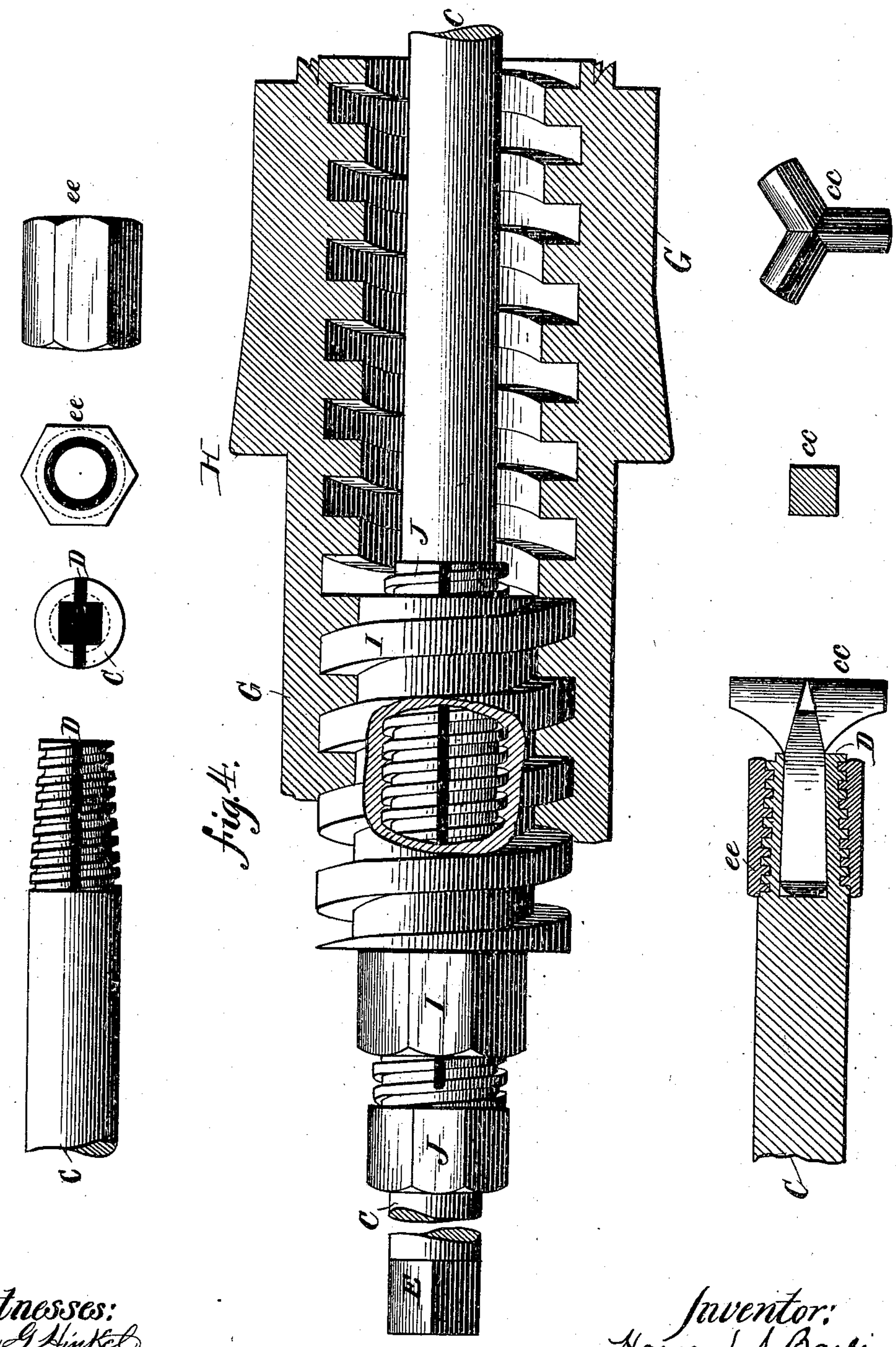

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(No Model.) 6 Sheets—Sheet 5.

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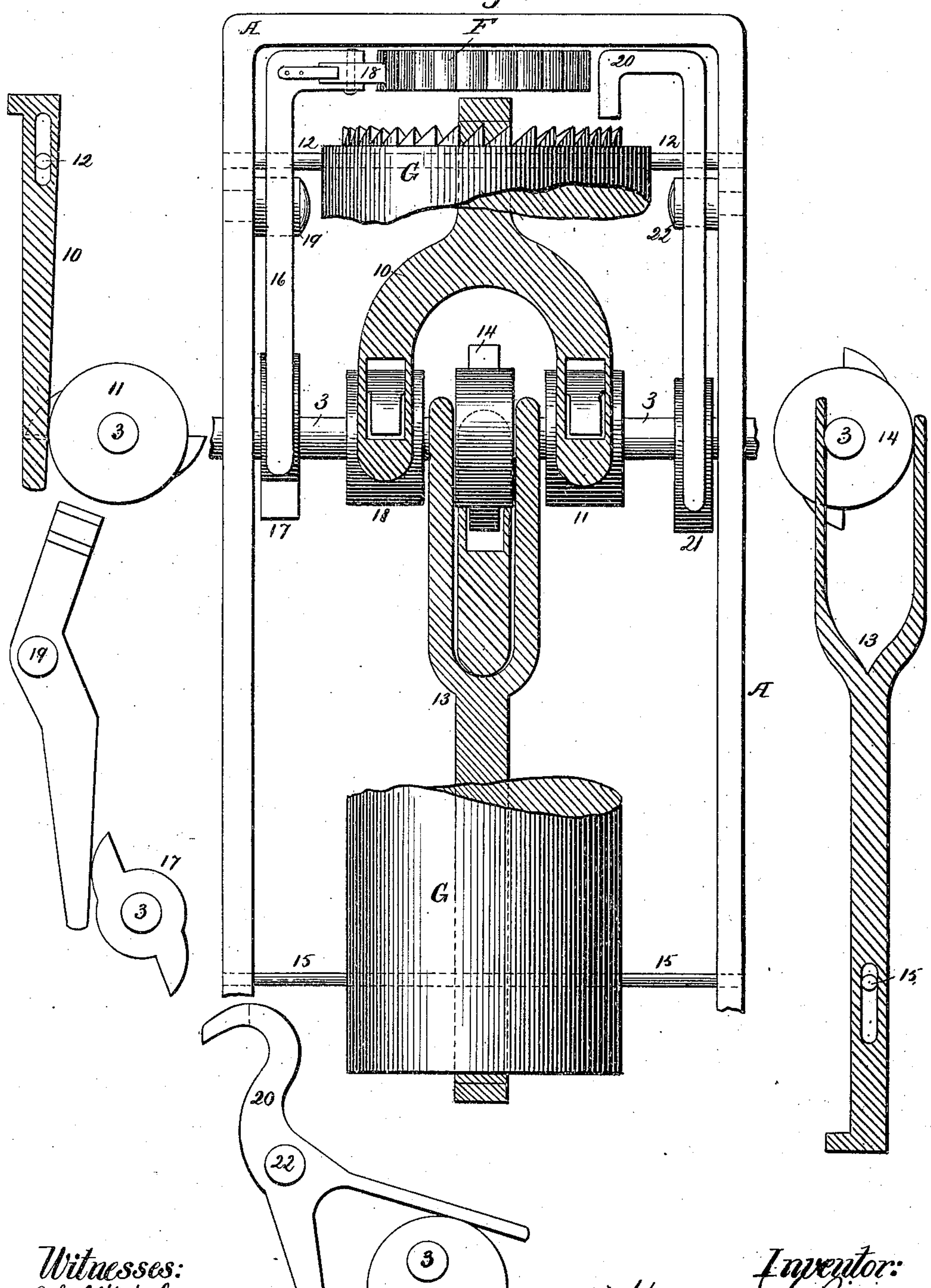
HAND ROCK DRILL.

No. 304,288. Patented Sept. 2, 1884.

Fig. 5.



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(No Model.)

6 Sheets—Sheet 6.

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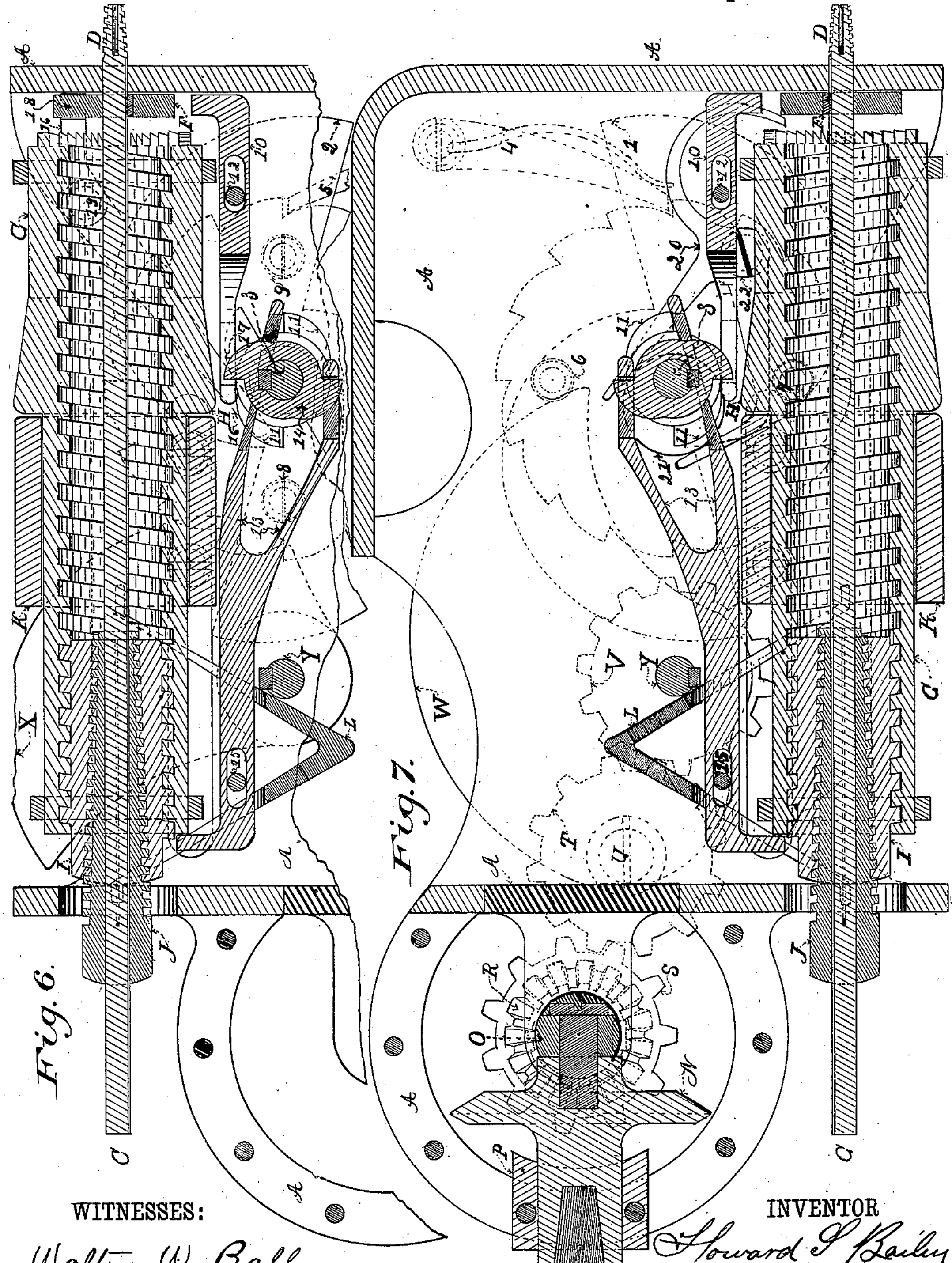

Fig. 6.

Fig. 7.

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UNITED STATES PATENT OFFICE.

HOWARD S. BAILEY, OF DENVER, COLORADO.

HAND ROCK-DRILL.

SPECIFICATION forming part of Letters Patent No. 304,288, dated September 2, 1884.

Application filed July 20, 1883. (No model.)

To all whom it may concern:

Be it known that I, HOWARD S. BAILEY, of the city of Denver, county of Arapahoe, and State of Colorado, have invented certain Improvements in Hand Rock-Drills, of which the following is a specification.

This invention relates to that class of rock-drills operating by hand-power; and it consists of certain improvements whereby power is applied at the end of the machine from any desired position, independent of the position of the machine; of certain improvements in the mechanism for retracting the hammer, whereby only a small amount of power is required; of improvements in the mechanism for reciprocating and partly rotating the drill-point, whereby the drill-point is firmly held against the rock until the blow is delivered; of an improved automatic feeding device; of an improvement consisting of a single rod having adjustable points, the rod feeding continuously through the machine, thus obviating the use of a large number of drills; of improvements in the arrangement of parts, whereby the jar occasioned by the striking of the hammer cannot be felt by the driller; of improvements in construction, enabling it to be placed within three inches of the walls of tunnels and shafts, it being less than five inches wide.

Figure 1 represents a side elevation of my invention. Fig. 2 represents a plan of the same. Fig. 3 represents parts of the machine. Fig. 4 represents a section through cylinder G, showing the device that holds and feeds the drill-holder, with the drill-rod C through it; also, full and sectional views of end D, of rod C, and nut *e e*, and full-size view of point C C and manner of holding it. Fig. 5 represents a plan of the levers and cams inside the frame. (Shown only in dotted lines in Figs. 1 and 2.) Fig. 6 represents a section through the entire machine in a plane parallel to the plane in Fig. 1, directly through the center of the cylinder and drill-rod, levers 13 and 10, disk 14, and spring L. Fig. 7 represents a similar section, looking from the opposite side of the machine, with the section of the bevel-gear N through its center, which is not in line with the center of the cylinder.

The frame A of my drill consists of four upright sides, forming a parallelogram, having a base which rests upon the coupling B. Through the center of the base of the frame the coupling-bolt *b b* passes. The frame may be secured in any position upon the coupling by means of the bolt, and the coupling may be secured in any position upon the horizontal bar *b' b'*. The longer sides of the frame form bearings for the shafts Y and 3, rods 12 and 15, pawls 4 and 5, and it also has slots opposite and parallel with each other, in which run the frictionless rollers of the hammer K. These sides have also in each a semicircular aperture on line with the base of frame, and encircling the coupling-bolt *b b*. This space allows the bolt to be loosened from either side of the machine. The drill-rod C rests in one end of the frame. The other end contains a hole large enough to admit the nut I. Upon this end of the frame are two projections containing the shaft O; also two segments forming rings of the same radius. They are parallel with each other and perforated with holes in line with and equidistant from each other.

The bevel-geared crank M is of a length sufficient to enable a miner to drill holes above his head or on a line with his feet while standing erect. It consists of two rods, *m* and *n*, containing each a bevel-gear, meshing into each other. A turning-wrench may be applied to either end of rod *m*. The two supporting-arms of the crank are secured to the ends of the shaft O by means of set-screws. The end of rod *n* is square and tapering and fits into the end of the bevel-gear N. The bevel-geared crank may be separated from the frame by loosening the set-screws, springing the rods of the shaft O, and withdrawing the rod *n* from the gear N. The bevel-gear N is supported by one of its hubs bearing against a flattened place on the shaft O. In the end of the hub is screwed a tap-bolt, which passes through the shaft O and revolves with the gear. The head of the bolt bears against a flattened place on the shaft. The other hub of the gear N passes through the box P. In the center of this end is a square socket, in which fits the rod *n* of the bevel-geared crank M. The box P fits between the segments. Two lugs upon it extend under the segment-rings and fit the curves. Through the box P are two holes in line with the holes in the segments. The double pin Q passes through both segments and the box P. By removing the pin Q the bevel-geared crank may be moved with the box P, bevel-gear N, and shaft O, and secured in any position upon the circumference of the segments by the pin Q being passed through the segment and box P. This gives a very large range of positions independent of the position of the frame A. Upon the shaft O revolves freely the double gear R S, of one piece of material. R is a bevel-gear of one-half of the diameter of N, and meshes into it. S is a spur-gear, and meshes into T. This gear is secured to the frame by the stud U, and meshes into the gear V, which is a part of the cam W. The cams W and X are of the same throw, but of different curves. The reason of this will be explained further on. They are keyed to the shaft Y, which shaft has bearings in the frame A. The cam W works upon the rollers 6 and 7 of the double ratchet-cam 1, and the cam X upon the rollers 8 and 9 of the double ratchet-cam 2. The double ratchet-cams 1 and 2 are of same throw and curve. The ratchets and cams are preferably of one piece of material. The pawls 4 and 5 are secured to the frame by studs. A spring, secured to the stud and bent to bear upon the top of each pawl, holds it against the ratchet. The ratchets and pawls prevent the machinery from being rotated in the wrong direction. They also hold the hammer wherever it may be stopped on its backward stroke. The double ratchet-cams are keyed upon the ends of the shaft 3 and close to the frame. Their working-edges are parallel, so as to operate as one cam upon the rollers of the hammer K. Upon the outside of each of the double ratchet-cams are secured two frictionless rollers, 6, 7, 8, and 9, by means of studs. These rollers are placed equidistant from the center of shaft 3 and upon lines passing through its center; but the rollers upon double cam 2 are placed at a right angle to the rollers upon the double cam 1. Thus (see Fig. 1) a straight line drawn through the centers of shafts Y and 3, and extended beyond 3, would pass through the centers of the rollers 8 and 9 upon cam 2. This same line would form right angles with a line drawn through the centers of rollers 6 and 7 upon cam 1. When the rollers of the double cams occupy the position represented in Fig. 1, two of the working-edges of the double ratchet-cams will be just in front of the rollers of the hammer K, as represented in Fig. 1.

The double cams 1 and 2, although upon opposite sides of the machine, operate as one cam. Motion is transmitted to them by the single cams W and X, working alternately upon their respective rollers, thus as the cam W (see Fig. 1) leaves the roller on double cam 1, the cam X will bear upon the roller 8 on double cam 2, and will carry it one-quarter of a circle. This will move the hammer one-half of its stroke. As the cam X leaves the roller 8, the cam W will bear on the roller 7, it having arrived where 8 was, but upon the other side of the machine, and will move it one-quarter of a circle, completing the stroke of the hammer. The roller 9 would then be where 8 now is in Fig. 1, and 7 would be where 6 is now. The shaft Y has made one revolution, the shaft 3 but one-half of a revolution. Thus the single cams W and X impart continuous rotative motion to the double ratchet-cams 1 and 2. The hammer K is placed inside the frame upon rollers attached to its sides. These rollers run in slots in the frame A, and protrude through on each side a distance equal to the thickness of the double ratchet-cams 1 and 2. Through the center of the hammer K the cylinder G passes. The back of the hammer contains two slots, and also the end of the frame in which the ends of the spring are placed. The spring is of V form, and has four ends. These straddle the cylinder G, and lever 13, and the nut I. The spring is held in place by its resilience. The cylinder G passes through the center of the hammer, and rests in the collars *g* and *g*, secured or cast to the frame A. The cylinder has a cylindrical bore through its center, which bore is threaded. At H the cylinder enlarges, forming a shoulder encircling the cylinder, and the hammer K strikes against this shoulder. The end of cylinder nearest the shoulder H is cut to form a shoulder, against which the lever 10 bears when moved by the disks 11 and 11. Upon the face of this end of the cylinder is cut a ratchet, the teeth facing the end of the frame A. One end of the lever 20 is formed to line with the ratchet. The other end of the lever 20 embraces the eccentric 21. The lever is pivoted at 22, and the eccentric is keyed to the shaft 3. Through the cylinder G passes the drill-rod C. One end bears in the frame, and it is supported in the cylinder by the collar J and nut I. A key-seat is cut in the drill-rod C its whole length, except on its ends. One end, E, is squared for a wrench, and the other end, D, is tapered and threaded on the taper. A square hole penetrates the end the depth of the taper, and the end is also split quarterly of its circumference. A nut, *e e*, fits the taper-thread.

The drill-point *c c* is essentially a part of the drill-rod C, as it is impossible to use in the machine the drills that are employed at present either for hand or machine drilling. The drill-point *c c* has three cutting-edges. The shank is square, and tapers from the back of the cutting-edges on all four sides nearly the whole length of the shank, where it is chamfered sharply to admit it into the drill-rod, the points where the tapers meet being the largest diameter of the shank. A full-size view of point *c c* is shown in Fig. 4. Upon the drill-rod C the collar J and nut I slide when not within the cylinder G. The collar J is tapered and threaded upon its outside nearly its whole length. Its largest end is made hexagonal. The collar is split quarterly of its circumference the length of the thread and taper. The nut I is bored tapering, and threaded to match the taper and thread upon the collar J. The outside of the nut I contains a thread matching the thread in cylinder G. One end is made hexagonal, admitting of a wrench.

Upon the drill-rod C, between the cylinder G and the end of frame A, is placed the ratchet-wheel F. A key is made fast to the wheel, and fits loosely in the key-seat of the drill-rod, allowing the rod to slide through the wheel F. One end of the lever 16 contains a pawl, 18, which is held against the ratchet-wheel F by a spring attached to the lever 16. The lever is pivoted at 19. The other end rests upon the double cam 17, keyed to the shaft 3. The lever 10 (see Fig. 5) slides upon the rod 12. One end of the lever is shouldered. The other two ends of the lever rest upon the faces of the disks 11 and 11 and contain slots for the projections on the disks to move in, and move the lever by bearing against the end of slot. The disks 11 and 11 contain each two projections, and the disks are keyed to the shaft 3, so as to act as one. Between the disks 11 and 11 is keyed the disk 14. The lever 13 is a forked lever. One fork contains a slot large enough to straddle the disk 14 and rest upon the shaft 3. The other fork lines with the disk 14, and contains a slot that receives the projections on the disk. The lever 13 slides on the rod 15. The end nearest the rod 15 contains a shoulder, which, when moved, bears against the end of cylinder G and moves it. The disk 14 has two projections, and is keyed to the shaft 3, so that its projections will stand at a right angle to the projections on the disks 11 and 11, as represented in Fig. 1. The section in Fig. 6 shows the disk 14 divided through its center, also the levers 13 and 10 and spring L.

The operation of my drill will be as follows: The horizontal bar b' b' is passed through the coupling B. The bar is then braced against the walls of a tunnel or shaft. The machine is adjusted to the required position, its front end being not more than two inches from the face of the rock. The coupling is then tightened upon the bracing-bar and the frame upon the coupling by the bolt *b b*. A drill-point is placed in the drill-rod, and the nut *e e* is tightened, forcing the split ends of the rod to conform to the taper of the shank. The rod and point are now pushed against the rock, a wrench is applied to the nut I and one to the collar J, and the nut I is tightened upon the collar J, forcing the split ends of the collar to grip the rod C. A turning-wrench is now applied to the most convenient side of the bevel-geared crank M on the rod *m*. Power is transmitted through the gears N, R S, T, and V to the shaft Y and single cams W and X, and by them alternately to the double cams 1 and 2. As these revolve as one cam, they push the hammer from them until the rollers of the hammer run off the cams, when the hammer is thrown forward against the shoulder H of the cylinder G by the spring L. The moment a blow is struck a projection on the disks 11 and 11 enters the slots in the ends of the lever 10, and moves its shoulder against the shoulder of the cylinder G, pushing it back, and the drill rod and point, from the rock, stopping when the projection leaves the slot. At the same time one side of the cam 17 lifts the lever 16, forcing the pawl 18 to partly rotate the ratchet-wheel F; consequently the drill-rod C, collar J, nut I, and cylinder G. The eccentric 21 then forces the bent end of the lever 20 into the ratchet on the end of cylinder, turning it upon the nut I backward whatever distance it was driven ahead by the hammer, the nut I, collar J, and drill-rod being held from turning by the pawl 18, bearing on the ratchet-wheel F. One of the projections on the disk 14 now enters the slot in the fork of the lever 13, that lines with it, and moves the shoulder of the lever against the end of cylinder, pushing it ahead and the drill-point against the rock. The point is held firmly against the rock until the blow has been delivered by the disk 14. The forks of the lever 13 must spring apart to let the projection move on when the point is against the rock, the blow being delivered before the projection leaves the slot. These movements are all executed while the hammer is moving back after each blow, except the movement of the lever 20. This lever comes in contact with the ratchet but once in two blows.

It will be seen by reference to Fig. 1 that the lever 20 is pivoted below the center of cylinder G. The eccentric causes the bent end of the lever to describe an arc whose chord will form the same angle to the axis of the cylinder as the pitch of the thread in the cylinder; consequently, when the lever comes in contact with the ratchet, it turns the cylinder on the nut I. As in most rock the distance that the point would be driven ahead in two blows would not exceed one sixty-fourth of an inch, (the cutter having three edges,) the lever would not come in contact with the ratchet until it had nearly completed its stroke. If the cylinder should be driven ahead one-eighth of an inch in very soft rock, the lever would engage the ratchet much earlier in its stroke, and would turn the cylinder on the nut I far enough to move it back an eighth of an inch. It makes no difference where the cylinder may be between the ends of frame A when the machine is first started, as the first movement of the levers 10, and 13, and 20, will bring it in the right place. In time the nut I and collar J will have traveled through the cylinder, when a crank is applied to the square end E of the rod C, and the nut and collar screwed out. The nut I is then loosened enough so that the rod C can be pushed through the collar J until the point *c c* strikes the bottom of the hole in the rock. Then the nut I is again tightened and the drilling resumed.

It can be seen that a hole can be drilled three feet deep—that being the length of the rod C—without moving the machine out of line with the hole. Experience has proved that light rapid blows will cut rock faster than heavy slow ones; consequently I prefer to use in my drill a spring such that sixty pounds will compress the stroke of the hammer. As it requires very little power to compress the spring one-half the stroke of the hammer, the cam X and the first half of the curves of each half of the double ratchet-cams 1 and 2 are made sharp; but as the power required to compress the spring the last part of the stroke of the hammer increases very rapidly as the stroke is completed; consequently the cam W and the last half of the throw of each half of the double ratchet-cams are made as fine wedges as possible. This secures great leverage and smoothness of action, which is most to be desired in a machine operating by hand-power. The introduction of a single rod fed through a machine having adjustable points is a material improvement in this class of drills. It obviates the use of a large number of drills of different lengths. The points are thrown away when dull, and can be replaced without moving the machine out of line with the hole. The expense of dressing drills is obviated. Prospectors will be especially benefited. The machine is light of weight, and requires very little power. It can be set up and operated where a miner can work single-handed; and sixty revolutions of a turning-wrench will deliver one hundred and eighty blows per minute.

It is necessary that a machine be able to drill holes within three or four inches of all sides of tunnels and shafts. If the machine will not do this, the holes must be drilled by hand. The machine described in this specification is less than five inches wide; consequently it will drill holes within two and one-half inches of walls. A serious drawback to the hand rock-drills at present in use is the jar upon the nerves of the operator occasioned by the freeing and striking of the hammer. The cams and gears represented and described receive and completely break the jar before it reaches the operator.

Having thus described my invention, what I claim is—

1. In a rock-drill, the combination, with a frame supporting and carrying the drill-operating mechanism, having projecting bearings and segments, of a frame pivoted thereto, carrying the driving-gear, a bar carried by the frame and supporting the driving-shaft, and a clamp connecting the driving-shaft and segments, whereby the driving-gear may be fixed at any desired angle to the drill, substantially as described.

2. The combination, with a rectangular frame supporting the drill and its operating mechanism, and having the projecting bearings and segments, of a shaft supported in said bearings, a bevel-gear on the shaft, connecting with the drill-operating mechanism, a frame pivotally connected with the shaft and carrying the driving-shaft, a beveled gear on the shaft, a box supported on the shaft, and a pin or clamp for securing the driving-shaft to the segments, the arrangement being such that the driving-shaft may be set at any desired angle to the drill and power be communicated to the drill-operating mechanism.

3. The combination, with the drill-supporting frame, of a shaft connected thereto, having a flattened portion, a shaft having a beveled gear secured to the flattened portion, and having a tapering socket, a frame carrying a beveled gear and a crank for driving it, and a shaft having a tapering end supported in said frame and driven by said gear, the ends of the frame being socketed, the arrangement being such that the socketed ends of the frame may be secured to the shaft on the drill-frame and the tapering end of the driving-shaft may engage with the socket in the beveled-gear shaft, as and for the purposes set forth.

4. The combination, with a continuous drill-shaft, of a cylinder embracing said drill, provided with a screw-thread, and a double screw-clamp, substantially as described, secured to the drill and having a screw-thread engaging with the thread in the cylinder, the arrangement being such that the drill may be clamped and fed the desired distance and then clamped and fed again, as set forth.

5. The combination, with a continuous drill-shaft, of a cylinder having a projecting head embracing said shaft, a screw-clamp connecting the shaft and cylinder, and a hammer sliding on the cylinder and impinging upon said head, substantially as described.

6. The combination, with a frame, of a drill-shaft, a cylinder embracing said shaft, a screw-clamping device connecting the drill to the cylinder, a hammer embracing the cylinder, and guided in slots in the frame, a spring for actuating the hammer, and cams for compressing and releasing the spring, substantially as described.

7. The combination of a frame, a drill-shaft, a pawl and ratchet-wheel for rotating the drill-shaft, a cylinder surrounding the drill-shaft, a clamping device connected to the drill-shaft, and provided with a screw-thread engaging the thread of the cylinder, and a pawl and ratchet for intermittently rotating the cylinder to feed the drill-shaft, the drill-shaft being provided with a square head, whereby the drill-shaft may be automatically fed forward the desired distance and then retracted, the clamp loosened, and, the drill-shaft being moved through the clamp, it may be screwed to another part of the drill-shaft, and again be fed forward, substantially as described.

8. The combination, with a frame and a hammer having projections sliding in slots in said frame, of a shaft having double cams bearing upon said projections, ratched wheels on said shaft, having friction-rollers arranged alternately, as set forth, and a shaft, connected with the driving-gear, having single cams, the arrangement being such that the single cams act alternately upon the friction-rolls,

and thereby rotate the shaft carrying the double cams, for retracting and releasing the hammer, substantially as described.

9. The combination, with a frame and a hammer having projections attached to its sides sliding in slots in the frame, of a headed cylinder carrying a drill encircled by the hammer, and double ratched cams secured to the frame, and bearing upon said projections, substantially as described.

10. The combination, with the drill-shaft, of a split tapering collar embracing the shaft, a nut having an internal taper fitting said collar, and having an external screw-thread, and a cylinder embracing them all, and having an internal screw-thread engaging the nut, substantially as described.

11. The combination, with the headed cylinder, connected to a drill-shaft, and having the ratched teeth on its end, of a bent lever adapted to engage with said ratched teeth, and having a bifurcated end, and an eccentric engaging with said bifurcated ends, substantially as described.

12. The combination, with a drill-shaft and a sliding cylinder embracing said shaft, and connected to the same by a screw-connection, of a hooked lever, as 10, having a slot embracing a pin, and on which the lever slides, and a disk having projections engaging with slots in the end of said lever, as and for the purpose described.

13. The combination, with a drill-shaft and a sliding cylinder embracing said shaft, and connected to the same by a screw-connection, of a hooked lever sliding on a pin, and having bifurcated slotted arms, and a disk having projections engaging with said slotted arms, as and for the purpose described.

14. The combination, with a drill-shaft and a sliding headed cylinder connected thereto by a screw-connection, of a hammer reciprocating on said cylinder, a hooked lever engaging the cylinder and withdrawing the same, and the drill-shaft, a pawl and ratched wheel for rotating the drill-shaft, a pawl and ratchet for rotating the cylinder and feeding the drill-shaft forward, and a hooked lever engaging the cylinder and carrying it and the drill-shaft into position to be struck another blow by the hammer, substantially as described.

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