No. 666,818. Patented Jan. 29, 1901.

# J. H. REDFIELD.

## DRILL.

(Application filed Apr. 18, 1900.)

(No Model.) 3 Sheets—Sheet 1.

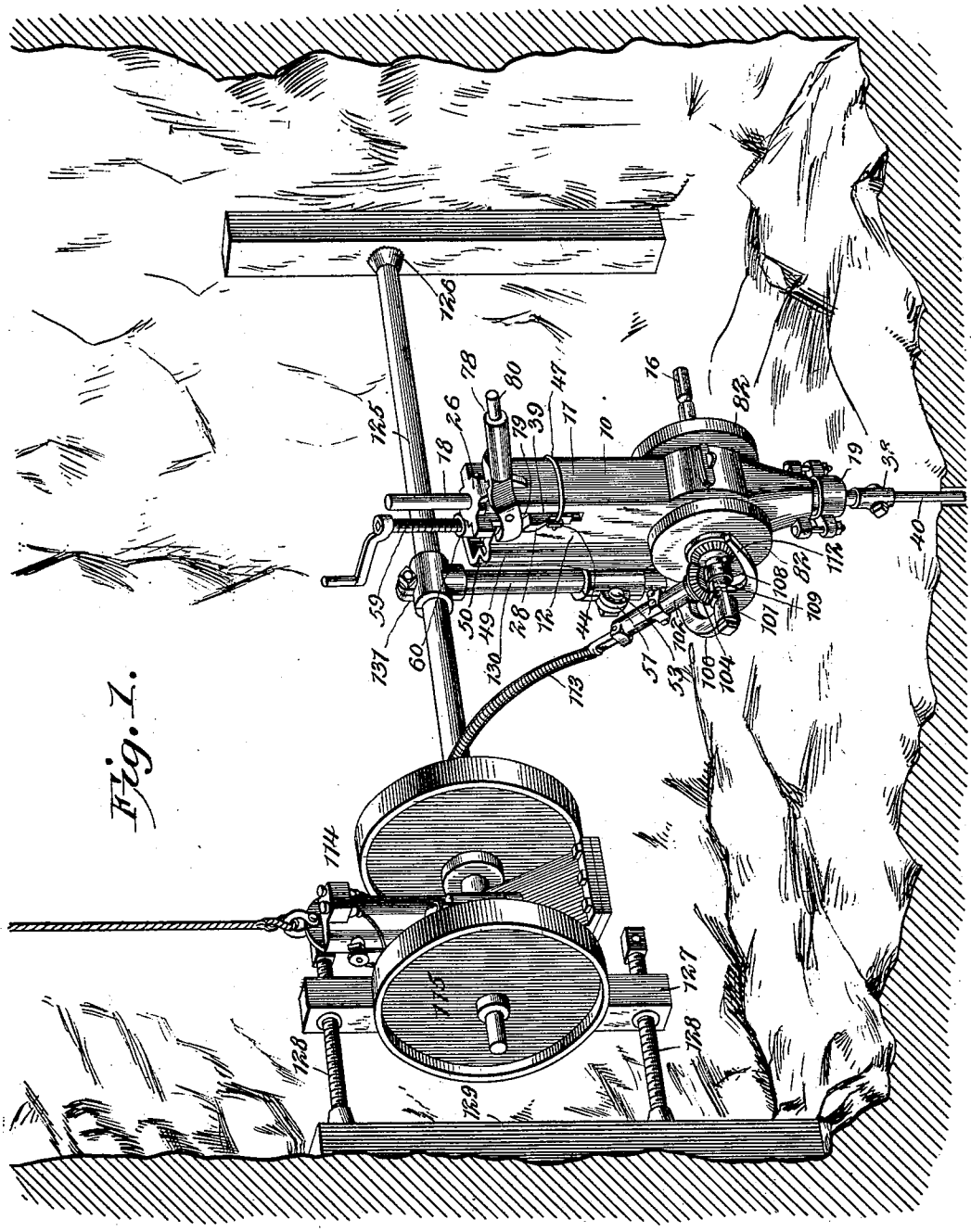

Fig. 1.

Witnesses
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(No Model.) 3 Sheets—Sheet 2.

Fig. 2.

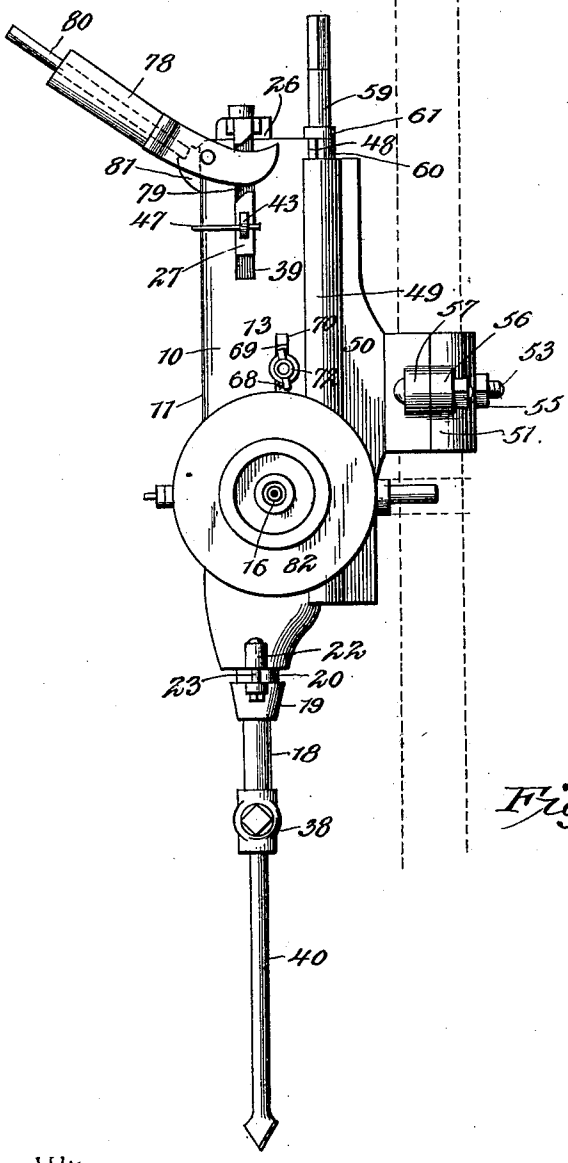



Fig. 5.

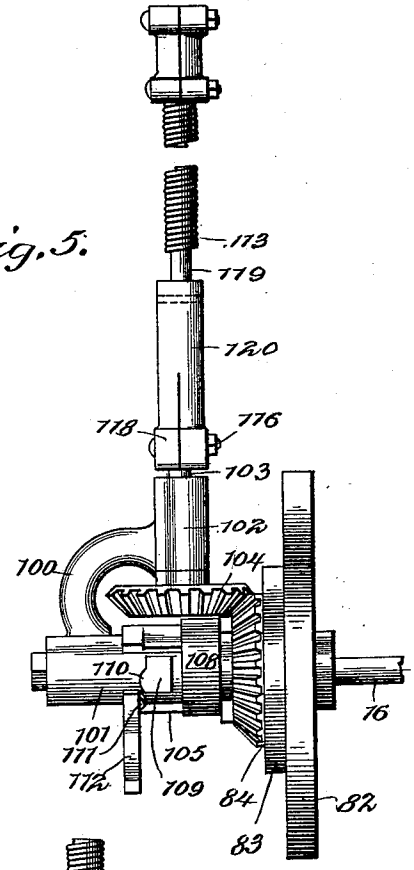
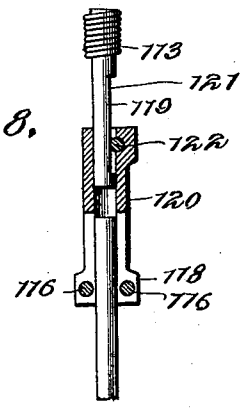



Fig. 8.




Witnesses

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(No Model.) 3 Sheets—Sheet 3.

Fig. 3.

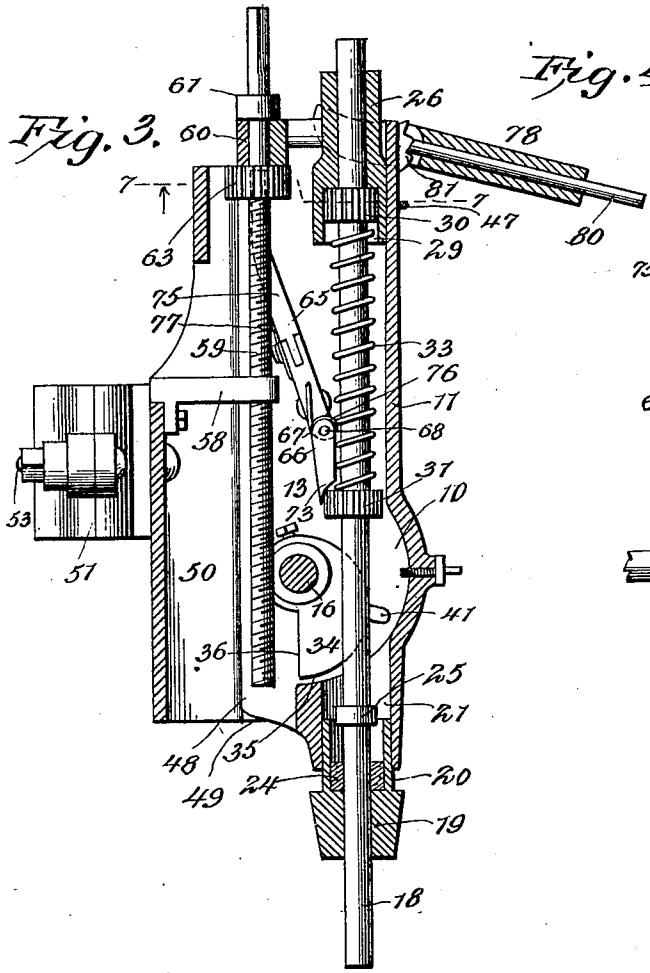



Fig. 4.

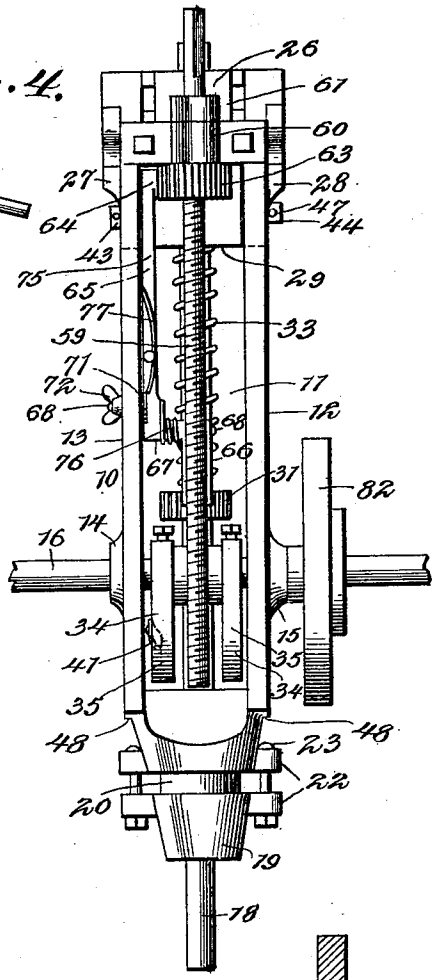



Fig. 7.

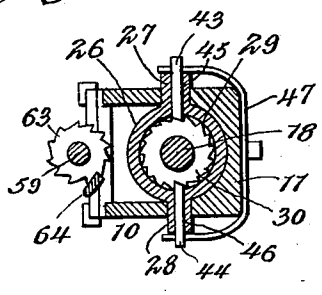
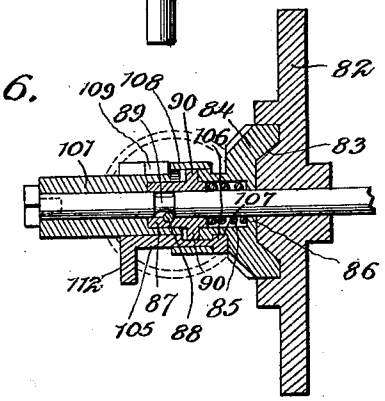



Fig. 6.




Witnesses

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# UNITED STATES PATENT OFFICE.

JOHN HILL REDFIELD, OF BOSSBURG, WASHINGTON, ASSIGNOR OF ONE-HALF TO CHARLES GRUTT, EMIL GRUTT, AND FRED GRUTT, OF SAME PLACE.

## DRILL.

SPECIFICATION forming part of Letters Patent No. 666,818, dated January 29, 1901.

Application filed April 18, 1900. Serial No. 13,361. (No model.)

*To all whom it may concern:*

Be it known that I, JOHN HILL REDFIELD, a citizen of the United States, residing at Bossburg, in the county of Stevens and State of Washington, have invented a new and useful Drill, of which the following is a specification.

This invention relates to drills in general, and more particularly to power-drills; and it has specific reference to drilling-machines employed in mining, quarrying, &c., one object of the invention being to provide a construction which may be readily held in its various operative positions and may be operated to drill the blasting-holes with accuracy and speed.

A further object of the invention is to provide a construction in which the drill may be turned to any desired angle and wherein the parts will be prevented from breaking in the event of the drill-bit becoming jammed and also to provide means for feeding the drill and also for rotating it step by step after each stroke to secure a most effective operation.

An additional object of the invention is to provide means for varying the force of the blow of the drill-bit and for absorbing the jar of the parts against the drill-frame. Various other objects of the invention will be evident from the following description.

In the drawings forming a portion of this specification, and in which like numerals of reference indicate similar parts in the several views, Figure 1 is a perspective view showing the complete drilling-machine in its operative position to drill a vertical blast-hole and illustrating the means for holding the drill and its driving-engine. Fig. 2 is a side elevation of the drilling-machine detached from the supporting-jack. Fig. 3 is a vertical longitudinal section of the drilling-machine and showing parts thereof in elevation. Fig. 4 is a plan view of the drill-frame and the parts carried thereby, the carriage being shown as removed and the drill-bit and driving-shaft being broken away. Fig. 5 is a top plan view of the mechanism for operating the drive-shaft or cam-shaft of the machine. Fig. 6 is a sectional view of the driving mechanism and showing the clutch mechanism for throwing the cam-shaft into and out of operation with respect to the driving-gearing. Fig. 7 is a section on line 7 7 of Fig. 3 and showing the means for moving the drill-rod to vary the strength of the stroke and also showing the ratchet-wheels through the medium of which the drill is fed forwardly and is rotated. Fig. 8 is a sectional view showing the friction connection between the rigid end of the flexible shaft and the shaft which operates the cam-shaft.

Referring now to the drawings, the drilling-machine comprises a box-like frame 10, having closed bottom and sides, the bottom 11 having a depressed portion, as shown, to accommodate the operating mechanism and the sides 12 and 13 having bearings 14 and 15, in which is rotatably mounted the cam-shaft 16, through the medium of which the drill is retracted after each stroke.

Disposed longitudinally of the drill-frame is the drill-shaft 18, one end of which is mounted for reciprocation in a bearing 19 at the forward end of the frame, this bearing being in the form of a sleeve having a contracted portion forming a bushing 20 for the cylindrical opening 21 in the end of the frame, and the sleeve and adjacent portion of the frame have perforated ears 22, which coöperate to receive adjusting-bolts 23, through the medium of which the bushing may be drawn into the opening of the end of the frame. In the bushing is disposed a yieldable cushion 24, of suitable yieldable material, which is adapted for engagement by the collar or flange 25 upon the drill-rod 18 to limit the outward movement of the drill-rod. Thus by adjusting the sleeve to lie inwardly the throw of the drill-rod may be shortened, and by moving the sleeve in the opposite direction the throw of the drill-rod will be lengthened.

The rear end of the drill-rod 18 is slidably disposed in a slidable block 26, which is arranged at the rear end of the casing 10 and has outwardly-directed flanges 27 and 28, which slidably engage longitudinal slots 39 in the sides 12 and 13 of the frame to hold the block from rotating. The forward end of the block is increased in internal diameter to form a recess 29, in which is rotatably disposed a ratchet-wheel 30, which is splined to the drill-rod and with respect to which the

drill-rod is slidable. The object of this ratchet-wheel will be presently described. A second ratchet-wheel 31 is mounted upon the drill-rod 18 and is fixed thereto at a point adjacent to the cam-shaft 16, and encircling the drill-rod is a helical spring 33, which rests with one end against each of the ratchet-wheels thereon and acts to hold the drill-rod normally projected, as will be presently described.

Upon the cam-shaft 16 are adjustably mounted two cams 34, similar in form and arrangement and each having an arcuate face 35 and a flat face 36, which forms the chord of the arc, and these cams are disposed one at each side of the drill-rod and in planes to engage the ratchet-wheel 31 with their arcuate faces against the front face of the wheel to press the drill-rod rearwardly and against the tendency of the helical spring 33. When the arcuate faces of the cams have passed from contact with the ratchet-wheel, the ratchet-wheel is released and the drill-rod returns under the influence of the helical spring and strikes a blow, it being understood that the forward end of the drill-rod is provided with a drill-chuck 38, which receives a drill-bit 40.

After each stroke of the drill it is of course advisable to partially rotate the drill to get the best results, and for this purpose the wheel 31 is made in the form of a ratchet-wheel, and the teeth thereof are disposed for engagement by a knife-edge 41, which is carried by one of the cams, and as the cam is brought into engagement with the ratchet-wheel the knife-edge engages the teeth thereof and acts to give a partial rotation to the ratchet and therewith to the drill-rod. It is necessary to hold the drill from return rotation under the influence of the bevel of the cutting edges of the bit at the next stroke, and for this purpose the ratchet-wheel 30 is provided, and this wheel, which is splined to the drill-rod, is engaged by two reciprocatory spring-pressed pawls 43 and 44, which are slidably disposed in slots 45 and 46 in the sides of the block 26 and are pressed inwardly to their operative positions by means of a bow-spring 47, passed transversely below the drill-frame and having its ends extended upwardly at the sides of the frame and engaged with perforations in the ends of the pawls. These pawls permit rotation of the drill-rod in one direction and prevent rotation in the opposite direction.

On the sides 12 and 13 of the frame and adjacent the upper edges thereof are formed longitudinally-extending guide-rails 48, which project outwardly and engage corresponding grooves 49 in a supporting-carriage 50, which is thus slidably connected with the drill-frame and is provided with a clamp 51, through the medium of which the carriage, and therewith the drill-frame, is held in its different operative positions upon a suitable support, to be hereinafter described. This clamp 51 has perforated flanges, through which is passed a clamping-bolt 53, which also engages a perforation in the carriages, and thus acts to effect the clamping action and to hold the clamp upon the carriage. Additional clamping action is secured by an additional clamping-bolt 55, which engages additional perforated lugs 56 and 57 upon the elements of the split band forming the clamp.

To permit of feeding the drill during its operation, the carriage is provided with a bracket 58, which extends into the inclosure of the drill-frame and has a terminal screw-threaded perforation with which is engaged a feed-screw 59, which is rotatably mounted in a bearing 60 upon the rear end of the drill-frame above the block 26. Movement of the screw longitudinally in one direction is prevented by a collar 61 upon the screw exterior to the drill-frame, while longitudinal movement in the opposite direction is prevented by a ratchet-wheel 63, which is fixed upon the screw and lies against the opposite end of the bearing from the collar. Thus if the screw be rotated the drill-frame will be moved with respect to the carriage by reason of the feed-screw passing through the bracket.

In order that the screw will be automatically rotated to automatically feed the drill-frame and therewith the drill, the ratchet-wheel 63 is provided and fixed to the screw. This ratchet-wheel is operatively engaged by a pawl 64 upon the side face of a two-part lever 65, comprising an element 66, which is in the form of a bell-crank, the shaft 67 of this element being hollow and pivotally mounted upon a stub-shaft 68, fixed to a slide-block 69, which is slidably mounted in a longitudinal slot 70 in the side 12 of the drill-frame. Through the block is a perforation with which is engaged a bolt carrying a washer 71, which lies between the head of the bolt and the inner face of the side of the frame, the opposite end of the bolt having a washer which lies between the outer face of the side 12 of the drill-frame and a thumb-nut 72 on the bolt, whereby the nut may be tightened to clamp the block at any point of its sliding movement. One end of this bell-crank element has a cam-face 73, which lies in the path of movement of the ratchet-wheel 31 for engagement thereby when it moves rearwardly under the influence of the cams, and whereby the bell-crank element will be rocked every time the drill-rod moves rearwardly. The opposite end of the bell-crank has the second element 75 of the lever hinged thereto, and this second element 75 carries the pawl 64, and is in effect itself the pawl, with the engaging face or projection 64, the element 75 being held yieldably in a position to engage the ratchet by means of a helical spring 76, wound around the pintle of the hinge-joint of the elements of the lever and having its ends engaged with the elements in the usual manner. The cam-face of the element 66 of the lever is held also yieldably in operative position in the path of the ratchet-wheel by a

similarly-disposed spring 77. By adjusting the slide-block 69 the cam-face 73 is moved to permit it to be traversed to a greater or less extent by the ratchet-wheel 37 to secure a greater or less feed of the frame with the drill. Thus as the drill-rod is reciprocated the lever 65 is rocked and the ratchet upon the feed-screw is rotated to feed the drill-frame in the carriage and advance the drill. With this construction it will be seen that the drill is retracted by the cams and that it is thrown forwardly to perform the cutting operation by means of the helical spring 33, and in order to vary the tension of said spring to correspondingly vary the strength of the blow of the drill a yoke-lever 78 is disposed to straddle the rear end of the drill-frame, to which its legs are pivoted, the free ends of the legs lying in slots or recesses 79 in the flanges 27 and 28. A locking-bolt 80 is slidably disposed in the yoke-lever, and coöperating therewith is a notched segment 81 upon the bottom of the drill-frame, this lever being adapted when moved to slide the block 26 toward and away from the ratchet-wheel 31 and correspondingly increase or diminish the force of the blow of the drill.

Upon the cam-shaft 16 and exterior to the drill-frame there is fixed a fly-wheel 82, having a clutch-face 83 at its outer side which is adapted for frictional engagement by a clutch member 84 in the form of a gear-wheel and which latter is rotatably mounted upon the shaft. The clutch member 84 is held normally and yieldably in operative engagement with the clutch-face of the fly-wheel by means of a helical spring 85, which encircles the cam-shaft and lies within the hollow hub of the clutch member, this hub being decreased in interior diameter, as shown at 86, to form a shoulder against which one end of the spring rests, the opposite end of the spring resting against a sleeve 87, which is loosely disposed upon the shaft 16 and is held from longitudinal movement thereon by means of a pin 88, which passes through a perforation in the sleeve and engages a circumferential groove 89 in the shaft. Lugs 90, extending radially from opposite points of the sleeve, slidably engage longitudinal slots in the outer end of the hub of the clutch member 84, causing the sleeve to rotate with the member and permitting longitudinal movement of the member independently of the sleeve.

A bearing-bracket 100 comprises a sleeve 101, the outer portion of which receives the extremity of the cam-shaft 16, while the inner portion thereof is of increased interior diameter and receives the outer end of the sleeve 87. The sleeve 101 lies at right angles to the bracket-arm, and at the outer end of the latter is a bearing 102, which lies at right angles to sleeve 101, and in this bearing is rotatably mounted the drive-shaft 103, having a bevel-gear 104 at its end which engages the gear of the clutch member 84. The teeth of these engaging bevel-gears are of sufficient depth to permit movement of the clutch member into and out of operative relation to the fly-wheel without disengaging the bevel-gears.

To move the clutch member 84 from its operative position, a slotted sleeve 105 is slipped over the sleeves 101 and 87 and has an inwardly-directed flange 106 at its inner end, which engages a peripheral groove 107 in the hub of the clutch member 84 and is held in position by an encircling band 108. Upon the sleeve 101 is a lug 109, having a cam 110 upon its outer face, and this cam is adapted for engagement by a cam 111 upon the inner face of an operating-lever 112, secured to or formed integral with the split sleeve 105, at the outer end of the latter, whereby when said cams are engaged the split sleeve 105 is drawn outwardly and by engagement of its inner flange with member 84 draws it from engagement with the cam-face of the fly-wheel, it being understood that the sleeve 101 bears at its inner end against the outer end of sleeve 87, which is held from movement by pressure of sleeve 101 by reason of the pin which connects it to the shaft against longitudinal movement. Thus by operation of lever 112 the clutch will be released and by moving the lever in an opposite direction the clutch will be engaged by action of the helical spring.

The drive-shaft 103 is operated from a flexible shaft 113, which is rotated by a suitable motor 114, which is in the present instance a gasolene-engine 115, the flexible shaft being connected with the shaft 103 by means of a friction-coupling consisting of a simple split sleeve, the split of which extends only part way of the length of the sleeve, and this split portion is clamped upon the end of the shaft 103 by means of the usual clamping bolts or screws 116, engaging perforated ears 118. The end of the flexible shaft is attached to a rigid section 119, which fits slidingly in the sleeve 120, and has a longitudinal groove or cut-away portion 121 at one side, in which lies a pin 122, passed through the sleeve transversely thereof. This pin permits sliding of the shaft-section in the sleeve and prevents rotation of the shaft-section with respect to the sleeve. On the other hand, the frictional clamping of the sleeve upon the shaft 103 may be so regulated that when the drill-bit jams the sleeve will slip and the parts of the mechanism will not be broken.

A supporting-jack for the drill and motor consists of a bar 125, having a gripping end 126, and at the opposite end is a cross-head 127, with the ends of which are engaged screws 128, these screws being manipulated to engage with their outer ends a block 129 at one side of a shaft, while the gripping end of the rod 125 engages a block at the opposite side of the shaft, whereby the bar may be held firmly in position. In practice the motor is mounted upon the cross-head 127, and the split collar or clamp of the carriage 50 is engaged with the supporting-bar 130, which is ad-

justably connected with the bar 125 by means of a clamp 131 at the end of the supporting-bar. Thus the drill may be moved to operate at any angle, due to the pivotal connection of the drill-carriage with the supporting-bar and the pivotal connection of the supporting-bar with bar 125, and after the blast-holes have been dug the screws may be turned back and the entire apparatus hoisted from the shaft ready for blasting. Furthermore, it will be understood that the supporting-frame for the drill may be adjusted in a drift and the motor may be carried upon a car or in any other manner.

What is claimed is—

1. In a drilling-machine the combination with a carriage and a drill-frame slidably mounted therein, of a reciprocatory drill-rod mounted in the frame and adapted for attachment of a drill-bit thereto, a ratchet upon the rod, a cam-shaft journaled in the frame, a cam upon the cam-shaft and adapted for engagement with the face of the ratchet to repress the drill-rod, a knife-edge carried by the cam for engagement with the teeth of the ratchet to rotate it and the drill-rod, means for returning the drill-rod when released by the cam, a feed-screw engaged with the frame for feeding it and provided with a ratchet, and a lever having a pawl at one end in operative relation to the ratchet on the feed-screw and having a cam-face at the other end for engagement by the ratchet on the drill-rod, to operate the lever and its pawl, said lever being adjustable to permit of the ratchet traversing the cam to a greater or lesser degree to vary the operative movement of the pawl and the feed of the frame.

2. A drilling-machine comprising a carriage, a drill-frame slidably mounted therein and having a reciprocatory drill-rod therein and adapted for attachment of a drill, a ratchet upon the drill-rod, a shaft having a cam for engagement with the face of the ratchet to repress the rod, a knife-edge carried by the cam for engagement with the teeth of the ratchet to rotate the ratchet and therewith the rod, means for returning the rod when released by the cam, a second ratchet slidably engaged with the rod and pawls for engagement with the second ratchet to hold the rod against return rotation, a feed-screw for the frame and having a ratchet, and a lever in operative relation to the ratchet on the drill-rod and the ratchet on the feed-screw for actuating one by the other to feed the frame when the drill is operated.

3. In a drilling-machine, the combination with a carriage and a frame slidably mounted therein, of a feed-screw for the frame and provided with a ratchet, a reciprocatory drill movable in the direction of feed of the frame, a lever pivoted to the frame for movement in a plane parallel with the drill and feed-screw and having a laterally-yieldable end movable at right angles to the pivotal movement of the lever for operative engagement with the ratchet, a cam at the opposite end of the lever, and a projection on the drill disposed for engagement with the cam to operate the lever to actuate the ratchet and feed the frame, said lever being adjustable to permit of the projection traversing the cam to a greater or lesser extent to vary the degree of operative movement of the lever.

4. A drilling-machine comprising a frame having a reciprocatory drill-rod therein, a ratchet on the rod, a shaft having cams for engagement with the face of the ratchet simultaneously at opposite sides of its axis to retract the rod, one of said cams having a knife-edge for engagement with the teeth of the ratchet to rotate the rod, a second ratchet splined to the rod and adapted for adjustment longitudinally thereof, and a helical spring encircling the rod and resting against the ratchets to hold the rod normally projected, said spring being adapted for adjustment by adjustment of said ratchet, said second ratchet having pawls for engagement therewith to hold the rod against return rotation.

5. A drilling-machine comprising a drill-frame having a reciprocatory and rotatable drill-rod journaled therein, a ratchet fixed upon the rod, a shaft having cams for engagement with the face of the ratchet to retract the rod, one of said cams having a knife edge for engagement with the teeth of the ratchet to rotate the rod as it is retracted, a second ratchet slidably engaged with the rod, a helical spring encircling the rod and lying with its ends against the ratchets to hold the rod normally projected, a sleeve containing the second ratchet, means for moving the sleeve to move the ratchet therein and vary the tension of the spring upon the rod, and pawls carried by the sleeve and engaging the second ratchet to hold it against return movement rotatably.

6. A drilling-machine comprising a carriage, a drill-frame slidably engaged with the carriage and having a reciprocatory and rotatable drill-rod mounted therein, a feed-screw carried by the frame parallel with the drill and engaging a threaded perforation of the carriage, a ratchet upon the screw, a lever pivoted to the frame and having a pawl for engaging the ratchet to rotate the screw, said lever being adapted for movement in a plane parallel with the screw and drill and having a cam-face, a ratchet upon the drill-rod for engagement with the cam-face to actuate the lever, and means for engagement with the ratchet on the drill-rod to rotate it and retract it.

7. A drilling-machine comprising a carriage, a drill-frame slidably engaged with the carriage and having a reciprocatory and rotatable drill-rod mounted therein a feed-screw carried by the frame, a nut carried by the carriage and engaged by the screw said screw having a ratchet-wheel thereon, a ratchet fixed upon the drill-rod, a shaft having cams

for engagement with the face of the ratchet upon the rod to retract the rod, one of the cams being adapted for engagement with the teeth of said ratchet to rotate the rod, a lever disposed in the path of movement of the ratchet on the rod for operation thereby and having its opposite end adapted for engagement with the feed-screw ratchet to rotate it and feed the drill-frame, a second ratchet on the drill-rod, a helical spring upon the rod and having its ends disposed against the ratchets thereon, a sleeve receiving the second ratchet, means for moving the sleeve to vary the tension of the spring, and pawls carried by the sleeve and engaging the ratchet therein to hold the rod against return rotation.

8. In a drilling-machine, the combination with a drill-frame and a drill therein, of a shaft for operating the drill and having a clutch member thereon, a gear carried by the clutch member, a sleeve upon the shaft and having a clutch member for coöperation with the first clutch member, a second sleeve on the shaft and having a bracket, a drive-shaft journaled in the bracket and having a gear engaged with the first-named gear, and a common means for holding the gears in coöperative relation and for operating the clutch members.

9. In a drilling-machine, the combination with a drill-frame of a reciprocatory rod therein, a shaft for operating the rod and having a clutch member thereon, a sleeve rotatably mounted on the shaft and having means for holding it from longitudinal movement thereon, a second clutch member mounted on the shaft and having means for holding it normally and yieldably against the first clutch member, a second sleeve inclosing the first sleeve at its outer end and having a lug, a split sleeve encircling the first two sleeves, said split sleeve having a flange engaging a peripheral groove in the hub of the second clutch member and having a cam for engagement with the lug of the second sleeve to move the split sleeve and therewith the second clutch member outwardly from operative engagement, means for operating the split sleeve to operatively engage the lug and cam, a bearing sustained by the second sleeve, a shaft in the bearing and having a bevel-gear, and a bevel-gear on the second clutch member and engaging the first gear.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

JOHN HILL REDFIELD.

Witnesses:
EMIL GRUTT,
D. M. NULTY.