

C. A. HULTQUIST.
ROCK DRILL.

APPLICATION FILED JULY 26, 1910.

Patented Apr. 22, 1913.

3 SHEETS—SHEET 1.

1,059,539.

Fig. 1.

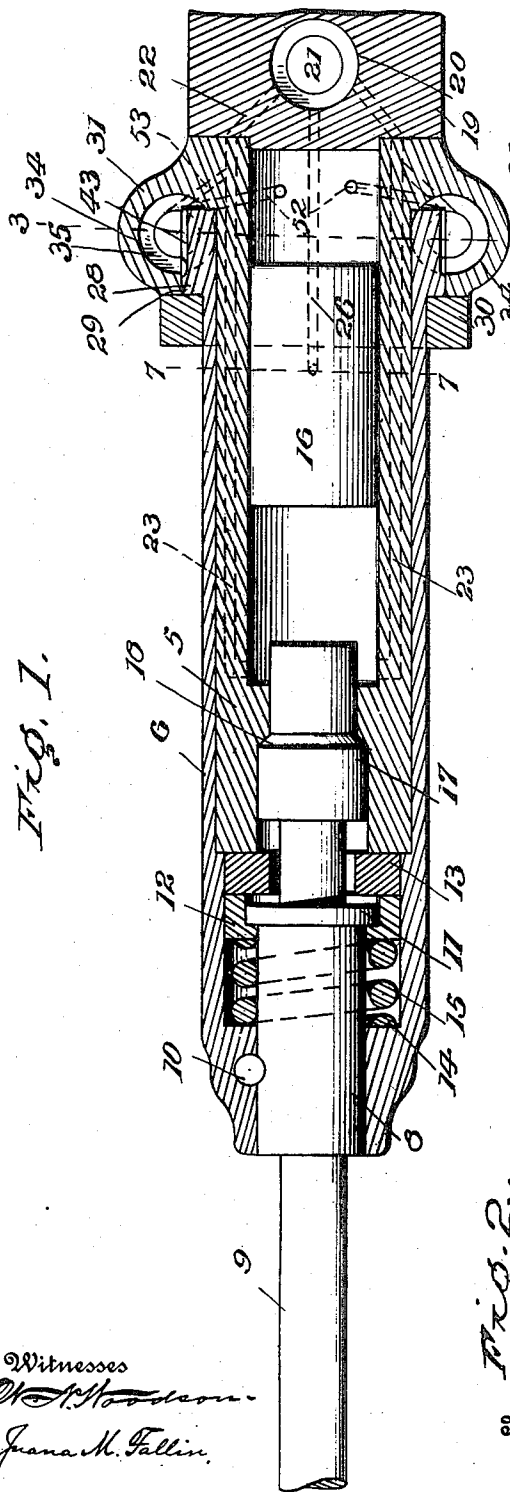
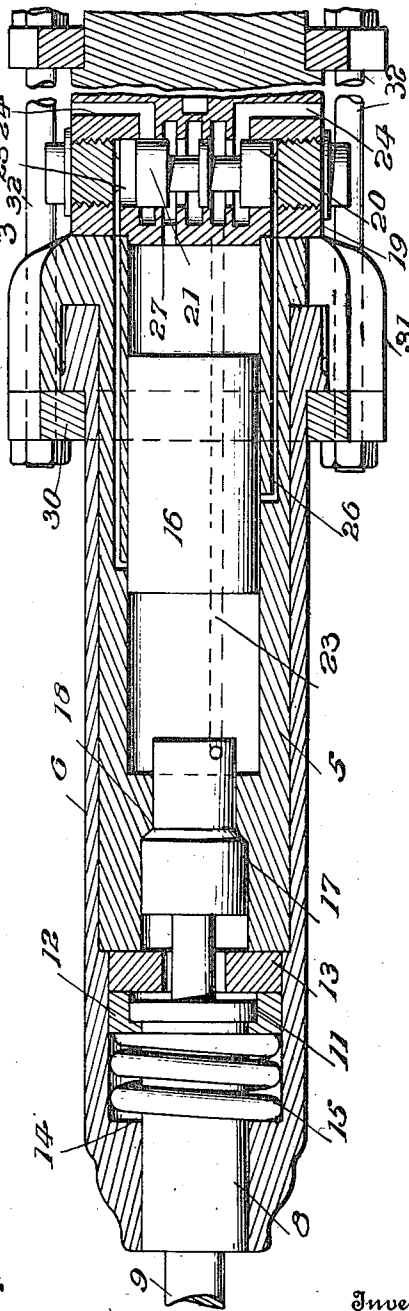


Fig. 2.



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3 SHEETS-SHEET 2.

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Fig. 3.

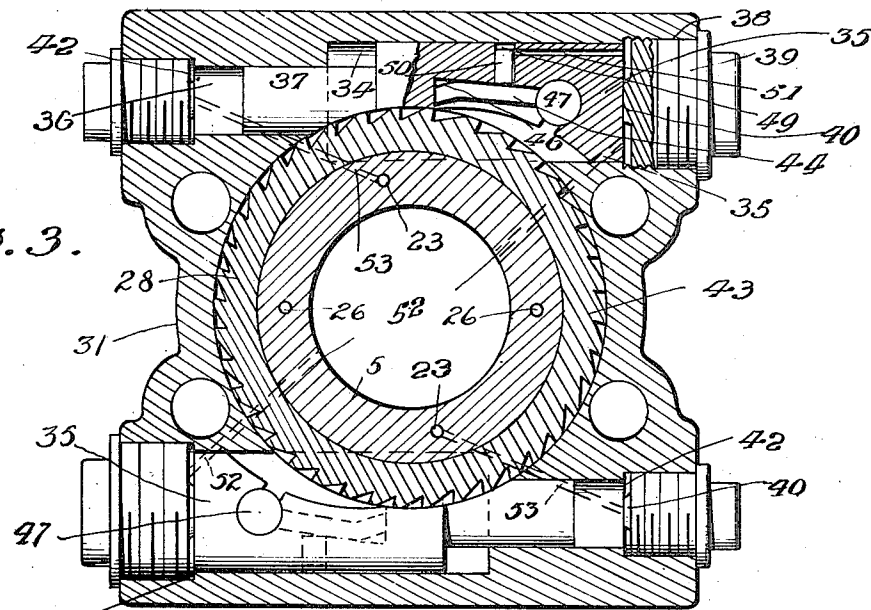
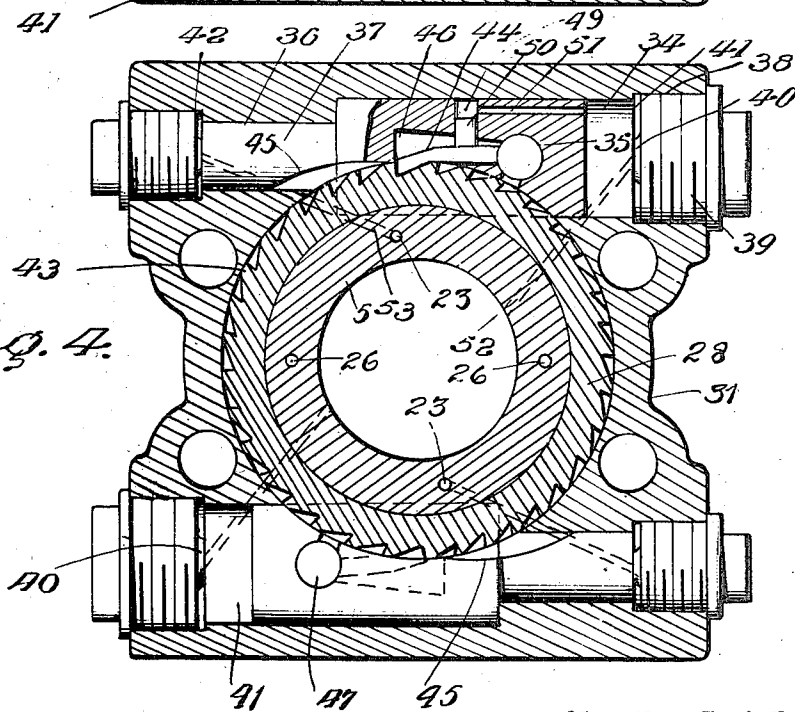


Fig. 4.



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3 SHEETS-SHEET 3.

Fig. 5.

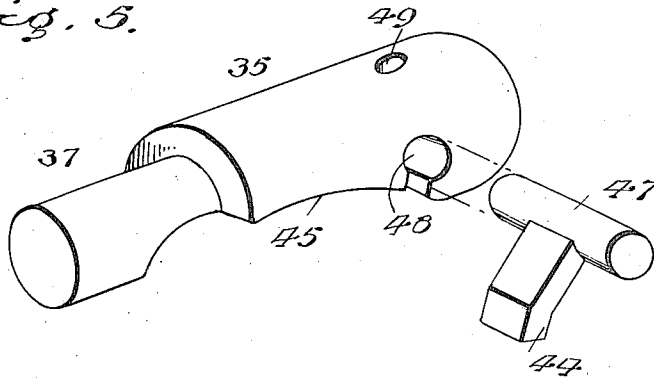


Fig. 6.

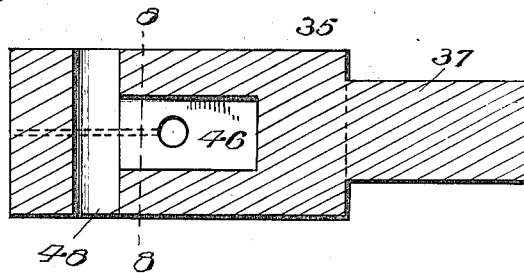


Fig. 8.

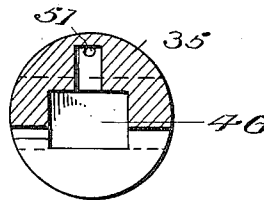
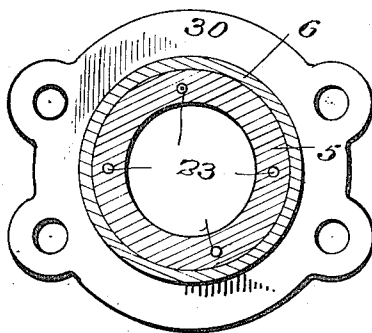


Fig. 7.



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UNITED STATES PATENT OFFICE.

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ROCK-DRILL.

1,059,539.

Specification of Letters Patent.

Patented Apr. 22, 1913.

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To all whom it may concern:

Be it known that I, CHARLES A. HULTQUIST, citizen of the United States, residing at Lowell Station, Bisbee, in the county of Cochise and State of Arizona, have invented certain new and useful Improvements in Rock-Drills, of which the following is a specification.

This invention relates to rock drills and more particularly to means for automatically rotating the cutting tool or bit during the drilling operation.

The object of the invention is to provide a rock drill in which the piston or hammer actuating fluid is utilized for operating the drill rotating mechanism.

A further object is to provide a rock drill including relatively stationary and movable members, one of which supports the drill bit and is provided with ratchet teeth for engagement with co-acting pawls pivotally mounted in suitable fluid actuated pistons carried by the other member.

A further object is to provide a rock drill, the bit rotating mechanism of which is so arranged that when fluid is admitted to the hammer to actuate the latter, a portion of said fluid will be conducted to the pistons, thereby to cause the pawls to engage the ratchet teeth and rotate the bit with a step by step movement during the drilling operation.

A further object is to provide a rock drill, the construction of which is such as to balance the twisting thrust on the movable cylinder, thus to reduce friction between the parts and consequently increase the efficiency of the machine.

Further objects and advantages will appear in the following description, it being understood that various changes in form, proportions and minor details of construction may be resorted to within the scope of the appended claims.

For a full understanding of the invention and the merits thereof, reference is to be had to the following description and accompanying drawings, in which:

Figure 1 is a longitudinal sectional view of a rock drill constructed in accordance with the present invention; Fig. 2 is a similar plan view taken at right angles to Fig. 1; Fig. 3 is a transverse sectional view taken on the line 3—3 of Fig. 1, showing the pistons at the beginning of their working

stroke; Fig. 4 is a similar view, showing the pistons at the end of their working stroke; Fig. 5 is a perspective view of one of the pistons detached, the pawl of said piston being shown in position to enter a seating recess; Fig. 6 is a longitudinal sectional view of one of the pistons; Fig. 7 is a transverse sectional view taken on the line 7—7 of Fig. 1; Fig. 8 is a transverse sectional view taken on the line 8—8 of Fig. 6 of one of the pawl carrying pistons.

Corresponding and like parts are referred to in the following description and indicated in all the views of the drawings by the same reference characters.

The improved rock drill forming the subject matter of the present invention comprises a relatively stationary main cylinder 5 and a movable cylinder or casing 6, the latter being provided with a bushing 8, preferably angular in cross section for the reception of a correspondingly shaped bit or tool 9. The bushing 8 is retained in position on the movable member or cylinder 6 by a transverse locking key 10, the inner end of said bushing being provided with a flange 11 which engages an inwardly extending flange on a collar 12. Interposed between the collar 12 and the adjacent end of the main cylinder 5, is a second collar 13, and interposed between said collar 12 and a shoulder 14 formed in the movable member 6, is a coil spring 15 which serves to receive and absorb the impact of the blow of the hammer 16 when drilling in soft ground or when the bit enters a depression or hole in a rock, thus to prevent undue strain on the working parts of the drill.

The outer end of the cylinder 5 is provided with a seating recess for the reception of a tappet 17, said tappet being provided with an enlarged head which engages the adjacent end of the bit 9 and is provided with an inclined stop shoulder 18 for engagement with a correspondingly inclined stop shoulder formed in the main cylinder, as best shown in Fig. 1 of the drawings.

Bearing against the inner end of the main cylinder 5, is a valve chest 19 having a seat 20 formed therein for the reception of a valve 21. The valve chest 19 is provided with oppositely disposed inlet ports 22 which communicate with longitudinal passages 23 opening into the main cylinder at the front of the hammer 16, there being angularly dis-

posed exhaust ports 24 also formed in the valve chest 19 and communicating with the atmosphere at the opposite ends of said valve chest. The valve 21 is provided with oppositely disposed chambers 25, there being a passage or conduit 26 forming a source of communication between one of said chambers and the front end of the cylinder, and a similar passage or conduit connecting the other chamber and rear end of the main cylinder so as to allow a portion of the fluid from the cylinder to enter said chambers and shift the position of the valve.

An inlet port 27 opens into the main cylinder at the rear of the hammer and through which fluid is admitted to said hammer for starting the latter on its working stroke.

The inner end of the movable member or cylinder 6 is provided with an annular collar 28 defining oppositely disposed shoulders 29, one of which bears against a retaining ring 30, while the other is seated within a casting or enlargement 31, preferably formed integral with the inner cylinder 5, as shown. The shoulders 29, by engagement with the retaining ring and enlargement 31, serve to prevent longitudinal movement of the movable cylinder 6, while at the same time permitting said cylinder to revolve on the main cylinder without undue friction between the parts. The ring 30 is retained in position by means of tie rods or bolts 32, which latter extend through perforations formed in said ring and enlargement 31, and also through perforations formed in lugs 33 formed on the valve chest. The enlargement or casting 31 is cored or hollowed out to produce oppositely disposed chambers 34 in which are slidably mounted fluid actuated pistons 35, one end of each chamber being reduced at 36 to accommodate a correspondingly shaped extension 37 formed on one end of the adjacent piston 35. The interior walls of the chambers 34 are threaded at 38 for engagement with removable plugs 39, the inner faces of said plugs being provided with lugs 40 defining circumferential chambers 41 and 42.

The outer face of the collar 28 is serrated to form ratchet teeth 43, which latter are engaged by suitable pawls 44 carried by the pistons 35. One face of each piston and its extension 37 is cut-away, as indicated at 45 to accommodate the collar 28, there being seating recesses 46 formed in the pistons at the cut-away portions thereof to receive the pawls 44. The pawls 44 are each provided with a cylindrical body portion 47 which fits within a correspondingly shaped recess 48 formed in the adjacent piston 35 so as to allow free pivotal movement of the pawl within the seating recess 46, while at the same time preventing accidental displacement of said pawl.

Intersecting the seating recess 46 of each

piston 35, is an opening 49 in which is seated a plunger 50, there being a passage or conduit 51 forming a source of communication between the chamber 41 and the adjacent opening 49, and through which air or other fluid is admitted to the plunger 50 for the purpose of forcing the free end of the pawl 44 into engagement with the ratchet teeth 43. The pistons 35 are made of differential diameters as more power is required for the working stroke than for the return stroke.

A passage or conductor 52 forms a source of communication between each chamber 41 and the interior of the main cylinder 5 at the rear of the hammer 16 so that when fluid is admitted to said hammer to start the latter on its working stroke, a portion of the fluid will pass through the passages 52 to the chambers 41 and thus cause the pawls 44 to engage the ratchet teeth 43 and partially rotate the movable cylinder 6 carrying the bit or working tool, some of the fluid being conducted through the passage 51 to the plunger 50 and serving to hold the active end of the pawl in engagement with the ratchet teeth during the rotation of the movable cylinder. A passage 53 also forms a source of communication between each chamber 42 and the adjacent passage 23 so that when fluid is admitted through the passages 23 to the front of the hammer 16 to start the latter on its return stroke, a portion of the fluid in the main cylinder at the front of said hammer 16 will be conducted through the passages 53 to the chambers 42 and return the pistons 35 to normal position, the pawls 44 riding loosely over the ratchet teeth 43 during the retraction of said pistons. As the pistons 35 are retracted, the fluid in the chambers 41 will exhaust through the passages 52 into the main cylinder 5 at the rear of the hammer 16, and thence pass through the inlet port 27, valve 21 and exhaust ports 24 to the atmosphere. On the forward movement of each piston 35, the air in the chambers 42 will pass through the passages or conduits 53 into the passages 23 to the front of the hammer 16 where it exhausts together with the cylinder exhaust. Thus it will be seen that on the working stroke of the hammer 16, a portion of the actuating fluid at the rear of the piston will enter the cylinders 34 to operate the pistons 35 and rotate the movable cylinder and bit with a step by step movement, thus obviating the necessity of manually rotating the bit during the drilling operation.

While it is preferred to rotate the movable cylinder 6 and bit on the working stroke of the hammer, it will of course be understood that the bit may be rotated on the return stroke of the hammer with equally good results.

It will here be noted that by having the pistons 35 disposed on opposite sides of the

casting or enlargement 31, the twisting thrust on the movable member or casing 6 is preferably balanced, thus reducing friction between the parts and consequently increasing the efficiency of the machine.

Having thus described the invention, what is claimed as new is:

1. A fluid pressure actuated rock drill including an inner cylinder, an outer cylinder rotatably mounted on the inner cylinder and provided with means for supporting a bit, a hammer mounted to reciprocate within the inner cylinder, a circumferential row of ratchet teeth on the outer cylinder, fluid pressure actuated means operating simultaneously on diametrically opposite portions of the row of ratchet teeth to rotate the outer cylinder with a step by step movement during the reciprocation of the hammer, and a single valve arranged transversely to the axes of the cylinders to admit pressure fluid simultaneously to the hammer and said fluid-pressure actuated means.

2. A fluid pressure actuated rock drill including an inner cylinder, an outer cylinder rotatably mounted thereon and formed with a circumferential row of ratchet teeth at its rear end and provided at its front end with means for supporting a bit, a hammer mounted for reciprocation within the inner cylinder, a casting on the rear end of the inner cylinder having oppositely disposed chambers formed therein opening through its opposite sides, pistons mounted to reciprocate in opposite directions in said chambers, pawls carried by the pistons and adapted to simultaneously engage the ratchet teeth at diametrically opposite portions of the outer cylinder for rotating the same with a step by step movement, and a single valve arranged at the rear end of the casting to simultaneously admit fluid to both chambers and to said hammer whereby the bit-supporting member will be continuously rotated in one direction during the reciprocation of the hammer.

3. A fluid pressure actuated rock drill including an inner cylinder, an outer cylinder rotatably mounted thereon and having ratchet teeth at its rear end and provided at its front end with means for supporting a bit, a casting carried at the rear end of the inner cylinder and provided with oppositely disposed chambers opening through its opposite sides, removable closures for the opposite ends of said chambers, a hammer mounted to reciprocate within the inner cylinder, pistons mounted to reciprocate in opposite directions within the chambers of the casting, pawls pivotally mounted in the pistons to engage the ratchet teeth on opposite sides of the outer cylinder, fluid pressure operated means acting on the pawls for normally holding said pawls in engagement with the ratchet teeth, and a single valve at

the rear of the casting for simultaneously controlling the flow of fluid to the pistons, the pawls and the hammer.

4. A fluid pressure actuated rock drill including relatively stationary and rotatable cylinders, means carried by one end of the rotatable cylinder for supporting a bit, a collar formed on the opposite end of said cylinder and provided with ratchet teeth, said collar defining oppositely disposed annular shoulders, a hammer mounted to reciprocate within the stationary cylinder, a casting carried by the stationary cylinder against one of said annular shoulders and provided with chambers at opposite sides of its longitudinal axis, said chambers opening through opposite sides of the casting, removable closures for the ends of said chambers, a retaining ring bearing against the opposite annular shoulder, pistons mounted to reciprocate in opposite directions within the chambers, pawls carried by the pistons and adapted to simultaneously engage the opposite sides of the ratchet teeth for rotating the bit-supporting member with a step by step movement, and a single valve for simultaneously controlling the flow of fluid to said chambers and the hammer.

5. A fluid pressure actuated rock drill including relatively stationary and rotatable cylinders, the rotatable cylinder being provided at one end with means for supporting a bit, ratchet teeth formed on the opposite end of said cylinder, a hammer mounted for reciprocation within the stationary cylinder, a casting around the rear ends of the cylinders having oppositely disposed parallel chambers formed therein opening through its opposite sides, each chamber being larger at one end than at the other end, removable plugs of different diameters forming closures for the opposite ends of the cylinders, pistons mounted to reciprocate in opposite directions within the enlarged portions of the chambers and provided with reduced extensions operating within the smaller portions of said chambers, pawls pivotally mounted on the larger portions of the pistons and adapted to simultaneously engage the ratchet teeth at diametrically opposite points, and a single valve at the rear of the casting to simultaneously admit fluid to said chambers and hammer.

6. A fluid pressure actuated rock drill including relatively stationary and rotatable cylinders, one of which is provided with means for supporting a bit and the other with longitudinally disposed fluid passages, a hammer mounted to reciprocate within the stationary cylinder, ratchet teeth formed on the rotatable cylinder, a casting around the rear ends of the cylinders having spaced chambers formed therein and opening through its opposite sides, removable closures for the ends of the chambers, pistons

mounted for reciprocation in opposite directions within said chambers, pawls pivotally mounted on the pistons, there being passages forming a source of communication between one end of each chamber and the interior of the stationary cylinder at the front of the chamber and similar passages forming a source of communication between the opposite end of each chamber and the fluid passages formed in said stationary cylinder, and a single valve at the rear end of the casting controlling the admission of fluid to the chambers and the hammer.

7. A fluid pressure actuated rock drill including relatively stationary and rotatable cylinders, one of which is provided with means for supporting a bit, ratchet teeth formed on the rear end of the rotatable cylinder, a hammer mounted to reciprocate within the stationary cylinder, a casting around the rear ends of the cylinders having chambers formed therein above and below and transversely to the cylinders and opening through the opposite sides of the casting, the interior walls of said chambers being threaded at their ends, correspondingly threaded plugs forming removable closures for the opposite ends of the chambers and provided at their inner ends with inwardly extending lugs defining fluid receiving compartments at the ends of the chambers, pistons mounted to reciprocate in opposite directions within the chambers, pawls pivotally mounted in the pistons and adapted to simultaneously engage the ratchet teeth at diametrically opposite points, and a valve for simultaneously controlling the admission of fluid to the chambers and hammer, there being fluid passages extending from the chambers at said plugs through the casting and stationary cylinder for conducting a portion of the fluid to the pistons.

8. A fluid pressure actuated rock drill including relatively stationary and movable members, one of which is provided with means for engagement with a bit, a hammer mounted for reciprocation within the stationary member, a casting having oppositely disposed chambers formed therein, ratchet teeth formed on the movable member, pis-

tons mounted for reciprocation in opposite directions within said chambers and provided with seating recesses having openings communicating therewith, pawls pivotally mounted in said recesses, plungers slidably mounted in the openings in the pistons, and means for simultaneously controlling the admission of fluid to the chambers and hammer, respectively, there being passages formed in the pistons for admitting fluid to the plungers, thereby, to simultaneously force the pawls in engagement with the ratchet teeth at diametrically opposite points to effect the continuous rotation of said bit supporting member during the reciprocation of the hammer.

9. A fluid pressure actuated rock drill including relatively stationary and movable cylinders, one of which is provided with means for supporting a bit, a collar carried by the movable cylinder and provided with ratchet teeth, a hammer mounted for reciprocation within the stationary cylinder, a casting provided with oppositely disposed chambers, pistons mounted for reciprocation in opposite directions within said chambers and each having one side thereof cut-away to accommodate the collar and provided with a seating recess having an opening communicating therewith, said pistons being provided with cylindrical openings communicating with the adjacent seating recesses, pawls having cylindrical portions seated in the cylindrical openings and adapted to simultaneously engage the ratchet teeth at diametrically opposite points on the collar for rotating the bit supporting member with a step by step movement, plungers mounted in the openings and bearing against the pawls, means for admitting fluid to the opposite ends of the pistons, and means for conducting a portion of the fluid to the plungers, thereby to force the pawls into engagement with the ratchet teeth.

In testimony whereof, I affix my signature in presence of two witnesses.

CHARLES A. HULTQUIST. [L. s.]

Witnesses:

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P. T. McRAE.