Aug. 5, 1941. J. C. CURTIS 2,251,269

ROCK DRILL

Original Filed Feb. 6, 1939

Fig. 1.

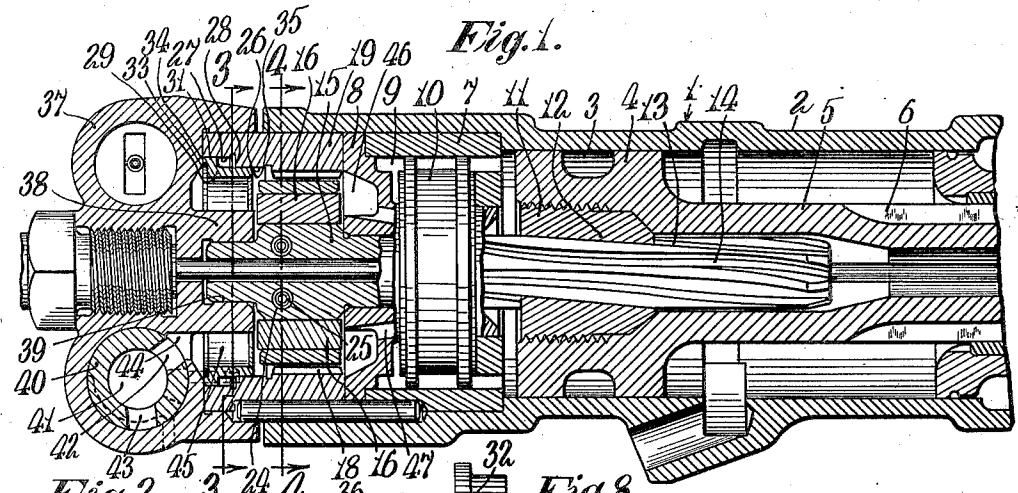


Fig. 2.

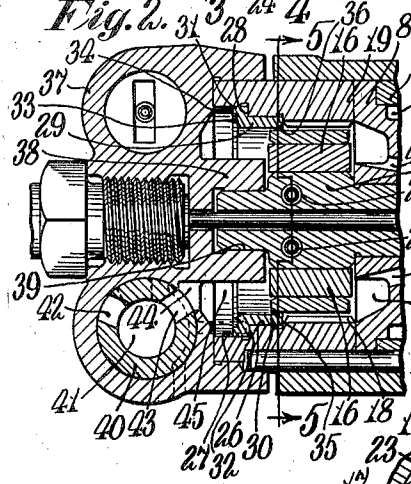


Fig. 8.



Fig. 3.

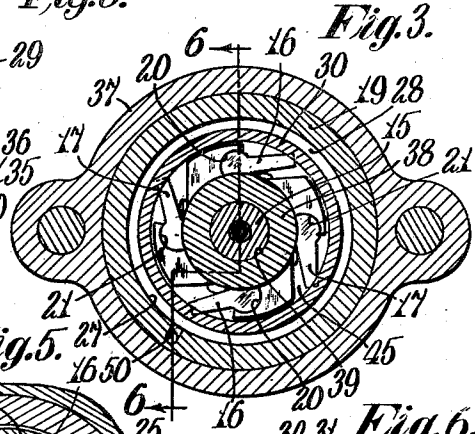


Fig. 5.

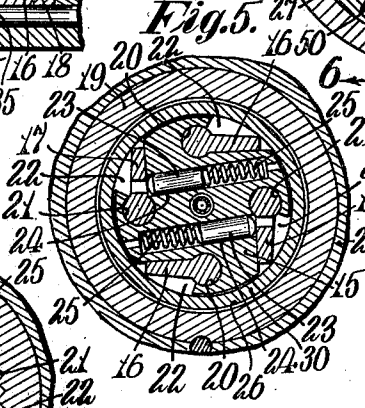


Fig. 6.

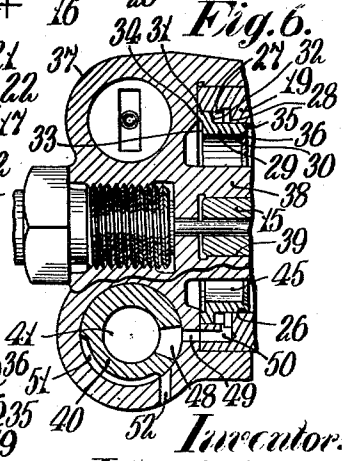


Fig. 4.

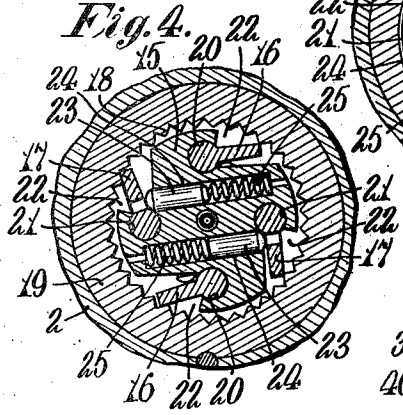
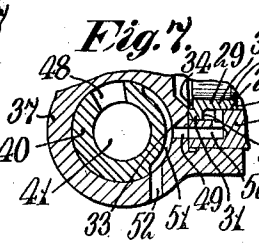


Fig. 7.



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Patented Aug. 5, 1941

2,251,269

UNITED STATES PATENT OFFICE

2,251,269

ROCK DRILL

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Application February 6, 1939, Serial No. 254,876
Renewed April 18, 1940

15 Claims. (Cl. 121—7)

This invention relates to rock drills and more particularly to means for controlling the rotation of working implements or drill steels actuated by hammer rock drills.

In rock drills, rotation of the drill steel is usually effected by a pawl and ratchet mechanism operating in conjunction with the hammer piston of the drill hammer motor. During one stroke of the hammer piston, preferably the return stroke, the pawls coact with the ratchet teeth to effect rotation of the drill steel, and during the opposite stroke of the hammer piston the pawls slip over the ratchet teeth, permitting the stroke to be made without rotation of the steel. It is desirable in such drills, during spotting of a hole or in case the drill steel becomes stuck in the hole, to release elements of the rotation mechanism from the hammer piston so that the latter may reciprocate without steel rotation, this usually being accomplished by holding the pawls out of engagement with the teeth of the ratchet ring.

It is an object of this invention to provide an improved means for controlling the rotation of a working implement in a rock drill. It is another object of this invention to provide an improved means, operative at will, for rendering the rotation mechanism of a rock drill ineffective to rotate the working implement. It is still another object of this invention to provide an improved means for holding the pawls of a rotation mechanism from engagement with the teeth of a ratchet to prevent rotation of the drill steel at will. It is still another object of this invention to provide an improved manually controlled, pressure fluid operated means for engaging the pawls of a rotation mechanism and holding the pawls from engagement with the teeth of a ratchet or for releasing the pawls for engagement with the teeth of the ratchet at the will of the operator. Yet another object is to provide an improved rotation release means which is associated in an improved manner with the fluid distribution means of the drill, and preferably controlled by the throttle valve of the drill hammer motor. Other objects and advantages will, however, hereinafter more fully appear.

In the accompanying drawing there is shown for purposes of illustration one form which the invention may assume in practice.

In this drawing—

Fig. 1 is a view in longitudinal vertical section through a hammer rock drill in which an illustrative embodiment of the invention is incorporated.

Fig. 2 is a fragmentary view in vertical section, similar to Fig. 1 but showing the rotation control means in a different position.

Fig. 3 is a cross sectional view taken on the line 3—3 of Fig. 1.

Fig. 4 is a cross sectional view taken on the line 4—4 of Fig. 1.

Fig. 5 is a cross sectional view taken on the line 5—5 of Fig. 2.

Fig. 6 is a view in vertical section taken substantially on the line 6—6 of Fig. 3.

Fig. 7 is a sectional view in the plane of Fig. 6, showing the throttle valve in a different position.

Fig. 8 is a side elevational view of the rotation control member per se, a portion being shown in vertical section.

In this illustrative construction there is shown in Fig. 1 a drill hammer motor, generally designated 1, having a cylinder 2 provided with a bore 3 containing a reciprocatory hammer piston 4. The hammer piston has an elongated extension 5 of reduced cross section for delivering blows to the shank of a conventional working implement or drill steel, not shown. Formed on the extension 5 are straight grooves 6 slidingly interlocked with straight keys on a chuck member (not shown) to effect rotary movement of the working implement in accordance with the rotative movement of the hammer piston. At the rear end of the cylinder bore is a combined rear cylinder head and valve box 7 and a valve box cover 8, the parts 7 and 8 cooperating to provide a valve chamber 9 in which is mounted an automatic, fluid-actuated, fluid distributing valve 10. The valve is adapted to control the flow of pressure fluid through suitable ports and passages to the bore 3 of the motor cylinder to effect reciprocation of the hammer piston 4, in a manner well known to those skilled in the art.

Rigidly secured within the piston 4 is a rifle nut 11 having spiral keys 12 slidingly interlocked with spiral grooves 13 formed on a rifle bar 14. Formed integrally with the rear end of the rifle bar is a pawl carrier 15 which carries two pairs of pawls 16 and 17. These pawls cooperate with the teeth 18 of a ratchet ring 19 suitably secured within the rear end of the cylinder 2 and seated against the valve box cover 8. The pairs of pawls 16 and 17 are, in this instance, elongated so that they project rearwardly a substantial distance with respect to the ratchet teeth and are herein suitably pivotally supported in sockets 20 and 21, respectively, in the pawl carrier 15, these sockets being generally cylindrical and opening

into spaces 22 formed by cutting away of the periphery of the pawl carrier. To maintain the pawls in yielding engagement with the ratchet teeth 18, pawl-engaging plungers 23 are provided, these plungers being disposed in bores 24 extending chordally of the pawl carrier and being pressed yieldingly against the inner surfaces of the pawls by springs 25. Formed in the rear portion of the ratchet ring is a bore 26 opening into the portion of the ring carrying the ratchet teeth, said bore shown as having a diameter slightly larger than the internal diameter of the ratchet ring measured to the base of the teeth 18. This diameter is not essential, although it must be sufficiently great to permit a control member within the bore 26 to engage the ends of the pawls as they ride over the ends of the ratchet teeth, and hold them from engagement with the teeth in a manner which will shortly be described. A larger bore 27, also formed in the ratchet ring in coaxial relation with the bore 26, completes the opening through the ratchet ring 19 and forms at its junction with the bore 26, a shoulder 28.

In accordance with this invention, means are provided for engaging the pawls 16 and 17 and holding them from contact with the ratchet teeth when conditions are established to effect actuation of the means into a pawl-engaging position. This means comprises a member 29 having sleeve portions 30 and 31 fitting respectively the bores 26 and 27. The member 29 is adapted to be actuated and held in its limiting positions by pressure fluid and is accordingly provided with a pressure surface 32 against which pressure fluid acts to move the member 29 to its rearward inactive position, and pressure surfaces 33 and 34 against which pressure fluid acts to move the control member 29 to its forward pawl engaging and holding position when pressure fluid is vented from the surface 32. The sleevelike portion 30 of the control member is provided with a front plane end surface 35 and this surface at its inner edge is beveled slightly as at 36, and the surface 35, when the control member is moved in a forward direction, frictionally engages the end surfaces of the rearwardly extending ends of the elongated pawls, and as the pawls slip over the ratchet teeth this frictional engagement of the end surface 35 with the pawl ends holds the pawls from engagement with the ratchet teeth against the action of the spring pressed plungers, and when all four pawls are out of engagement with the ratchet teeth, the sleeve portion 30 of the control member, as the latter moves forwardly, slides over the tooth engaging ends of the pawls to lock the pawls in their released position within the sleeve bore. The surfaces 35 and 36 are of course subjected to the action of pressure fluid when the throttle valve is open, and tend to offset the effect of the pressure fluid acting on the surfaces 33 and 34. It has been found that the beveled surface 36 on the control member 29 may be omitted and that the forward edge of the unbeveled control member at the inner edge thereof may frictionally engage the rearwardly projecting ends of the pawls as the pawls slip over the ratchet teeth and hold them out of engagement with the ratchet teeth. When all four pawls are out of engagement with the ratchet teeth, the control member 29 may move forwardly into its extreme forward position, and as the control member moves forwardly the walls of the sleeve bore move over the pawls to hold them within the sleeve portion of the control member.

Disposed on the rear end of the ratchet ring is a rear head block 37 having a central annular projection 38 providing a bearing 39 for the rear end of the rifle bar 14. Arranged transversely of the head block 37 is a throttle valve 40 having a central supply chamber 41 and radial passages 42 and 43 for connecting the supply chamber 41 with a supply passage 44 formed in the head block and communicating with an annular chamber 45 surrounding the annular projection 38. The annular chamber 45 communicates through the open center of the control member 29 and through the spaces formed between the ratchet teeth with an annular recess 46 formed in the rearward face of the valve box cover 8. The recess 46 is connected by a series of passages 47 through the valve box cover 8 with the valve chamber 9. A radial passage 48 in the throttle valve 40 connects the supply chamber 41 with a passage 49 in the head block (as shown in Fig. 6) when the throttle valve is in a position to connect the radial passage 42 with the supply passage 44. Connecting with the passage 49 is a passage 50 in the ratchet ring, which opens through the wall of the ratchet ring at the inner end of the bore 27. A groove 51 formed in the periphery of the throttle valve 40 is adapted to connect the passage 49 with a vent 52 in the head block (as shown in Fig. 7) when the throttle valve is in position to connect the radial passage 43 with the supply passage 44.

The mode of operation of the improved rotation control means will be clearly apparent from the description given. When the throttle valve 40 is in the position shown in Figs. 1 and 6, pressure fluid is conducted from the supply chamber 41 through the radial passage 42, supply passage 44, annular chamber 45, through the spaces between the ratchet teeth to the annular recess 46, and through the passages 47 to the valve chamber 9, where it is distributed by the valve 10 through suitable passages to the cylinder bore 3 to effect reciprocation of the hammer piston 4. As the pressure fluid passes through the annular chamber 45, it acts against the pressure surface 33 on the control member 29 and tends to move the member 29 in a forward direction. The effect of this is somewhat offset by the action of the pressure fluid on surfaces 35 and 36. At the same time pressure fluid flows from the supply chamber 41 through the radial passage 48 in the throttle valve and through the passages 49 and 50 in the head block and ratchet ring against the pressure surface 32 on the control member 29. Since the pressure acting against the surface 33 is substantially less than that acting against the surface 32, due to the flowing action of the pressure fluid to operate the hammer piston, and since the pressure on the areas 35 and 36 partially offsets the pressure on the area 33, the control member 29 will be held in its rearward position. If the control member 29 is in its forward position when the throttle valve is rotated to connect the radial passage 42 with the supply passage 44 and the radial passage 48 with the passage 49, the pressure acting on the surfaces 33 and 34 will be partially counteracted by the pressure acting on surfaces 35 and 36 at the forward end of the control member 29, and the pressure on the surface 32, being greater than that on the oppositely facing surfaces 33 and 34, will force the control member 29 to its rearward position.

When the control member 29 is in its rearward position, the pawls are pressed into engagement with the ratchet teeth by the spring-pressed plungers 23 to hold the rifle bar against rotation in one direction but to permit its rotation in the opposite direction. The keys on the rifle nut and the grooves in the rifle bar are so spiraled that movement of the hammer piston over the rifle bar in a forward direction causes the rifle bar to turn in its freely rotating direction. When the hammer piston moves in its rearward direction, the rifle bar is held against rotation by the engagement of the pawls with the ratchet teeth, and the piston is caused to rotate, at the same time effecting rotation of the drill steel.

If the drill steel becomes stuck in the hole or for any other reason, such as hole spotting, it is desirable to disconnect the rotation mechanism, the throttle valve 40 may be rotated into a position to connect the vent 52 to the passage 49 through the groove 51. When the throttle valve is in this position, pressure is vented from the surface 32 of the control member 29 and at the same time pressure fluid flows through the radial passage 43 to the valve chamber to continue reciprocation of the hammer piston. Pressure fluid flowing through the radial passage 43 acts on the pressure surface 33 to move the control member 29 into engagement with the projecting ends of the pawls. As the pawls ride over the tooth engaging ends of the ratchet teeth, they are frictionally engaged by the forward end of the control member 29, and when all the pawls are so engaged the pressure on the surfaces 33 and 34 forces the control member 29 over the tooth engaging ends of the pawls to hold them from engagement with the ratchet teeth. The rifle bar is then free to move in either direction, and rotation of the hammer piston and drill steel is discontinued. After the hammering of the piston releases the drill steel or spotting of the hole is completed, the throttle valve may be moved to the position in which pressure fluid is conducted to the pressure surface 32 to move the control member 29 to its rearward position again and to continue operation of the hammer motor with rotation of the drill steel.

As a result of this invention, it will be noted that an improved drilling mechanism is provided wherein rotation of the drill steel may be controlled in a very simple and efficient manner. It will further be noted that by arranging the control member in the manner disclosed, the rotation mechanism is not only controlled in an improved manner, but also the pressure fluid flows through the control member to the distribution means of the motor, thereby making it possible to take advantage of the pressure differential produced by such fluid flow. Further, the control means, due to improved arrangement and its simplified control, is a substantial advance over known devices of like character.

While there is in this application specifically described one form of the invention, it will be understood that this form is shown for purposes of illustration only, and that the invention may be modified and embodied in various other forms without departing from its spirit or the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent is:

1. In a rock drill, in combination, a cylinder having a bore, a piston reciprocably mounted in said bore, a distribution valve for distributing pressure fluid to said cylinder bore to effect reciprocation of said piston, means for supplying pressure fluid to said distribution valve, a rotation mechanism comprising a rifle bar having a spiral grooves slidingly interlocked with said piston, a pawl carrying member formed on said rifle bar, a ratchet ring having ratchet teeth, pawls carried by said pawl carrying member and engaging the teeth of said ratchet ring to prevent rotation of said rifle bar in one direction, a control member mounted for movement relative to said ratchet ring and having control surfaces for engaging said pawls as the latter slip over the ratchet teeth to hold said pawls from engagement with said ratchet ring, means for actuating said control members to engage and hold said pawls as aforesaid including a pressure surface against which pressure fluid acts as it flows to said distribution valve, and valve means for controlling the flow of pressure fluid to said distribution valve.

2. In a rock drill, in combination, a cylinder having a bore, a piston reciprocably mounted in said bore, a distribution valve for distributing pressure fluid to said cylinder bore to effect reciprocation of said piston, a rotation mechanism comprising a rifle bar having spiral grooves slidingly interlocked with said piston, a pawl carrying member formed on said rifle bar, a ratchet ring having ratchet teeth, pawls carried by said pawl carrying member and engaging the teeth of said ratchet ring to prevent rotation of said rifle bar in one direction, a sleeve reciprocably mounted for movement relative to said ratchet ring and having surfaces engaging said pawls as the latter slip over the ratchet teeth to hold said pawls from engagement with said ratchet ring, means for supplying pressure fluid to said distribution valve through said sleeve, means for actuating said sleeve to engage and hold said pawls including a pressure surface against which pressure fluid acts as it flows to said distribution valve, and valve means for controlling the flow of pressure fluid to said distribution valve.

3. In a rock drill, in combination, a cylinder having a bore, a piston reciprocably mounted in said bore, a distribution valve for distributing pressure fluid to said cylinder bore to effect reciprocation of said piston, means for supplying pressure fluid to said distribution valve, a rotation mechanism comprising a rifle bar having spiral grooves slidingly interlocked with said piston, a pawl carrying member formed on said rifle bar, a ratchet ring, pawls carried by said pawl carrying member and engaging said ratchet ring to prevent rotation of said rifle bar in one direction, a control member mounted for movement relative to said ratchet ring and having control surfaces for controlling engagement of said pawls with said ratchet ring, means for actuating said control member including opposed pressure surfaces on said member, and means for supplying pressure fluid to said pressure surfaces simultaneously.

4. In a rock drill, in combination, a cylinder having a bore, a piston reciprocably mounted in said bore, a distribution valve for distributing pressure fluid to said cylinder bore to effect reciprocation of said piston, a rotation mechanism comprising a rifle bar having spiral grooves slidingly interlocked with said piston, a pawl carrying member formed on said rifle bar, a ratchet ring, pawls carried by said pawl carrying member and engaging said ratchet ring to prevent rotation of said rifle bar in one direction, a sleeve

reciprocably mounted in said ratchet ring for controlling engagement of said pawls with said ratchet ring, means for supplying pressure fluid to said distribution valve through said sleeve, means for actuating said sleeve including opposed pressure surfaces on said sleeve, and means for supplying pressure fluid to said pressure surfaces simultaneously, one of said pressure surfaces being subjected to pressure fluid flowing to said distribution valve.

5. In a rock drill, in combination, a cylinder having a bore, a piston reciprocably mounted in said bore, a distribution valve for distributing pressure fluid to said cylinder bore to effect reciprocation of said piston, a rotation mechanism comprising a rifle bar having spiral grooves slidingly interlocked with said piston, a pawl carrying member formed on said rifle bar, a ratchet ring, pawls carried by said pawl carrying member and engaging said ratchet ring to prevent rotation of said rifle bar in one direction, a sleeve reciprocably mounted in said ratchet ring for controlling engagement of said pawls with said ratchet ring, means for actuating said sleeve including opposed pressure surfaces on said sleeve, means for supplying pressure fluid to said distribution valve through said sleeve, thereby subjecting to pressure one of said pressure surfaces, a vent for the other of said pressure surfaces, and means for venting said last mentioned pressure surface while pressure fluid is being supplied to said distribution valve.

6. In a rock drill, the combination with a fluid-actuated hammer motor having a reciprocatory hammer piston for percussively actuating a drill steel and means operated by said hammer piston for intermittently rotating the drill steel including a ratchet and pawl mechanism, of means operable at the operator's will for interrupting drill steel rotation while reciprocation of the hammer piston continues comprising a fluid-actuated control member arranged coaxially with and movable relative to the ratchet and pawl mechanism and operable to engage the pawls to effect holding of the pawls from engagement with the ratchet teeth, said control member having opposed differential pressure areas constantly subjected to pressure fluid during running of the hammer motor and another pressure area subjected to line pressure fluid and valve controlled for holding said control member in one position, and valve controlled means for venting said last mentioned pressure area when it is desired to effect movement of said control member into its other position by the net pressure of the pressure fluid acting on said differential pressure areas.

7. In a rock drill, the combination with a fluid-actuated hammer motor having a reciprocatory hammer piston for percussively actuating a drill steel and means operated by said hammer piston for intermittently rotating the drill steel including a ratchet and pawl mechanism, of means operable at the operator's will for interrupting drill steel rotation while reciprocation of the hammer piston continues comprising a fluid-actuated control member arranged coaxially with and movable relative to the ratchet and pawl mechanism and operable to engage the pawls to effect holding of the pawls from engagement with the ratchet teeth, said control member having opposed differential pressure areas constantly subjected to pressure fluid during running of the hammer motor and another pressure area subjected to line pressure fluid and valve controlled for holding said control member in one position, valve controlled means for venting said last mentioned pressure area when it is desired to effect movement of said control member into its other position by the net pressure of the pressure fluid acting on said differential pressure areas, said control member comprising a sleeve adapted to engage the pawls to hold the latter out of engagement with the ratchet teeth, and a throttle valve for controlling the flow of motive fluid to said hammer motor and said differential pressure areas and for supplying fluid to and venting said last mentioned pressure area.

8. In a rock drill, the combination with a fluid-actuated hammer motor having fluid distribution means, a fluid-actuated hammer piston for percussively actuating a drill steel and means operated by said hammer piston for intermittently rotating the drill steel including a ratchet and pawl mechanism, said ratchet and pawl mechanism comprising a stationary ratchet ring having internal ratchet teeth and a pawl carrier carrying spring-pressed pawls engaging said ratchet teeth, said pawls being elongated and projecting outwardly a substantial distance from said ratchet ring, of means operable at the operator's will for interrupting drill steel rotation while reciprocation of said hammer piston continues comprising a fluid-actuated control member arranged coaxially with and movable relative to the ratchet and pawl mechanism and operable to engage said outwardly projecting ends of said pawls to hold said pawls inwardly out of engagement with the ratchet teeth, said control member having an open center through which pressure fluid flows to the distribution means of said hammer motor and having opposed differential pressure areas constantly subjected to pressure fluid during running of the hammer motor and another pressure area subjected to line pressure fluid and valve controlled for holding said control member in one position, valve controlled means for venting said last mentioned pressure area when it is desired to effect movement of said control member into its other position by the net pressure of the pressure fluid acting on said differential pressure areas, and a throttle valve for controlling the flow of motive fluid to said hammer motor and to said differential pressure areas and for supplying pressure to and venting said last mentioned pressure area.

9. In a rock drill, the combination with a fluid-actuated hammer motor having fluid distribution means, a reciprocatory hammer piston for percussively actuating a drill steel and means operated by said hammer piston for intermittently rotating the drill steel including a ratchet and pawl mechanism, of means operable at the operator's will for interrupting drill steel rotation while reciprocation of the hammer piston continues comprising a fluid-actuated control member arranged coaxially with and movable relative to the ratchet and pawl mechanism and operable to engage the pawls to effect holding of the pawls from engagement with the ratchet teeth, said control member having an open center through which pressure fluid flows to the distribution means of said hammer motor and having opposed differential pressure areas constantly subjected to pressure fluid during running of the hammer motor and another pressure area subjected to line pressure fluid and valve controlled for holding said control member in one position, and valve controlled means for venting said last mentioned pressure area when it is desired to effect movement of said control member into its other posi-

tion by the net pressure of the pressure fluid acting on said differential pressure areas.

10. In a rock drill, the combination comprising drill steel rotation mechanism including relatively rotatable ratchet and pawl carrier elements, one of said elements being held against movement and said carrier element carrying pivoted pawls engageable with the teeth of said ratchet element, and means operable at will for interrupting drill steel rotation comprising a release ring coaxial with and movable relative to said ratchet and pawl carrier elements and engageable with the teeth engaging ends of said pawls remote from their pivots to hold the pawls out of engagement with the teeth of said ratchet element, said release ring slipping completely over said pawls when in its pawl releasing position.

11. In a rock drill, the combination comprising drill steel rotation mechanism including relatively rotatable ratchet and pawl carrier elements, one of said elements being held against movement and said carrier element carrying pivoted pawls engageable with the teeth of said ratchet elements, said pawls being elongated and having their elongated portions projecting outwardly beyond the ends of the ratchet teeth, and means operable at will for interrupting drill steel rotation comprising a release ring coaxial with and movable relative to said ratchet and pawl carrier elements and engageable with the elongated portions of said pawls at the tooth engaging ends of the latter remote from their pivots to hold said pawls out of engagement with the teeth of said ratchet element, said release ring slipping completely over said pawls when in its pawl releasing position.

12. In a rock drill, the combination comprising a fluid actuated hammer motor having a motor cylinder containing a reciprocatory hammer piston adapted to deliver impact blows to a drill steel, drill steel rotation mechanism including relatively rotatable ratchet and pawl carrier elements, one of said elements being held against movement and said carrier element carrying pivoted pawls engageable with the teeth of said ratchet element, and means operable at will for interrupting drill steel rotation comprising a release ring coaxial with and movable relative to said ratchet and pawl carrier elements and through which pressure fluid flows to the motor cylinder, said ring engageable with the tooth engaging ends of said pawls remote from their pivots to hold said pawls out of engagement with the teeth of said ratchet element, said release ring slipping completely over said pawls when in its pawl releasing position.

13. In a rock drill, the combination comprising drill steel rotation mechanism including relatively rotatable ratchet and pawl carrier elements, said ratchet element being held against movement and having a bore and said carrier element carrying pivoted pawls engageable with the teeth of said ratchet element, and means operable at will for interrupting drill steel rotation comprising a release ring coaxial with said ratchet and pawl carrier elements and reciprocably mounted in said ratchet element bore, said ring engageable with said pawls to hold the latter out of engagement with the teeth of said ratchet element and when in its pawl releasing position slipping completely over said pawls, and means for effecting reciprocatory movement of said ring relative to said ratchet element into and out of its pawl engaging position.

14. In a rock drill, the combination comprising drill steel rotation mechanism including relatively rotatable ratchet and pawl carrier elements, said carrier element carrying pivoted pawls engageable with the teeth of said ratchet element, operative connections between one of said elements and a drill steel to be rotated, means for holding the other element against rotation, and means operable at will for releasing the pawls from engagement with the ratchet teeth to interrupt drill steel rotation, said means comprising a control element coaxial with and reciprocable relative to said ratchet and pawl carrier elements and having internal control surfaces arranged to act upon the teeth engaging ends of the pawls remote from their pivots to hold said pawls out of engagement with the ratchet teeth, said control element slipping completely over said pawls when in its pawl releasing position.

15. In a rock drill, the combination comprising a fluid actuated hammer motor having a motor cylinder containing a reciprocatory hammer piston and a throttle valve for controlling fluid flow to the motor cylinder, drill steel rotation mechanism including relatively rotatable ratchet and pawl carrier elements, said carrier element carrying pivoted pawls engageable with the teeth of said ratchet element, operative connections between one of said elements and drill steel to be rotated, means for holding the other element against rotation, means operable at will for releasing the pawls from engagement with the ratchet teeth to interrupt drill steel rotation, said means comprising a control element coaxial with and reciprocable relative to said ratchet and pawl carrier elements and having internal control surfaces arranged to act upon the teeth engaging ends of said pawls remote from their pivots to hold said pawls out of engagement with the ratchet teeth, said control element when in its pawl releasing position slipping completely over said pawls, and means controlled by said throttle valve for effecting actuation of said reciprocable control element.

JOHN C. CURTIS.

CERTIFICATE OF CORRECTION.

Patent No. 2,251,269. August 5, 1941.

JOHN C. CURTIS.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, second column, line 4, claim 1, for the words "a spiral" read --spiral--; and line 16, same claim, for "members" read --member--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 18th day of November, A. D. 1941.

Henry Van Arsdale,
Acting Commissioner of Patents.

(Seal)