Dec. 17, 1940. J. C. CURTIS 2,224,860

ROCK DRILL

Original Filed Sept. 29, 1937

Fig. 1.

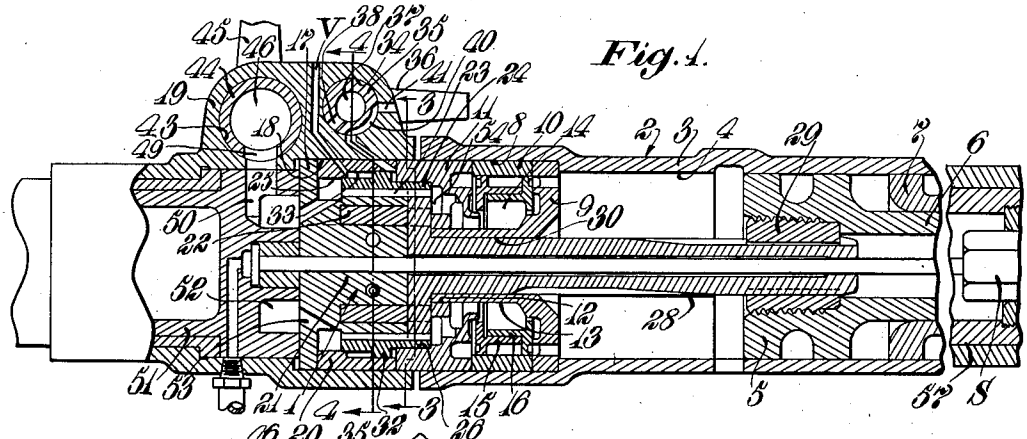


Fig. 2.

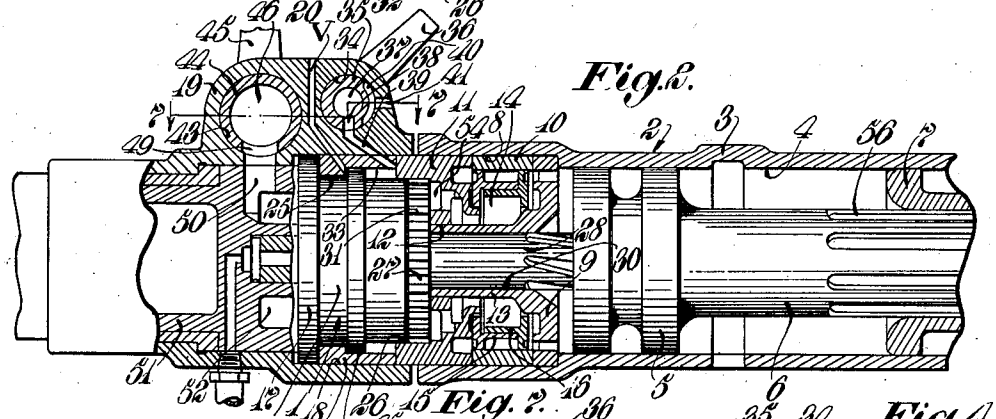


Fig. 3.

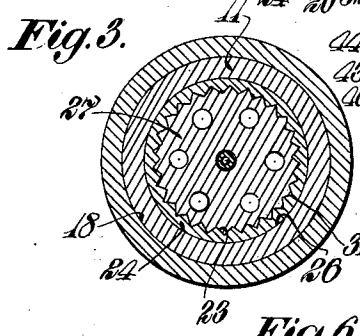


Fig. 4.

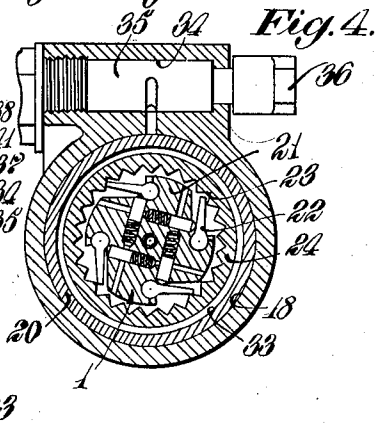


Fig. 5.

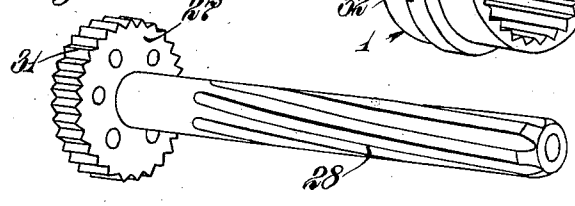
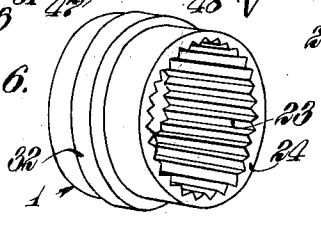


Fig. 6.



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# UNITED STATES PATENT OFFICE

2,224,860

## ROCK DRILL

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Application September 29, 1937, Serial No. 166,385
Renewed December 16, 1939

21 Claims. (Cl. 121—7)

This invention relates to rock drills, and more particularly to improvements in the rotation mechanism for the drill steel of a rock drill.

An object of this invention is to provide an improved drill steel rotation mechanism for a rock drill. Another object is to provide an improved drill steel rotation mechanism having improved release means for interrupting drill steel rotation at will. A further object is to provide an improved drill steel rotation mechanism of the intermittent ratchet and pawl type, operated by the hammer piston of the drilling motor and having improved release means for the rotation mechanism whereby, when desired, rotation of the drill steel may be discontinued while the hammer piston continues to reciprocate. Yet another object is to provide, in a rotation mechanism of the above character, improved release means for disconnecting the ratchet and pawl means from the hammer piston. A still further object is to provide, in a rotation mechanism of the rifle bar operated, ratchet and pawl type, improved rotation release means for disconnecting the rifle bar from the ratchet and pawl means. Another object is to provide an improved rotation release means of the fluid actuated type, controlled by a valve independently of the throttle valve of the drilling motor. These and other objects and advantages of the invention 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 section through a rock drill in which an illustrative form of the invention is embodied.

Fig. 2 is a view similar to Fig. 1, showing parts in a different position.

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

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

Fig. 5 is a perspective view of the rifle bar.

Fig. 6 is a perspective view of the ratchet ring.

Fig. 7 is a horizontal sectional view taken substantially on line 7—7 of Fig. 2.

In this illustrative embodiment of the invention, the improved drill steel rotation mechanism, generally designated 1, is shown embodied in a hammer rock drill of the stoper type having a drilling motor, generally designated 2, herein similar to that disclosed in my copending application Serial No. 152,609, filed July 8, 1937. It will be evident, however, that the invention may be embodied in rock drills of various other types. The drilling motor disclosed herein is of the pressure fluid actuated hammer type, comprising a cylinder 3 containing in its bore 4 a reciprocatory hammer piston 5. The hammer piston has a forwardly projecting striking bar 6 adapted to strike against the shank of a drill steel S in a well known manner. The piston-striking bar is guided in a bore in a front cylinder head 7; and arranged in a bore 8 formed in the rearward portion of the cylinder and alined with the cylinder bore, is a rear cylinder head 9. Also arranged in the bore 8, and abutting the rear surface of the cylinder head 9, is a valve box 10 having a rear cover 11, the latter also arranged in the bore 8 and abutting the rear surface of the valve box. The cover 11 has a central bore 12 receiving the rear portion of an axial sleeve-like projection 13 formed integral with the rear head 9. Arranged within the valve chamber 14 formed by the cooperant parts 9, 10 and 11 and the projection 13, is a pair of cooperating, relatively movable, fluid actuated, fluid distributing valves 15 and 16 for controlling the flow of motive fluid to the opposite ends of the cylinder bore to effect reciprocation of the hammer piston. As these distributing valves and their associated distributing passages do not per se enter into this invention and are clearly described in the copending application above referred to, further illustration and description thereof are considered unnecessary.

The improved means operated by the hammer piston for rotating the drill steel comprises a member 17 arranged in a bore 18 formed in a rear head block 19 and abutting the rear surface of a sleeve 20, likewise arranged in the bore 18, this sleeve abutting the rear surface of the valve box cover 11. The parts 17 and 20 and the parts 9, 10 and 11 arranged in the bore 8 are held in assembled relation by the rear head block 19, the latter being suitably clamped to the motor cylinder. The member 17 has an integral axial projection 21 at its forward end, and this projection constitutes a pawl carrier carrying a plurality of spring pressed pawls 22 engageable with the internal ratchet teeth 23 of an elongated ratchet ring 24, the latter mounted for axial and rotary movements in axially alined bores 25 and 26 in the members 20 and 11 respectively, as shown in Figs. 1 and 2. Arranged within the member 11, in advance of the projection 21, is a disk 27 preferably formed integral with a forwardly projecting rifle bar 28, the latter having a spiral groove connection with a rifle nut 29 fixed within the hammer piston 5. The rifle bar 28 is, in this

instance, rotatably mounted in the bore 30 of the rearward projection 13 of the back cylinder head 9. The disk 27 has external teeth 31 slidingly interlocked with the teeth 23 of the ratchet ring 24, and is preferably perforated, as shown in Fig. 5.

The improved rotation release or "slip rotation" means comprises an annular piston 32 formed about the outer periphery of the ratchet ring 24 and fitted for axial reciprocation in a cylinder bore 33 formed in the member 20. It will thus be seen that the ratchet ring 24 is slidably mounted in the guiding bores 25 and 26 in the parts 20 and 11, and that when the piston 32 moves in its cylinder bore, the ratchet ring 24 moves axially therewith, for a purpose to be later explained. The bore 25 is larger than the bore 26, so that when there is only atmospheric pressure on both of the opposite surfaces of the piston 32 the ratchet ring will move forward by the action of pressure fluid on the rear end of the ratchet ring. The space to the rear of the piston 32 is vented through vent means V to the atmosphere. Therefore, if pressure be applied to the forward side of piston 32 the ratchet ring 24 will move rearward. To admit and vent at will pressure relative to the forward surface of piston 32 there is arranged in a transverse bore 34 in the rear head block 19, a rotary control valve 35 having a manual control handle 36, and this valve has a central pressure fluid chamber 37 communicable, when the valve is in the position shown in Fig. 2, through a passage 38 in the valve with a passage 39 in the rear head block, leading to the forward end of the cylinder bore 33 at the forward side of the piston 32. The pressure fluid flowing from the valve chamber through the passages 38 and 39 to the forward end of the cylinder bore 33 acts on the forward pressure area of the piston 32 to move the ratchet ring 24 axially rearwardly in its guiding bores to disconnect the teeth 23 of the ratchet ring 24 from the teeth 31 of the rifle bar disk 27, thereby to release the rifle bar for free rotation relative to the ratchet ring. The valve 35, when in its closed position shown in Fig. 1, has a peripheral vent groove 40 for connecting the passage 39 to a vent port 41.

Arranged in a parallel bore 43 in the rear head block is a rotary throttle valve 44 having a manual control handle 45. This valve has a central pressure fluid chamber 46 communicating through a supply connection 47 with any suitable source of pressure fluid supply. The chamber 37 in the valve 35 is supplied with pressure fluid from the supply connection 47 through a passage 48 (see Fig. 7) connecting the bore 34 with the bore 43. The throttle valve has a passage 49 communicable with a passage 50 in a member 51 secured within the rear head block 19, the latter passage communicating with an annular chamber 52 in the member 51, connected by passages 53 in the member 17 with the bore 25 in the member 20 at the rear side of the ratchet ring 24, the pressure fluid flowing to this bore acting on the rear pressure area of the ratchet ring constantly to urge the latter toward its foremost position. Pressure fluid flows from the bore 25 through the space between the ratchet teeth and the pawl carrier, through the ratchet ring, into an annular recess 54 in the rear face of the member 11, this recess in turn communicating with the valve chamber 14 in the manner described in the copending application above referred to.

From the foregoing, it will be evident that when the parts are in the position shown in Fig. 1 and the hammer piston is moving forwardly to effect its working stroke, i. e., to deliver a blow to the drill steel shank, the rifle bar 28 is rotated by the rifle nut 29 fixed to the piston, and the teeth 23 of the ratchet ring 24 slip over the pawls 22 of the pawl carrier so that the piston strikes an unimpeded blow on the drill steel shank. Upon reverse movement of the hammer piston, the ratchet ring 24 is held stationary by the pawls 22, thereby holding the rifle bar 28 against rotation; and as a result the hammer piston, due to its connection by the rifle nut with the rifle bar, is given a rotary motion. The rotary motion of the piston as it moves rearwardly is transmitted through straight grooves 56 on the piston-striking bar slidingly interlocked with straight keys on the usual chuck nut of a chuck 57 in which the drill steel shank is mounted. It is accordingly evident that as the hammer piston reciprocates, the drill steel is intermittently rotated.

When it is desired to operate the rotation release or "slip rotation" means to free the drill steel from its rotation mechanism, the operator moves the control valve 35 into the position shown in Fig. 2, thereby admitting pressure fluid to the cylinder bore 33 at the forward side of the piston 32, and the pressure fluid acting on the forward pressure area of the piston 32 added to the effect of the pressure on the front end of the ring 24, moves the ratchet ring 24 rearwardly from the position shown in Fig. 1 to the position shown in Fig. 2, thereby disconnecting the rifle bar 28 from the ratchet ring 24, and as a result the rifle bar freely oscillates as the hammer piston reciprocates, and the drill steel is disconnected from the rotation mechanism. When it is again desired to effect drill steel rotation, the valve 35 is turned into the position shown in Fig. 1, connecting the cylinder 33 at the forward side of the piston 32 to exhaust through the vent groove 40 communicating with the vent passage 41, the pressure fluid acting on the rear end of the ratchet ring moving the latter forwardly into its connected position with the rifle bar.

As a result of this invention it will be noted that an improved drill steel rotation mechanism is provided for a hammer rock drill, whereby the drill steel may be readily released from the rotation mechanism with facility and in an extremely simple manner. It will further be evident that by disconnecting the rifle bar from the ratchet ring in the manner disclosed, rotation may be readily interrupted. Further, by the provision of the fluid actuated operating means for the rotation release, the mechanism is freed from any complicated structure, and by manipulation of the control valve the desired control may be readily effected. These and other uses and advantages of the invention will be clearly apparent to those skilled in the art.

While there is in this application specifically described one form which the invention may assume in practice, it will be understood that this form is shown for purposes of illustration 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, drill steel rotation mechanism including a ratchet and pawl mechanism and operative connections between said ratchet and pawl mechanism and a drill steel to be rotated

comprising a rifle bar controlled by said ratchet and pawl mechanism, means operative at will during running of the drill for effecting disconnection between said rifle bar and said ratchet and pawl mechanism to interrupt drill steel rotation, and manually controllable means operable at will for controlling said last mentioned means.

2. In a rock drill, drill steel rotation mechanism including a ratchet and pawl mechanism and operative connections between said ratchet and pawl mechanism and a drill steel to be rotated comprising a rifle bar controlled by said ratchet and pawl mechanism, means operative during running of the drill and actuated by pressure fluid for effecting disconnection between said rifle bar and said ratchet and pawl mechanism to interrupt drill steel rotation, and manually controllable means operable at will for supplying pressure fluid to said last mentioned means.

3. In a rock drill, drill steel rotation mechanism including relatively rotatable ratchet and pawl carrier elements, a rifle bar connected to said rotatable element, operative connections between said rifle bar and a drill steel to be rotated, means for holding the other element against rotation, and means for moving said rotatable element axially to release said rifle bar therefrom to interrupt drill steel rotation.

4. In a rock drill, drill steel rotation mechanism including relatively rotatable ratchet and pawl carrier elements, a rifle bar connected to the rotatable element, operative connections between said rifle bar and a drill steel to be rotated, means for holding the other element against rotation, and means actuated by pressure fluid for moving the rotatable element axially to disconnect the rifle bar therefrom to interrupt drill steel rotation.

5. In a rock drill, drill steel rotation mechanism including relatively rotatable ratchet and pawl carrier elements, a rifle bar connected to the rotatable element, operative connections between said rifle bar and a drill steel to be rotated, means for holding the other element against rotation, and means actuated by pressure fluid for moving the rotatable element axially in one direction to disconnect the rifle bar therefrom to interrupt drill steel rotation, and in the opposite direction to connect the rifle bar thereto.

6. In a rock drill, drill steel rotation mechanism including relatively rotatable ratchet and pawl carrier elements, means for holding one of said elements against rotation, operative connections between the rotatable one of said elements and a drill steel to be rotated including a terminal connecting member connectible directly to and releasable from said rotatable element, means operative during running of the drill for effecting disconnection between said terminal connecting member of said operative connections and said rotatable element to interrupt drill steel rotation, and manually controllable means operable at will for controlling said last mentioned means.

7. In a rock drill, drill steel rotation mechanism including relatively rotatable ratchet and pawl carrier elements, means for holding one of said elements against rotation, operative connections between the rotatable one of said elements and a drill steel to be rotated including a terminal connecting member connectible directly to and releasable from said rotatable element, means operative during running of the drill and actuated by pressure fluid for effecting disconnection between said terminal connecting member of said operative connections and said rotatable element to interrupt drill steel rotation, and manually controllable valve means operable at will for controlling the supply of pressure fluid to said last mentioned means.

8. In a rock drill, drill steel rotation mechanism including a ratchet and pawl mechanism having a rotatable element, operative connections between said rotatable element of said ratchet and pawl mechanism and a drill steel to be rotated including a terminal connecting member connectible directly to and releasable from said rotatable element, means operative during running of the drill for effecting disconnection between said terminal connecting member and said ratchet and pawl mechanism to interrupt drill steel rotation, and manually controllable means operable at will for controlling said last mentioned means.

9. In a rock drill, the combination with a motor cylinder containing a reciprocatory hammer piston for percussively actuating a drill steel, of a ratchet and pawl mechanism comprising a stationary pawl carrier and a rotatable ratchet ring and pawls on the pawl carrier engaging the teeth of the ratchet ring, a rifle bar connected to said piston and having teeth interlocked with the teeth of the ratchet ring, said rifle bar effecting rotary motion of the piston, means for transmitting the rotary motion of the piston to the drill steel, and means for moving said ratchet ring axially to disconnect the ratchet teeth from the rifle bar teeth to interrupt drill steel rotation.

10. In a rock drill, drill steel rotation mechanism comprising a stationary pawl carrier, a rotatable ratchet ring surrounding said pawl carrier, pawls on said carrier engaging the teeth of the ratchet ring for controlling the direction of rotation of the ratchet ring, a rifle bar connected to said ratchet ring, and operative connections between said rifle bar and a drill steel to be rotated.

11. In a rock drill, the combination with a motor cylinder containing a reciprocatory hammer piston for percussively actuating a drill steel, of drill steel rotation mechanism comprising a stationary pawl carrier, a rotatable ratchet ring surrounding said pawl carrier and having internal ratchet teeth, pawls on said pawl carrier engaging the teeth of said ratchet ring to control the direction of rotation of the ratchet ring, a rifle bar connected to said ratchet ring and said hammer piston for effecting rotation of the hammer piston, and means for transmitting the rotary motion of the hammer piston to the drill steel.

12. In a rock drill, the combination with a motor cylinder containing a reciprocatory hammer piston for percussively actuating a drill steel, of drill steel rotation mechanism comprising a stationary pawl carrier, a rotatable ratchet ring, pawls on said pawl carrier engaging the teeth of said ratchet ring to control the direction of rotation of the ratchet ring, a rifle bar connected to said ratchet ring and said hammer piston for effecting rotation of the hammer piston, means for transmitting the rotary motion of the hammer piston to the drill steel, means operative during reciprocation of the hammer piston for disconnecting the ratchet ring from said rifle bar to interrupt drill steel rotation, and manually controllable means operable at will for controlling said disconnecting means.

13. In a rock drill, the combination with a motor cylinder containing a reciprocatory hammer piston for percussively actuating a drill steel, of drill steel rotation mechanism operated by said hammer piston comprising a stationary pawl carrier, a reciprocable and rotatable ratchet ring mounted for rotary and axial movements relative to said pawl carrier, pawls on said carrier engaging the teeth of said ratchet ring for controlling the direction of rotation of said ratchet ring, a rotatable rifle bar connected to said hammer piston for effecting intermittent rotary motion of said piston as the latter reciprocates, a disk connected to said rifle bar and having teeth slidingly interlocked with the teeth of said ratchet ring, the pawls of said pawl carrier and the ratchet ring engaged thereby controlling the direction of rotation of said rifle bar, means for transmitting the rotary motion of said piston to the drill steel, and means for effecting axial movement of said ratchet ring to release the teeth thereof from the teeth of said rifle bar disk to interrupt drill steel rotation.

14. In a rock drill, the combination with a motor cylinder containing a reciprocatory hammer piston for percussively actuating a drill steel, of drill steel rotation mechanism operated by said hammer piston comprising a stationary pawl carrier, a reciprocable and rotatable ratchet ring mounted for rotary and axial movements relative to said pawl carrier, pawls on said carrier engaging the teeth of said ratchet ring for controlling the direction of rotation of said ratchet ring, a rotatable rifle bar connected to said hammer piston for effecting intermittent rotary motion of said piston as the latter reciprocates, a disk connected to said rifle bar and having teeth slidingly interlocked with the teeth of said ratchet ring, the pawls of said pawl carrier and the ratchet ring engaged thereby controlling the direction of rotation of said rifle bar, means for transmitting the rotary motion of said piston to the drill steel, and means for effecting axial movement of said ratchet ring to release the teeth thereof from the teeth of said rifle bar disk to interrupt drill steel rotation, said ratchet-ring-moving means comprising a piston fixed to the ratchet ring, a cylinder containing said piston and means for supplying pressure fluid to said cylinder to act on said piston.

15. In a rock drill, a motor comprising a cylinder containing a reciprocatory hammer piston for percussively actuating a drill steel, drill steel rotation mechanism driven by said hammer piston including relatively rotatable ratchet and pawl carrier elements, means for holding one of said elements against rotation, operative connections between the rotatable element and said piston and between said piston and the drill steel to be rotated, means operative during running of said motor for effecting disconnection between said operative connections and said rotatable element to interrupt drill steel rotation, and manually controllable means operable at will for controlling said last mentioned means.

16. In a rock drill, a motor comprising a cylinder containing a reciprocatory hammer piston for percussively actuating a drill steel, drill steel rotation mechanism driven by said hammer piston including relatively rotatable ratchet and pawl carrier elements, means for holding one of said elements against rotation, operative connections between the rotatable element and said piston and between said piston and the drill steel to be rotated, means operative during running of said motor and actuated by pressure fluid for effecting disconnection between said operative connections and said rotatable element to interrupt drill steel rotation, and manually controllable valve means operable at will for controlling the pressure fluid supply to said last mentioned means.

17. In a rock drill, a motor comprising a cylinder containing a reciprocatory hammer piston for percussively actuating a drill steel, drill steel rotation mechanism actuated by said piston and including a ratchet and pawl mechanism, operative connections between said ratchet and pawl mechanism and said piston and between said piston and the drill steel to be rotated, means operative during running of said motor for disconnecting said operative connections completely from said ratchet and pawl mechanism to interrupt drill steel rotation, and manually controllable means operable at will for controlling said disconnecting means.

18. In a rock drill, drill steel rotation mechanism including a rifle bar operatively connected to a drill steel and means connected to said rifle bar for controlling the rotation of said rifle bar, means for effecting disconnection between said rotation controlling means and said rifle bar to interrupt drill steel rotation, and manually controllable means operable at will while the dril is running for controlling said second mentioned means.

19. In a rock drill, drill steel rotation mechanism including a rifle bar operatively connected to a drill steel and means for controlling the rotation of said rifle bar, said rotation controlling means comprising a rotatable element engageable with said rifle bar and means for controlling the rotation of said element, and means for moving said rotatable element out of engagement with said rifle bar to interrupt drill steel rotation.

20. In a rock drill, drill steel rotation mechanism including a rotatable element and means for holding said element against rotation in one direction, operative connections between said rotatable element and a drill steel to be rotated including a terminal connecting member connectible directly to and releasable from said rotatable element, means actuated by pressure fluid for disconnecting said rotatable element from said terminal connecting member of said operative connections to interrupt drill steel rotation, and manually controllable means operable at will for controlling the supply of pressure fluid to said disconnecting means.

21. In a rock drill, drill steel rotation mechanism including a rifle bar operatively connected to a drill steel, an intermittent grip device operatively connected to said rifle bar for controlling rotation of said rifle bar, and means operable at will during running of the drill for effecting disconnection between said intermittent grip device and said rifle bar to interrupt drill steel rotation.

JOHN C. CURTIS.