June 1, 1937. E. G. GARTIN 2,081,919

ROCK DRILL

Filed April 26, 1934

Fig. 1.

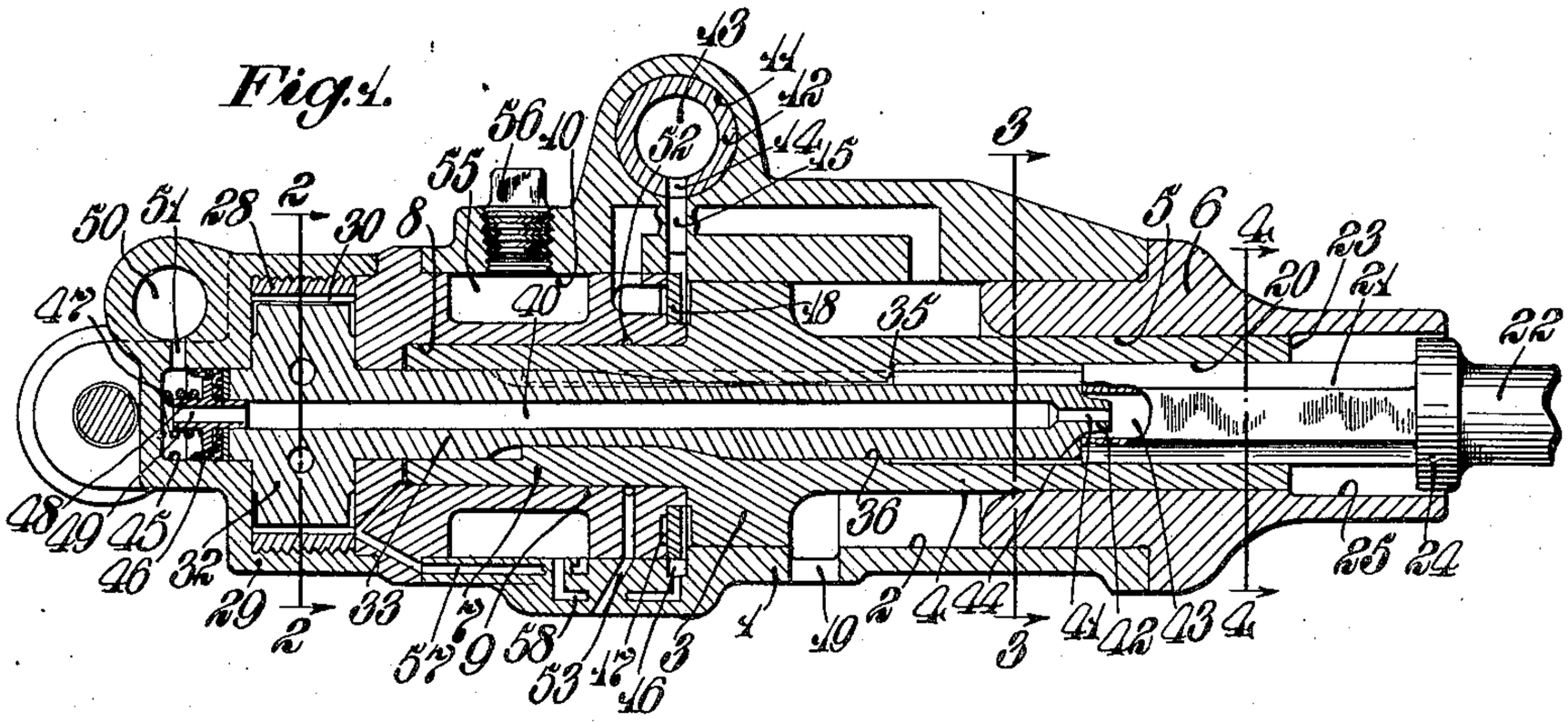


Fig. 2.

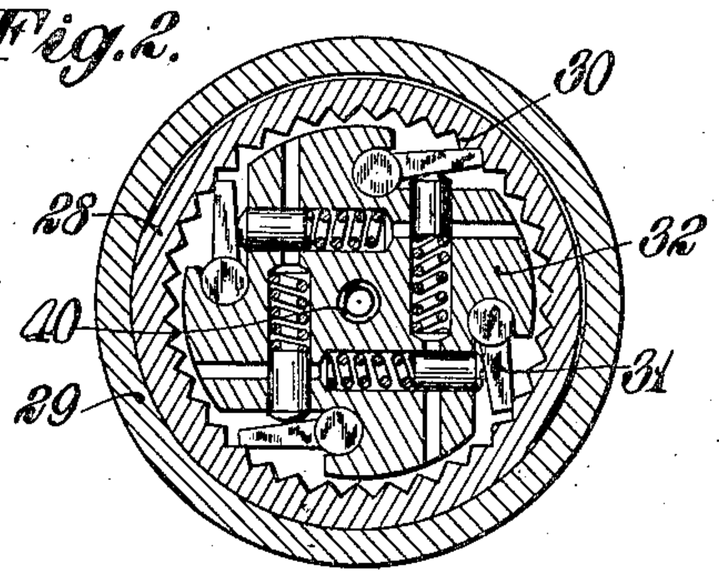


Fig. 3.

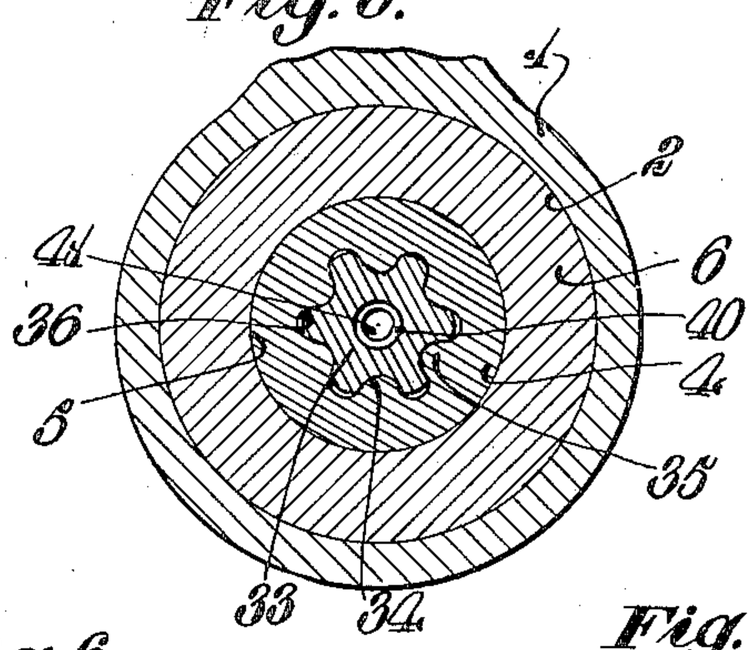


Fig. 6.

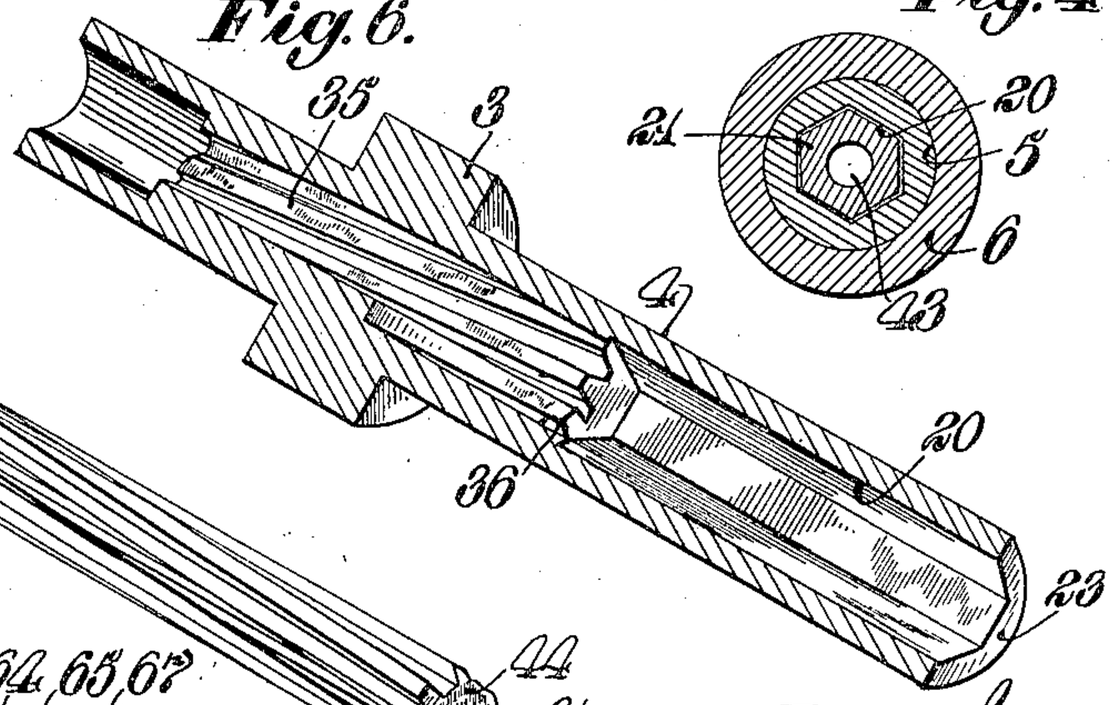
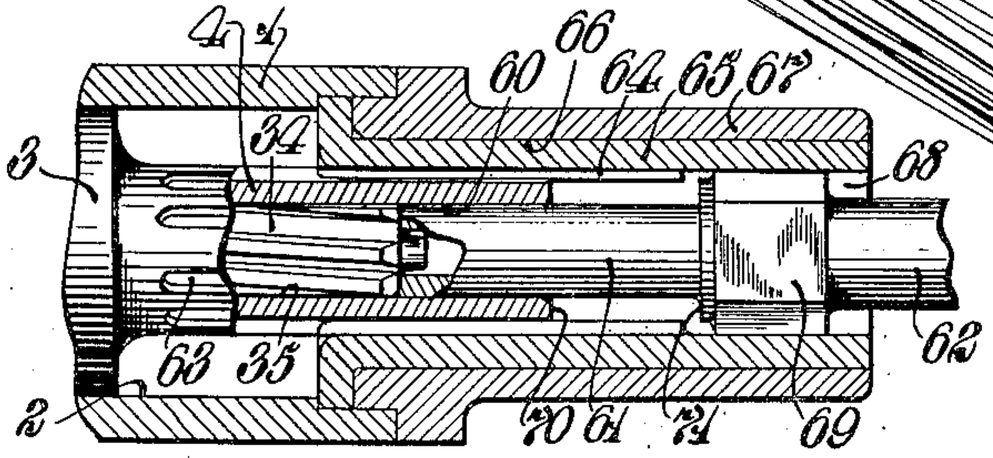


Fig. 4

Fig. 5.

Fig. 7.



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UNITED STATES PATENT OFFICE

2,081,919

ROCK DRILL

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25 Claims. (Cl. 121—6)

This invention relates to rock drills, and more particularly to improvements in the hammer motor structure and hole cleansing means of rock drills of the hammer type.

An object of this invention is to provide an improved hammer type rock drill. Another object is to provide an improved hammer motor structure for such drills having improved means for transmitting the hammer blows of the hammer piston to the drill steel. A further object is to provide an improved hole cleansing means for such a drill whereby a cleansing fluid is conducted to the drill steel bore in an improved manner. Yet another object is to provide an improved hole cleansing means associated with the drill steel rotation means operated by the hammer piston. Still another object is to provide an improved hammer piston and drill steel structure for such a drill. Still another object is to provide an improved hole cleansing means of the so-called "dustless" liquid type wherein pressure fluid leaking from the motor is prevented from flowing to the drill steel bore. Yet another object is to provide an improved hole cleansing means wherein the cleansing fluid conducting conduit is an integral part of the rotation bar of the steel rotation means so that the rotation bar performs both fluid conducting and rotation functions. These and other objects of the invention will, however, hereinafter more fully appear.

In the accompanying drawing there are shown for purposes of illustration two forms which the invention may assume in practice.

In this drawing,—

Fig. 1 is a central longitudinally extending sectional view through the preferred illustrative embodiment of the invention.

Fig. 2 is a cross sectional view taken on line 2—2 of Fig. 1.

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

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

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

Fig. 6 is an axial sectional perspective view of the hammer piston.

Fig. 7 is a fragmentary view taken in the plane of Fig. 1 showing a modified form of construction.

In the preferred illustrative embodiment of the invention shown in Figs. 1 to 6, inclusive, there is shown a rock drill of the pressure fluid actuated hammer type comprising a cylinder 1 having a bore 2 containing a reciprocable hammer piston 3. The hammer piston has a forwardly projecting striking bar 4 extending into an axial bore 5 formed in a combined front head and chuck housing 6 suitably secured to the forward end of the motor cylinder. Projecting rearwardly from the piston head is a cylindrical extension 7 extending within an axial bore 8 formed in a combined valve chest member and rear head 9 projecting within an enlarged bore 10 formed in the cylinder and suitably secured to the rear end of the cylinder. Arranged in a bore 11 formed in the side of the cylinder is a throttle valve 12 having a central pressure fluid chamber 13. Traversing the wall with this valve is a port 14 for conducting pressure fluid from the chamber 13 through a passage 15 to an annular supply groove 16 formed in the cylinder wall. This groove communicates with a valve chamber 17 formed between the head member and cylinder and having reciprocable therein a pressure fluid actuated fluid distributing valve 18 herein of the annular disc type. Pressure fluid is adapted to flow from this valve chamber under the control of the distributing valve 18 to the opposite ends of the cylinder bore to effect piston reciprocation. The cylinder is provided with a centrally located, piston controlled, free exhaust port 19. As the particular valve mechanism shown is of a well known type, further description thereof is herein considered unnecessary.

Now referring to the improved piston and drill steel structure, it will be noted that the forward portion of the piston striking bar 4 is provided with an axial chamber 20 herein of hexagonal cross section within which the shank 21, likewise of hexagonal cross section, of a drill steel 22 extends. The portion of the piston striking bar surrounding the steel shank is provided with a front annular striking surface 23 adapted to deliver the impact blows of the piston to an annular collar 24 formed integral with the steel shank. This steel collar is movable within an enlarged axial bore 25 formed within the forward portion of the chuck housing.

The drill steel rotation means comprises a ratchet ring 28 threaded within a head block 29 suitably secured to the rear end of the head member 9, and this ratchet ring has internal ratchet teeth 30 with which are engageable spring pressed pawls 31 carried by a pawl carrier 32 herein formed integral with a rotation bar 33. This rotation bar is suitably journaled within the head block 29 and the member 9 and has formed externally thereon spirally arranged rifle flutes 34 interlocked with spiral vanes 35 formed within the axial bore 36 of the hammer piston.

This bore 36 at its forward end communicates with the axial steel shank receiving bore 20. These spiral vanes are formed internally with the hammer piston throughout a greater portion of the length thereof and between the bore 20 and a cylindrical portion of the base 36 at the rear of the spiral vanes, as shown in Fig. 6. The parts are so arranged that when pressure fluid is supplied to the rear end of the cylinder bore the hammer piston 3 has unimpeded forward movement to effect its working stroke, i. e. to deliver an impact blow to the drill steel collar 24, the pawls 31 at that time slipping over the teeth 30 of the ratchet ring 28. When pressure fluid is supplied to the forward end of the cylinder bore the hammer piston 3 is driven rearwardly to effect its retractive stroke, and upon initiation of such rearward movement the pawls 31 engage the ratchet teeth 30 to hold the rotation bar 33 against rotative movement, and as a result rotative movement is imparted to the hammer piston 3 by the spiral vanes 34 of the rifle nut engaging the spiral rifle flutes of the rotation bar 33. This rotative movement of the hammer piston 3 is transmitted through the piston striking bar 4 to the drill steel shank 21, the walls of the hexagonal opening 20 engaging the hexagonally shaped portion of the steel shank so that when the piston 3 is rotated the drill steel 22 rotates therewith.

Now referring to the improved hole cleansing means associated with the steel rotation means, it will be noted that the rotation bar 33 is axially elongated and has formed therein an axial bore 40 communicating with a restricted axial opening 41 formed in the jet-like forward tip end 42 of the rotation bar. This tip end 42 of the rotation bar constitutes a jet-forming means and projects within the axial bore 43 of the drill steel 22, and when the steel is in the position shown in Fig. 1 the forward end shoulder 44 of the rotation bar engages the rear end of the drill steel shank, thereby to provide a sealing engagement between the rotation bar and the rear end of the steel when the latter is in its rearmost position shown. Formed axially within the head block 29 in alinement with the rotation bar axis is a chamber 45 having reciprocable therein a piston 46 having a suitable packing and normally urged toward its foremost sealing position by a coil spring 47. This piston has formed thereon a cylindrical portion 48 having an axial opening 49, the forward end of this cylindrical portion projecting within the axial bore 40 of the rotation bar in the manner shown. The coil spring forces the piston tightly against the rear end of the rotation bar, thereby to provide a seal between the rifle bar journal and the axial bore 40 so that no pressure fluid may escape from the motor cylinder past the rotation bar to the bore of the latter. Liquid is adapted to be supplied to the chamber 45 at the rear of the piston from a supply chamber 50 through a passage 51 communicating with the chamber 45. Formed in the head member 9 and surrounding the rearward extension 7 of the hammer piston is an annular groove 52 connected by a passage 53 to atmosphere so as to form a vent for any pressure fluid leaking from the motor cylinder along this rearward extension thereby to prevent excessive leakage along the rotation bar. In case any leakage does occur it will flow along the spiral flutes 34 and through the axial chamber 20 to the chamber 25 from which it is vented directly to atmosphere, such flow of exhaust fluid preventing entry of dirt within the chuck housing, thereby keeping the bores 5, 20 and 25 clean.

Formed in the rear head member 9 is a lubricant chamber 55 having a suitable filller plug 56. Lubricant is adapted to be conducted through a passage 57 to the bore 8 to lubricate the rearward piston extension and through a passage 58 to the fluid supply chamber 16 to lubricate the distributing valve and hammer piston.

In the modified form of construction shown in Fig. 7 the striking bar 4 of the hammer piston 3 has formed within its forward portion in advance of the spiral vanes 35 of the rotation mechanism a cylindrical bore 60 for receiving the cylindrical shank 61 of a drill steel 62. In this instance the interlocking hexagonal connection between the piston striking bar and the steel shank is omitted and the exterior of the piston striking bar is provided with longitudinal flutes 63 interlocked with straight vanes 64 formed on a rotatable chuck sleeve 65. This chuck sleeve is journaled within a bore 66 formed in a front chuck housing 67 suitably secured to the forward end of the cylinder 1. This chuck sleeve is provided with an axial opening 68 of hexagonal cross section for receiving the collar portion 69, likewise of hexagonal cross section, of the drill steel 62. The bore 68 is elongated so that the steel collar is free to reciprocate therein during the hammering action thereon by the hammer piston. It will thus be seen that as the hammer piston 3 reciprocates it is rotated during its retractive stroke by the rotation bar 33, and this rotative movement of the hammer piston is transmitted through the straight groove 63 on the striking bar 4 and the straight vanes 64 on the chuck sleeve 65 to the hexagonal collar on the drill steel 62. As in the form above described, the piston striking bar is provided with an annular front striking surface 70 adapted to deliver impact blows to an annular surface 71 formed on the drill steel collar 69. Otherwise this form of the invention is similar to that above described.

As a result of this invention, it will be noted that an improved rock drilling motor is provided having an improved rotation mechanism wherein the hammer piston is connected in rotation transmitting engagement with the drill steel in an improved manner and the hammer piston is provided with an improved striking bar whereby an improved hammering action is attained on the steel collar. It will further be noted that an improved hole cleansing means is provided of the so-called "dustless" liquid type wherein liquid is conducted to the steel bore in an improved manner while entry of pressure fluid from the motor cylinder to the steel bore is prevented. It will still further be evident that by utilization of the rotation bar as a liquid conduit, the structure of the hole cleansing means is materially simplified, and by forming the rotation bar in the manner shown a pressure fluid seal between the rotation bar and steel shank is attained. These and other uses and advantages of the improved rock drill will be clearly apparent to those skilled in the art.

While there are in this application specifically described two forms which the invention may assume in practice, it will be understood that these forms of the same may be 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, a cylinder, a piston reciprocable therein, said piston provided with a forwardly projecting striking bar having an axial bore and a front annular striking surface, and a drill steel having a shank adapted to project within the striking bar bore and having a collar adapted to receive the impact blows of the front annular striking surface of the striking bar.

2. In a rock drill, a cylinder, a hammer piston reciprocable therein, a drill steel having a shank adapted to receive the impact blows of the hammer piston, said piston having an axial bore within which the steel shank is adapted to project and having a front annular striking surface, and drill steel rotation mechanism including means providing an interlocking connection between the drill steel shank and said piston and means for effecting rotary movement of the hammer piston, said rotary piston movement being transmitted through said interlocking connection between the piston and the steel shank, said drill steel having a portion adapted to receive the impact blows of said front annular striking surface.

3. In a rock drill, a cylinder, a piston reciprocable therein having an axial bore and a front annular striking surface, a drill steel adapted to receive the impact blows of the piston, and having its shank projecting within said piston bore, said steel having a portion adapted to receive the impact blows of said front annular striking surface and drill steel rotation means including a ratchet and pawl mechanism having a spirally grooved rotation bar interlocked with the piston, and an interlocking connection within the hammer piston with the drill steel shank.

4. In a rock drill, a cylinder, a piston reciprocable therein, said piston having an axial bore and a forwardly projecting striking bar, a drill steel adapted to receive the impact blows of the striking bar, said piston striking bar having a front annular striking surface and said steel having an annular portion adapted to receive the impact blows of said front annular striking surface, and drill steel rotation means including a ratchet and pawl mechanism having a spirally grooved rotation bar interlocked with the hammer piston, and an internal interlocking connection directly between the piston striking bar and the steel shank.

5. In a rock drill, a cylinder, a piston reciprocable therein, said piston having a forwardly projecting striking bar, a drill steel adapted to receive the impact blows of the striking bar, and drill steel rotation means including a ratchet and pawl mechanism having a spirally grooved rotation bar interlocked with the hammer piston, and an internal interlocking connection between the piston striking bar and the steel shank, said striking bar having an axial bore and an annular front striking surface and said steel shank extending within said bore and having interlocking connection therewith, said drill steel having an annular portion adapted to receive the impact blows of said annular striking surface.

6. In a rock drill, a cylinder, a piston reciprocable therein, a hollow drill steel for receiving the impact blows of the hammer piston, drill steel rotation mechanism including a spirally grooved rotation bar interlocked with the hammer piston and relative to which the latter is reciprocable, said rotation bar having means providing a sealing engagement with the rear end of the steel shank, and hole cleansing means including an axial liquid conducting passage formed in said rotation bar.

7. In a rock drill, a cylinder, a piston reciprocable therein, a hollow drill steel for receiving the impact blows of the hammer piston, drill steel rotation mechanism including a spirally grooved rotation bar interlocked with the hammer piston and relative to which the latter is reciprocable, said rotation bar having means providing a sealing engagement with the rear end of the steel shank, hole cleansing means including an axial liquid conducting passage formed in said rotation bar, and means for sealing the rear end of said rotation bar for precluding entry of pressure fluid from the motor cylinder thereto.

8. In a rock drill, a cylinder, a piston reciprocable therein, a drill steel adapted to receive the impact blows of said piston and having a shank of polygonal cross section, said piston having a forwardly projecting striking bar having an axial opening of polygonal cross section within which said steel shank extends, said striking bar interlocked with the steel shank and having a front annular striking surface adapted to deliver impact blows to a collar integral with the steel, and drill steel rotation means including a ratchet and pawl mechanism arranged at the rear end of the drill and having a spirally grooved rotation bar interlocked with the piston for effecting rotative movement of the piston, the rotative movement of the piston being transmitted to the steel through the interlocking connection between the striking bar and steel shank.

9. A rock drill hammer piston having a head, a forwardly projecting striking bar and a rearward extension, the forward portion of the striking bar having an axial bore of polygonal cross section and the rear end of said extension having a cylindrical bore, the internal portion of the piston between said bores being spirally fluted.

10. A rock drill rotation bar having an axial opening and spirally arranged grooves formed externally thereon, and a liquid-conducting jet-forming means integrally formed on the front end of said rotation bar near the forward termination of said grooves and to which liquid is conducted through said axial opening, said rotation bar having an annular sealing surface surrounding said jet for sealingly engaging an element into which said jet discharges.

11. In a rock drill, a cylinder, a piston reciprocable therein, said piston having an axial bore and a front annular striking surface, and a drill steel having a shank adapted to project within the piston bore and having a collar adapted to receive the impact blows of said front annular striking surface.

12. In a rock drill, a cylinder, a piston reciprocable therein and having an axial bore, a drill steel adapted to receive the impact blows of said piston having a shank projecting within said piston bore and an integral annular portion, said piston having means interlocked with means on the drill steel shank and having a front annular striking surface adapted to deliver impact blows to said annular portion integral with the drill steel, and drill steel rotation means including a ratchet and pawl mechanism arranged at the rear end of the drill and having a grooved rotation bar interlocked with the piston for effecting rotative movement of the piston, the rotative movement of the piston being transmitted to the drill steel through the interlocking connection between the piston and the steel shank.

13. In a rock drill, a cylinder, a piston recipro-

cable therein, a drill steel adapted to receive the impact blows of said piston and having a shank, said piston having a forwardly projecting striking bar having an axial opening within which said steel shank extends, said striking bar having means interlocked with means on the drill steel shank and having a front annular striking surface adapted to deliver impact blows to a collar integral with the drill steel, and drill steel rotation means including a ratchet and pawl mechanism arranged at the rear end of the drill and having a grooved rotation bar interlocked with the piston for effecting rotative movement of the piston, the rotative movement of the piston being transmitted to the steel through the interlocking connection between the striking bar and the steel shank.

14. In a rock drill, a cylinder, a piston reciprocable therein, a hollow drill steel for receiving the impact blows of said piston, drill steel rotation mechanism including a grooved rotation bar interlocked with the piston and relative to which the latter is reciprocable, said rotation bar having means providing an end-sealing engagement with the rear end of the steel shank, and hole cleansing means including an axial liquid conducting passage formed in said rotation bar.

15. In a rock drill, a cylinder, a piston reciprocable therein, a hollow drill steel for receiving the impact blows of said piston, drill steel rotation mechanism including a grooved rotation bar interlocked with the piston and relative to which the latter is reciprocable, said rotation bar having means providing a sealing engagement with the rear end of the steel shank, hole cleansing means including an axial liquid conducting passage formed in said rotation bar, and means for sealing the rear end of said rotation bar for precluding entry of pressure fluid from the motor cylinder thereto.

16. A rock drill rotation bar having an axial opening and grooves formed externally thereon, and an integral reduced tip providing a liquid conducting jet to which liquid is supplied through said axial opening, said axial opening being restricted as it passes through said tip and said tip having radially outwardly thereof an annular sealing surface for sealingly engaging an element within which said jet discharges.

17. A rock drill hammer piston having between its ends an enlarged head, a forwardly projecting reduced striking bar portion and a rearwardly projecting reduced extension, said striking bar portion having an axial opening adapted to receive the shank of a drill steel and a front annular striking surface, said rearward projection having an axial opening alined with the opening in said striking bar, and said piston having an axial bore therein connecting said axial openings.

18. A rock drill hammer piston having between its ends an enlarged head, a forwardly projecting reduced striking bar portion and a rearwardly projecting reduced extension, said striking bar portion having an axial opening adapted to receive the shank of a drill steel and a front annular striking surface, said rearward projection having an axial opening alined with the opening in said striking bar, and said piston having an axial bore therein connecting said axial openings, the walls of said connecting bore being spirally grooved for connection with a rotation element.

19. A rock drill hammer piston having a head, a forwardly projecting striking bar and a rearward guide extension, the forward portion of the striking bar having an axial bore adapted to receive the shank of a rock drill steel and the rear end of said rearward extension having a cylindrical bore, and the internal portion of the piston between said bores being formed for connection with rotation means.

20. A rock drill rotation bar having an axial opening and spirally arranged grooves formed externally thereon and a liquid-conducting jet-forming means formed on the front end of said rotation bar to which liquid is conducted through said axial opening, said bar having an end-sealing annular surface surrounding the rear end of said jet for sealingly engaging an element within which said jet discharges.

21. A rock drill hammer piston having a rearward extension internally bored and formed to receive in interlocking relation therewith an element of an automatic rotation mechanism, said piston providing a bore freely communicating with said first mentioned bore and formed to receive a drill steel and said piston having surrounding the forward end of the second mentioned bore an annular impact surface.

22. In a rock drill, a cylinder, a piston reciprocable therein, a drill steel actuated by said piston and having a shank and an integral collar, said piston having an axial bore and a front annular striking surface surrounding the mouth of said bore, said bore adapted to receive the shank of said drill steel and said annular surface to impinge upon said collar on such steel, and said piston having a rearward extension, and said drill including automatic rotation means, a portion of which cooperates with said rearward extension.

23. As an article of manufacture, a rock drill hammer piston adapted for association with a collared drill steel, said piston open from end to end for the reception of fluid conducting means and having within its rearward end means effective to cooperate in piston rotation, and at its forward end steel receiving and impinging means, said impinging means arranged on the piston in advance of the rear end of said steel receiving means and said receiving means adapted to receive a drill steel shank and said impinging means adapted to engage an integral shank collar located in advance of the rear end of the steel shank.

24. In a rock drill, a cylinder, a piston reciprocable therein, a hollow drill steel actuated by said piston and having means on which the piston impinges, cleansing fluid means arranged axially within said piston and having a portion adapted to extend into said drill steel, said piston having means for impinging upon said drill steel at a point in advance of the point of termination of the cleansing fluid supply means within the steel.

25. As an article of manufacture, a rock drill hammer piston adapted for association with a collared drill steel, said piston having within its rearward end means effective to cooperate in piston rotation, and at its forward end steel receiving and impinging means, said impinging means arranged on the piston in advance of the rear end of said steel receiving means and said receiving means adapted to receive a drill steel shank and said impinging means adapted to engage an integral shank collar located in advance of the rear end of the steel shank.

ELMER G. GARTIN.