April 16, 1963 J. A. LARCÉN 3,085,638

ROCK DRILLING MECHANISMS

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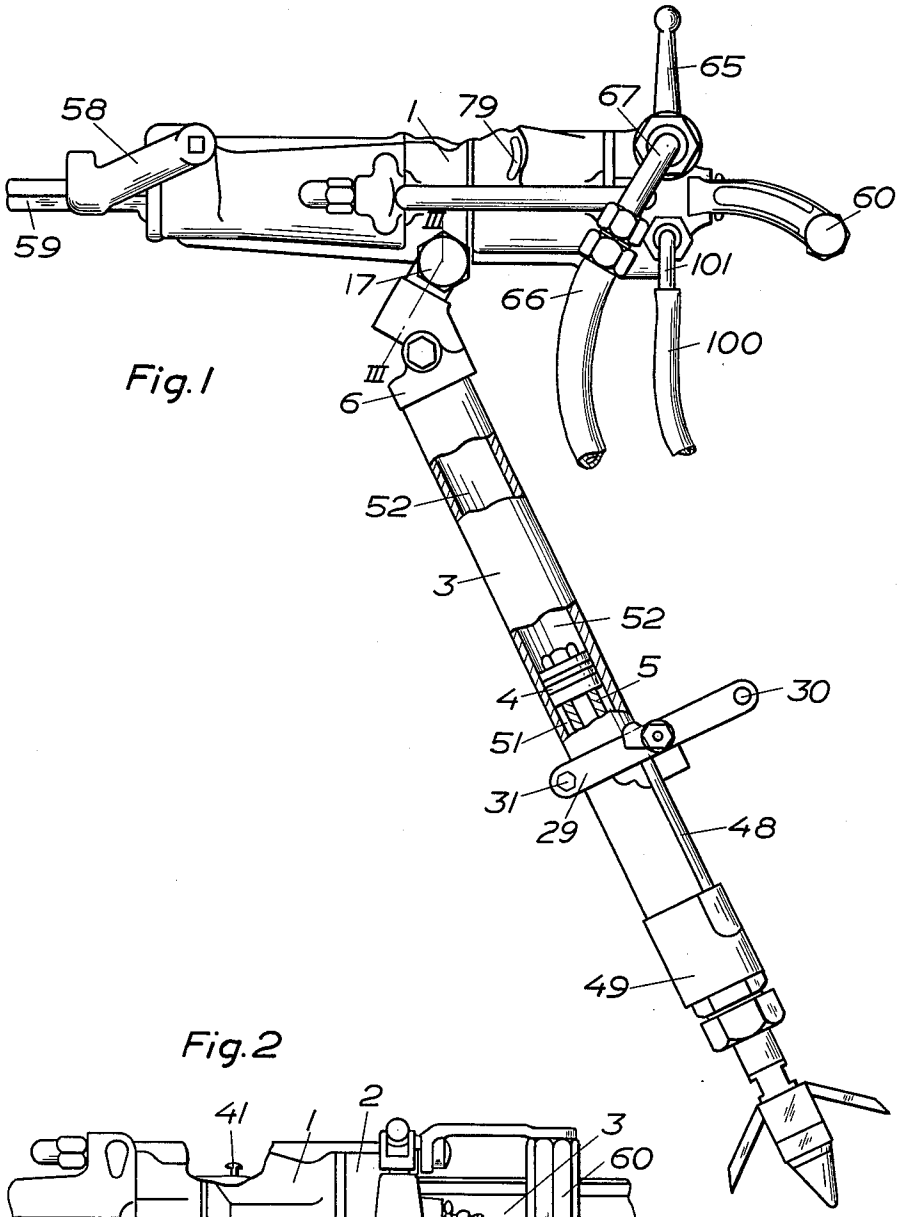
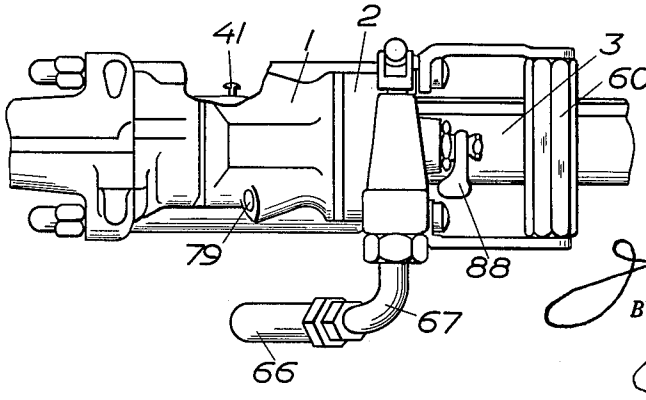


Fig. 1

Fig. 2



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Fig. 3

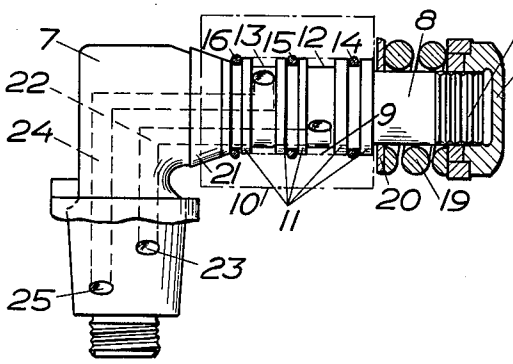


Fig. 4

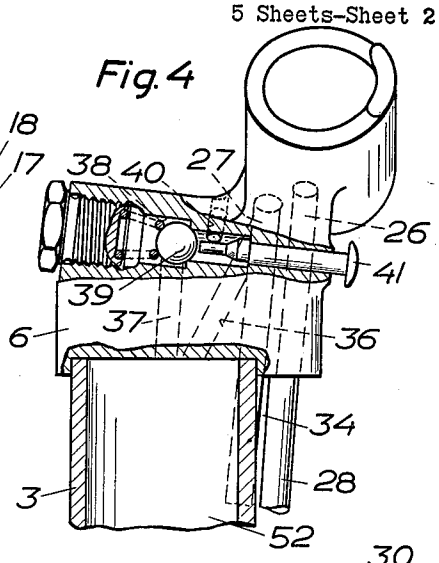
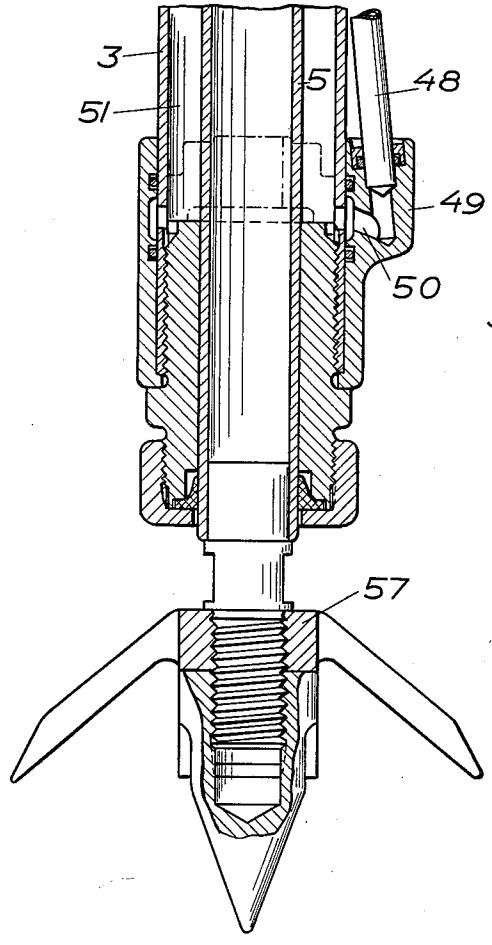


Fig. 6



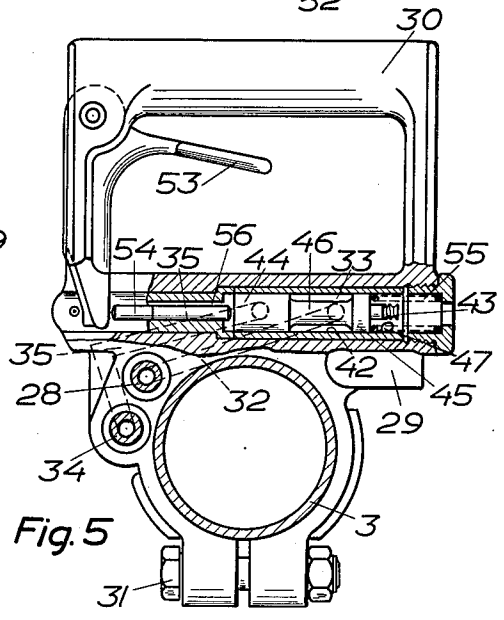


Fig. 5

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Fig.7

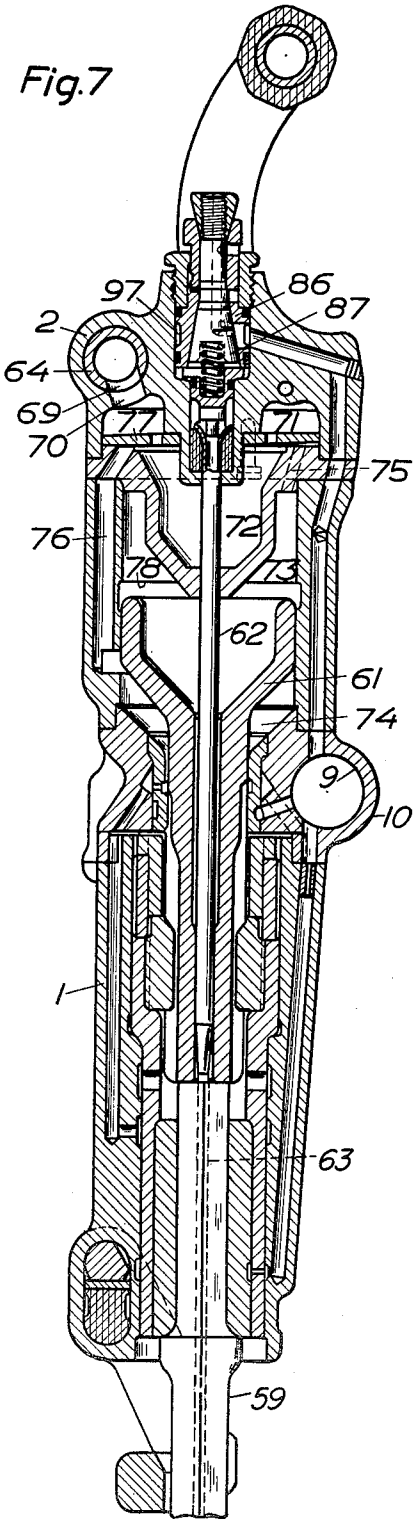


Fig.8

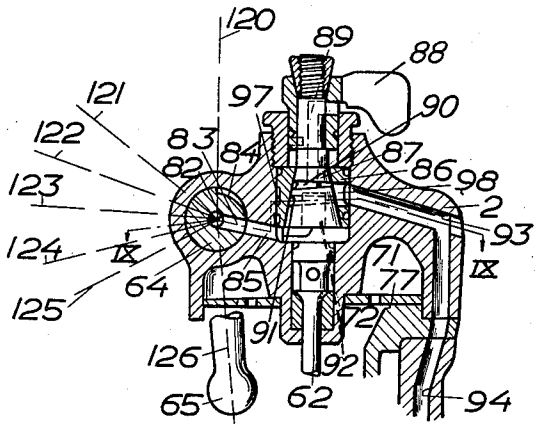
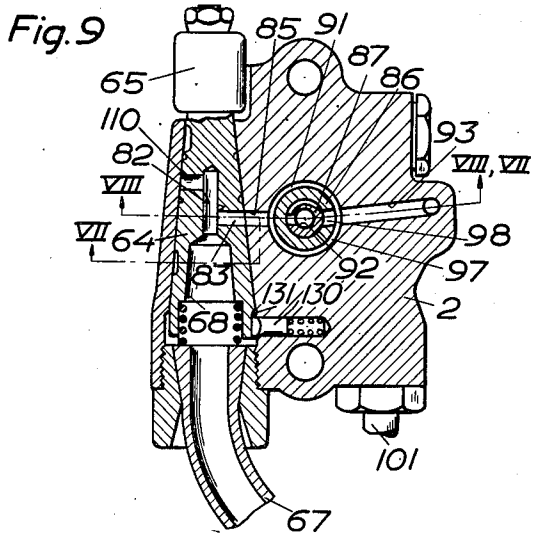


Fig.9



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Fig. 11

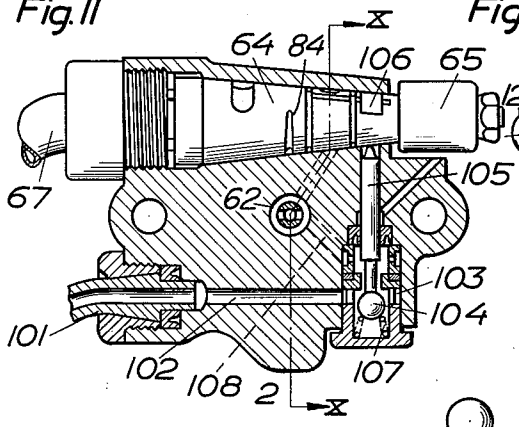


Fig. 10

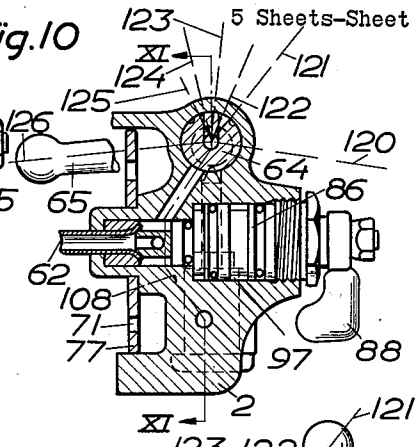


Fig. 13

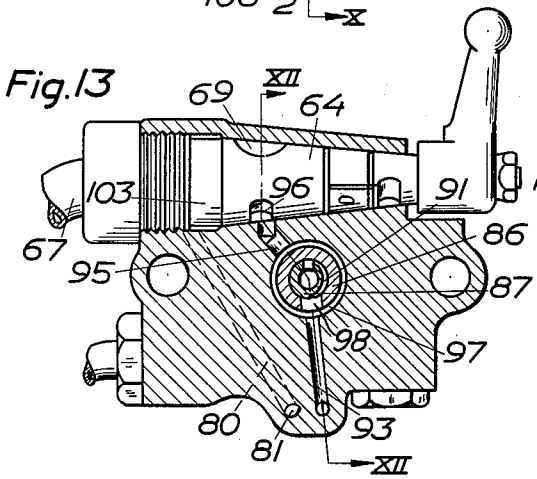


Fig. 12

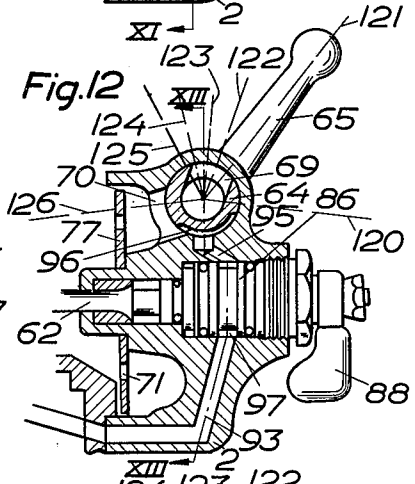


Fig. 15

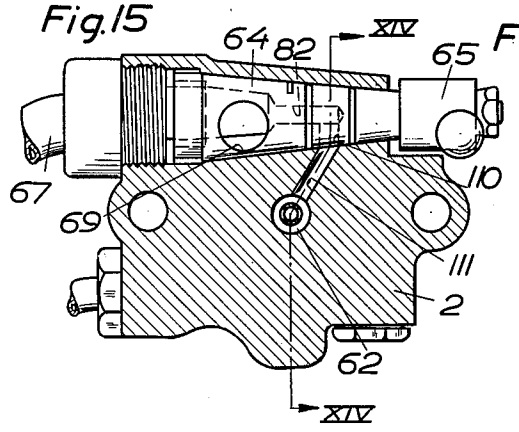
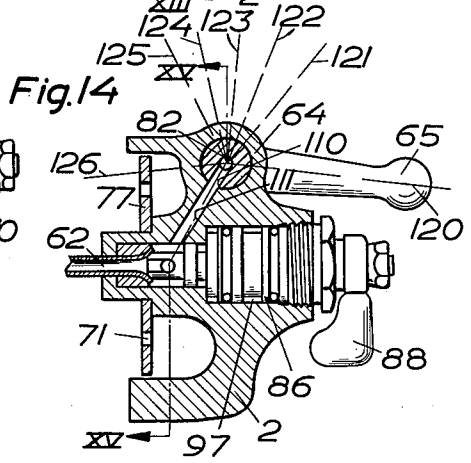


Fig. 14



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ROCK DRILLING MECHANISMS

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Fig.16

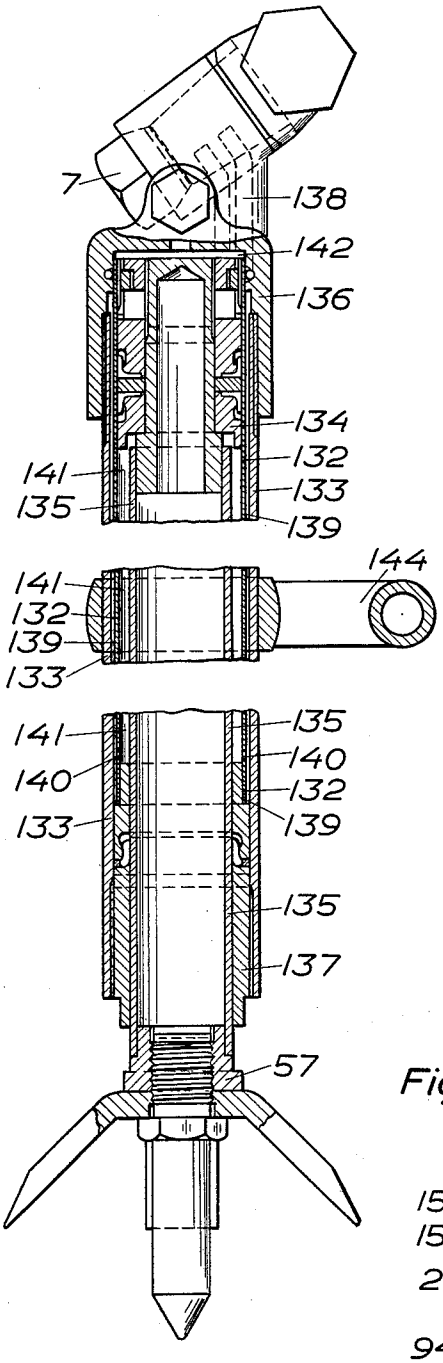


Fig.17

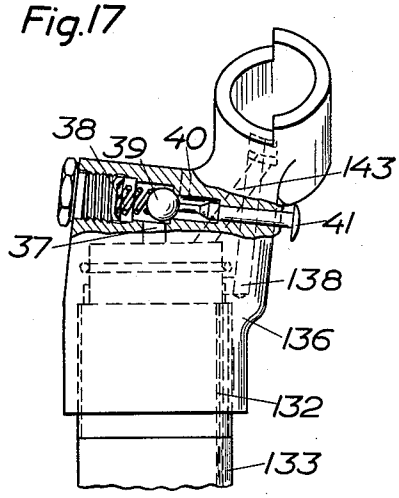


Fig.19

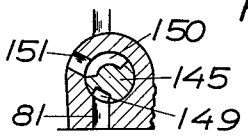


Fig.18

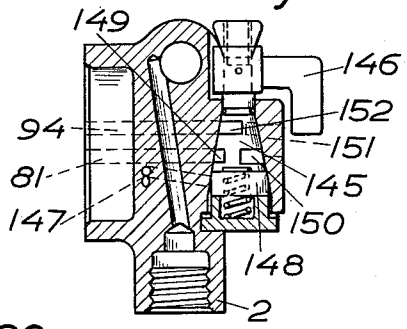
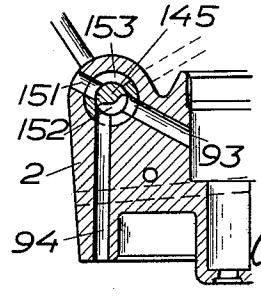


Fig.20



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United States Patent Office 3,085,638 Patented Apr. 16, 1963

3,085,638

ROCK DRILLING MECHANISMS

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Filed Oct. 23, 1953, Ser. No. 387,847
10 Claims. (Cl. 175—129)

This invention relates to a rock drilling mechanism comprising a drill steel actuating motor and a feeding device for movement of the motor towards a rock face to be drilled. One object of the invention is to reduce the effort on the operator for handling the drilling mechanism. A further object of the invention is to reduce the time needed by the operator for maneuvering rock drilling mechanisms comprising a drill and a pressure fluid actuated feeding device. A still further object of the invention is to provide concentrated control means for the operation of a rock drilling mechanism comprising a drill and a feeding device. A still further object of the invention is to provide a rock drilling mechanism including an improved telescopically arranged feed leg in which the cylinder of the feed leg is hingedly connected to a rock drill. A further object of the invention is to provide a rock drilling mechanism which is quick and simple in operation and cheap in manufacture. Other features of the invention will be apparent from the following description of an embodiment of the invention and a modification thereof, which, however, should only be considered as an example and which by no means limits the scope of the invention as set forth in the claims.

FIG. 1 is a side view, partly in section, of a rock drill and a feed leg forming a drilling mechanism according to the invention. FIG. 2 is a horizontal view of the rock drill and a portion of the feed leg according to FIG. 1. FIGS. 3 and 4 illustrate on a larger scale parts forming a member for hingedly connecting the feed leg to the rock drill and FIG. 3 is a section on line III—III in FIG. 1. FIG. 5 is a detail view also on a larger scale illustrating a handle and associated valve mechanism on the feed leg. FIG. 6 is a detail section also on a larger scale of the foot end portion of the feed leg. FIG. 7 is a section on the line VII—VII of FIG. 9 of a rock drill forming a part of the drilling mechanism according to the invention. FIGS. 8 and 9 are diagrammatic sections of the back head of the rock drill according to FIG. 7 illustrating a main valve and pressure reduction device and passages for supplying pressure fluid for feeding purposes and FIG. 8 is a section on line VIII—VIII of FIG. 9 while FIG. 9 is a section on line IX—IX of FIG. 8. FIGS. 10 and 11 are similar diagrammatic sections of the back head illustrating the main valve and associated means and passages for supplying flushing water to a hollow drill steel and FIG. 10 is a section on line X—X of FIG. 11, while FIG. 11 is a section on line XI—XI of FIG. 10. FIGS. 12 and 13 are similar diagrammatic sections of the back head illustrating means for venting the feed leg through the main valve and FIG. 12 is a section on line XII—XII of FIG. 13 while FIG. 13 is a section on line XIII—XIII of FIG. 12. FIGS. 14 and 15 are similar diagrammatic sections of the back head illustrating the main valve and passages for compressed air flushing of the drill hole and FIG. 14 is a section on line XIV—XIV of FIG. 15 while FIG. 15 is a section on line XV—XV of FIG. 14. FIG. 16 is a side view and partial section of a modification of the feed leg illustrated in FIGS. 1–6. FIG. 17 is a further view of a portion of the feed leg of FIG. 16. FIG. 18 is a diagrammatic section of the back head of a drill with a modified valve device for use in connection with the feed leg of FIGS. 16 and 17. FIGS. 19 and 20 are detail sections of the valve device according to FIG. 18.

The drilling mechanism illustrated in the drawings consists of a drill steel actuating motor and an expansible and contractible feed leg hingedly connected to the actuating motor for supporting the motor and for movement of the motor towards a rock face to be drilled.

The drill steel actuating motor may, of course, be of any suitable type and is here illustrated as a hammer rock drill having a casing 1 and a back head 2 and the feeding device is presented as a feed leg comprising a cylinder 3 in which a piston 4 and a piston rod 5 are movable under the action of compressed air and which is hingedly connected to the casing 1. The cylinder 3 is provided with a head 6 in which a body 7 is secured, said head and body together forming a member for connecting the cylinder 3 to the drill 1. The body 7 for this purpose has formed thereon a trunnion 8 which is journalled in a bearing 9 formed by a lug 10 on the underside of the casing 1 of the drill as shown in FIG. 7. The trunnion 8 is provided with three bearing surfaces 11 separated by two annular grooves 12 and 13, respectively, and is provided with sealing rings 14, 15, 16 which together with the bearing surface 9 form a seal between the grooves 12 and 13 as well as between the grooves and the atmosphere. A nut is secured on screw threads 18 at one end of the trunnion 8 and forces a spring 19 with a friction washer 20 against one side of the lug 10, whereas a conical surface 21 on the trunnion 8 bears against a conical surface at the opposite side of the lug 10. A passage 22 communicates with the groove 12 and an opening 23 in the body 7 and a passage 24 forms a communication between the groove 13 and an opening 25 in the body 7, as obvious from FIG. 3. The openings 23 and 25 register with openings of passages 26 and 27, respectively, in the head 6. The passage 26 is connected through a pipe 28, see FIG. 4, with a bracket 29 forming the base of a handle 30 fixed on the cylinder 3 by means of a screw bolt 31. The pipe 28 communicates through a passage 32 with a space 33 in a valve device provided in the bracket 29 of the handle 30. The passage 27 also communicates with the interior of the cylinder 3 through a passage 36, which is formed as a branch of passage 27 as shown in FIG. 4. The interior of the cylinder 3 furthermore communicates with a passage 37 leading to a space 38 in the head 6 which by means of a spring actuated ball valve 39 is separated from a passage 40 in the head 6 leading to the atmosphere. A spindle carrying a push button 41 is provided in the head 6 for opening the valve 39 when the operator desires to vent the cylinder 3 to the atmosphere through the passage 37, space 38 and passage 40. Such venting is sometimes desirable when the drill steel meets cracks in the rock or for other purposes.

The bracket 29 has a transverse bore 42 accommodating a slide valve 43 provided with lands 44 and 45 separated by an annular reduced portion 46 forming the space 33. A passage 47 opening in the bore 42 communicates through a pipe 48 with a lower head 49 on the cylinder 3. A passage 50 in the head 49 leads from the pipe 48 to a working chamber 51 in the cylinder 3 formed between the piston 4, the piston rod 5, the cylinder 3 and the lower head 49. The chamber 51 constitutes a working chamber for pressure fluid in the feed leg for producing contraction of the feed leg. A chamber 52 is formed in the cylinder 3 between the piston 4 and the head 6 and forms the working chamber for pressure fluid acting to expand the feed leg.

As soon as the drill is connected to a supply of pressure fluid, such as compressed air, pressure fluid flows through

passages in the drill which will be described hereinbelow to the groove 12 in the trunnion 8 and further through the passage 22, the port 23 the passage 26 in the head 6, through the pipe 28 and the passage 32 to the space 33 in the bracket 29. The handle 30 is provided with a trigger 53 which when pressed towards the handle moves a pin 54 which displaces the valve 43 against the pressure of a spring 55 so that the space 33 between the lands 45 and 44 provides a communication between the passage 32 and the passage 47 thereby conveying pressure fluid to the pipe 48, the passage 50 and the contraction chamber 51 of the feed leg. The displacement of the valve 43 to the right in FIG. 5 by means of the trigger 53 to uncover passage 35 by land 44 also opens a vent passage from the working chamber 52 through the passage 36, the passage 27, the pipe 34, the passage 35 in the bracket 29 and a passage 56 to the atmosphere. The pressure fluid acting in the chamber 51 then causes contraction of the feed leg.

The piston rod 5 is provided with a foot portion 57 adapted to rest on the ground or any suitable structure or wall in the working place.

The drill steel actuating motor as mentioned hereinabove consists of a casing 1 and a back head 2. A suitable steel retainer 58 for a hollow drill steel 59 is provided in conventional manner at the front end of the casing 1. A handle 60 is provided on the backhead 2 in conventional manner. The casing 1 contains a reciprocable hammer piston 61 which upon reciprocation in a manner known per se delivers blows to the shank of a hollow drill steel 59. A flushing medium tube 62 extends through the hammer piston 61 into a duct 63 for flushing medium in the drill steel 59 in a manner which is also very conventional in connection with rock drills. The back head 2 contains a conical valve member 64 which may be operated by means of a handle 65. Compressed air is supplied to the drill through a hose 66 and a tube 67 fitted in the back head 2 endwise of the valve member 64. The valve member 64 is bored as indicated at 68, this bore communicating with a port 69 in the valve member which within a certain angle of displacement of the handle 65 communicates through a passage 70 in the back head 2 with valve chambers 71 and 72. The valve chambers may be brought into communication with working chambers 73 and 74 behind and in front of the piston 61 through passages 75 and 76, respectively. A flapper valve 77 is provided in the drill for distribution of compressed air to the chambers 73 and 74. 78 indicates a groove in the cylinder wall communicating with exhaust ports 79 of the drill.

A passage 80, FIG. 13, in the back head 2 is in constant communication with the compressed air supply pipe 67 and communicates through a passage 81 in the casing 1 with the groove 12 in the trunnion 8, FIG. 3, as described hereinabove, and supplies compressed air of line pressure to the space 33 in the bracket 29, FIG. 5.

The valve member 64 has a further bore 82, FIGS. 8, 9 which through a passage 83 and a groove 84 in the valve member 64 in certain angular positions of the valve member 64 may be brought into communication with a passage 85 leading to a pressure reduction device which consists of a valve member 87 rotatable in a plug 86 in the back head 2 by means of a handle 88. The valve member 87 has a vent passage 89, FIG. 8, leading to the atmosphere and communicating with a groove 90 in the valve member 87. Another groove 91 in the valve member 87 communicates through a bore 92 with the passage 85. Both grooves 90 and 91 register with an opening 98 in the plug 86. The grooves 90 and 91 are of such relative dimensions and shape and varying width as to control the distribution of air vented to the passage 89 and supplied to a passage 93 leading to a passage 94 in the casing 1 and the groove 13 on the trunnion 8 and further through the passages 24, 27 and 36 to the working chamber 52 of the feed leg. Consequently, by suitable adjustment of the handle 88 the pressure in the working chamber 52 of the feed leg may be adjusted at the will of the operator. The back head 2 has a passage 95 which through a groove 97 in the plug 86 connects the passage 93 through a groove 96 and the port 70, FIG. 12, with the atmosphere through the working chamber and exhaust 78 of the drill for venting the working chamber 52 of the feed leg in certain angular positions of the handle 65 and the valve member 64.

Flushing water is supplied to the drill through a flushing water tube 100 connected to a tube 101 fitted in the back head 2 and communicating through a passage 102, FIG. 11, with a valve chamber 103 containing a spring actuated ball valve 104 operated to open position by a pin 105 which is in contact with a cam surface 106 on the valve member 64 due to the pressure of the flushing water and a spring 107 acting on the ball valve 104. In open position the ball valve 104 provides communication between the passage 102 and the chamber 103 to a passage 108 communicating with the flushing medium tube 62. Within certain angular positions of the handle 65 the cam 106 operates the flushing water valve 104 to provide more or less flushing water to the flushing medium tube 62. The valve member 64 is provided with a passage 110, FIGS. 9 and 15, communicating with the bore 82 and in certain positions of the valve member 64 with a passage 111 in the back head 2 which passage also communicates with the flushing medium tube 62. Consequently, in certain positions of the valve member 64 compressed air may be supplied to the flushing medium tube 62 for blowing the drill hole with live air.

The passages, grooves and ports provided in and cooperating with the control valve member 64 are arranged in such a manner that when the handle 65 is in the position 120 in FIG. 14 flushing air is supplied to the flushing medium tube 62 and the duct 63 of the drill steel at full line pressure and simultaneously the working chamber 52 of the feed leg is vented to the atmosphere through the control valve 64 and exhaust ports of the drill, FIG. 12. When the handle 65 is moved from the position 120 past the position 121 the vent passage 95 for the chamber 52 is closed. After further movement of the handle 65 to the position 122 air is admitted to the working chamber 52 of the feed leg through the groove 84 and passage 85, FIG. 8, so that feeding of the drill towards the rock face is initiated. After further turning of the valve handle 65 to the position 123 flushing water also starts to flow up to the flushing medium tube 62 due to actuation of the spindle 105 by the high portions of the cam surface 106 while the drill is fed towards the rock. In the position 124 the supply of feeding air and flushing water increases and through port 69 air is also admitted to the drilling motor, which starts to operate slowly. This is the position where collaring begins. In the position 125 full feeding pressure and water supply is obtained and the drilling motor operates with increased speed. The handle 65 is then turned to the position 126 where the drill operates at full speed with full feeding pressure and full flushing water supply. In any position in which feeding air is supplied to the feed leg and the working chamber 52 thereof the pressure of the air admitted to the working chamber 52 may be adjusted by means of the handle 88, which controls the relation of the areas of the grooves 90 and 91 uncovered by the port 98, FIG. 8.

When a hole has been drilled the operator returns the handle 65 from the position 126 to the position 120 thereby automatically turning off flushing water and blowing the drill hole and venting the feed leg. Holding the drill handle 60 with one hand he then grasps the handle 30 and presses the trigger 53 which causes contraction of the feed leg by air supplied to the working chamber 51 so that he can bring the foot portion 57 into a new advanced position. Upon turning of the handle 65 again to the position 126 the drilling mechanism con-

tinues the drilling and feeding operation in the same manner and with the same setting of the feed pressure and flushing water supply as before. A spring pressed plunger 130, FIG. 9, cooperating with notches 131 on the valve member 64 retains the valve member in various positions from the positions 120 to 126 without the operator having to keep his hand on the handle 65.

The modification of the invention illustrated in FIGS. 16–20 consists of a feed leg comprising a cylinder built up by two tubular members 132 and 133 accommodating a piston 134 and a piston rod 135. The members 132 and 133 are fitted in a head 136, similar to the head 6, in which the body 7 fits. The members 132 and 133 are also fitted to a lower head 137 through which the piston rod 135 extends and carries a foot portion 57. The head 136 has a passage 138 communicating through the body 7 with the passage 81 of the drill. The passage 138 communicates with a space 139 between the tubular members 132 and 133 which through openings 140 communicates with a working chamber 141 on the under side of the piston 134. Compressed air admitted to the chamber 141 produces contraction of the feed leg when a working chamber 142 on top of the piston 134 is vented to the atmosphere. The head 136 is provided with a venting passage 37 leading from the chamber 142 to a space 38 in the same way as in the head 6. The space 38 is by means of a spring actuated ball valve 39 separated from a passage 40 leading to the atmosphere. A spindle carrying a push button 41 is provided in the head 136 for opening the valve 39 when the operator desires to vent the chamber 142 to the atmosphere. The head 136 is also provided with a passage 143 communicating with the chamber 142 and through the body 7 with the passage 94 in the drill.

The tubular member 133 carries a handle 144 corresponding to the handle 30 but the valve mechanism in the handle 30 has been placed on the drill. For this purpose a valve member 145, FIG. 18, is provided in the back head 2, this valve member being rotatable by means of a handle 146. A passage 147 corresponding to passage 89 in FIG. 13 communicates with a space 148 at the big end of the conical valve member 145. The valve member 145 has two grooves 149 and 150, the groove 149 providing communication between the passage 147 and the working chamber 141 in the position of the valve member 145 illustrated in FIG. 19. This is the position for contraction of the feed leg. A 90° turn of the valve member 145 causes the groove 150 to bring the passage 81 into communication with a vent passage 151 to the atmosphere for venting the working chamber 141. A groove 152, FIG. 20, in the valve member 145 provides communication between the passages 93 and 94 for supplying compressed air of suitable pressure to the working chamber 142 for expansion of the feed leg. A further groove 153 serves for venting of the chamber 142 through the passage 151 after a 90° turn of the valve member 145 from the position in FIG. 20, i.e. to the position in FIG. 19. It is obvious that the feed leg of FIGS. 16–20 operates in the same way as the feed leg illustrated in FIGS. 1–6 only that the valve device in the handle 30 has been moved to the drill and the externally disposed pipes 28, 34 and 48 have been dispensed with.

Other modifications of the invention may be made by those skilled in the art within the scope of the claims.

What we claim is:

1. A rock drilling mechanism comprising a hammer rock drill, a compressed air actuated hammer piston in said drill, a casing in the drill in which said hammer piston is reciprocable, a back head on the drill, a telescopically arranged expansible and contractible feed leg hingedly connected to said casing for supporting the drill and for movement of the drill toward a rock face to be drilled, means for supplying compressed air for reciprocation of the hammer piston, a main valve in said back head controlling the supply of compressed air to the hammer piston, flushing medium passages in the drill leading to a flushing medium duct in a drill steel engaged by the drill, flushing water passages in the back head, compressed air passages in the back head, means on said main valve for controlling supply of flushing water from said flushing water passages to said flushing medium duct, means on said main valve for controlling supply of compressed air from said compressed air passages to the flushing medium duct, a cylinder in said feed leg, a feed piston and piston rod reversably movable in said cylinder upon actuation by compressed air to produce said movement of the drill and contraction of the feed leg, respectively, a first working chamber for compressed air in the feed leg for producing expansion of the leg, a second working chamber for compressed air in the feed leg for producing contraction of the leg, a member on the cylinder for hingedly connecting the cylinder and the casing, a trunnion on said member, a bearing in the casing for mounting the trunnion to form said hinged connection between the leg and the casing, passages in the back head and the casing and said member for supplying compressed air to said working chambers in the feed leg, means in said main valve for controlling the supply of compressed air to said first working chamber, a pressure reduction device in the back head for controlling the pressure of the compressed air supplied to said working chambers, and means for venting compressed air from the first working chamber of the feed leg.

2. A rock drilling mechanism comprising a hand guided and directed drilling tool, said tool having a pressure fluid operated motor for actuating a drilling implement, a handle mounted at the rear end of the tool which is grasped by the operator in the guiding and directing of the tool, a pressure fluid operated feed leg adapted to rest at its lower end upon the floor, and comprising relatively reciprocable fluid cylinder and piston elements providing between them an expansive chamber, said cylinder element projecting upwardly above said piston element, a cylinder head carried by said cylinder element at one end of said expansion chamber in said cylinder element at one end of said piston element, a feed leg contraction chamber in said cylinder element at the opposite end of said piston element, a trunnion and a cooperating bearing on said tool providing a transverse hinge connection between the upper end of the cylinder element and said drilling tool to permit tilting of said tool and feed leg in upright planes in different angular positions with respect to each other, at least two circumferential grooves in said trunnion, passages in said tool communicating with said grooves, a first passage in the trunnion and in the cylinder head and forming communication between one of said grooves and said expansion chamber, a second passage in the trunnion and in the cylinder forming communication between another of said grooves and said contraction chamber, means for attaching said trunnion to said cylinder head, fluid supply means leading to the tool, control valve means for controlling the supply of operating fluid through said passages from said fluid supply means to said operating chambers in the feed leg for producing expansion or contraction of the feed leg, respectively, and means located at the rear end of the tool adjacent to said handle for venting pressure fluid from said feed leg expansion chamber.

3. In rock drilling apparatus of the character described for drilling holes in generally non-vertical directions in a rock face and under the manual guidance and control of an operator, the combination which comprises a rock drill having a drill-receiving chuck at one end and a back head and manipulating means to be grasped by the operator at the opposite end, a telescoping elongated and axially extendible and retractable feed leg for supporting at least a substantial portion of the weight of said rock drill and for feeding thereof toward said rock face as manipulated by said operator, hinge means interconnecting one end of said feed leg with said rock drill for con-

tinuous angular movement with respect thereto about an axis substantially perpendicular to the longitudinal axis of said rock drill during said support and feeding thereof by said feed leg in various progressive positions of said rock drill as it drills into said rock face, ground engaging means at the other end of said feed leg against which it supports and feeds said rock drill, double-acting pressure fluid cylinder-and-piston means in said feed leg for progressive extension thereof to urge said rock drill toward said rock face and for power retraction of said feed leg from extended positions thereof, means for supplying fluid pressure to said rock drill, means for conducting said pressure fluid from said rock drill separately to opposite sides of said piston in said double-acting cylinder-and-piston means for effecting said separate extending and retracting movements thereof, feed valve means for controlling and regulating flow of said pressure fluid to said feed leg for said progressive extension thereof, venting valve means for relieving pressure fluid from said feed leg to permit retraction thereof, and retracting valve means for controlling flow of said pressure fluid to said feed leg for said power retraction thereof, all said valve means being disposed on said apparatus in positions readily accessible to said operator while manipulating said rock drill by said manipulating means.

4. In rock drilling apparatus of the character described for drilling holes in generally non-vertical directions in a rock face and under the manual guidance and control of an operator, the combination which comprises a rock drill having a drill-receiving chuck at one end and a back head and manipulating means to be grasped by the operator at the opposite end, a telescoping elongated and axially extendible and retractable feed leg for supporting at least a substantial portion of the weight of said rock drill and for feeding thereof toward said rock face as manipulated by said operator, hinge means interconnecting one end of said feed leg with said rock drill for continuous angular movement with respect thereto about an axis substantially perpendicular to the longitudinal axis of said rock drill during said support and feeding thereof by said feed leg in various progressive positions of said rock drill as it drills into said rock face, ground engaging means at the other end of said feed leg against which it supports and feeds said rock drill, double-acting pressure fluid cylinder-and-piston means in said feed leg and including a first working cylinder chamber for progressively extending said telescoping feed leg upon admission of pressure fluid thereinto to urge said rock drill toward said rock face and a second working cylinder chamber for power retraction of said extended telescoping feed leg upon admission of pressure fluid thereinto, means for feeding pressure fluid to said rock drill, internal flow passages through said hinge means for conducting said pressure fluid from said rock drill separately into said first and second cylinder chambers of said double-acting cylinder-and-piston means for said separate extending and retracting movements of said feed leg, feed valve means for controlling and regulating said flow of said pressure fluid to said first cylinder chamber for said progressive extension of said feed leg, venting valve means for relieving pressure fluid from said first cylinder chamber to permit retraction of said feed leg, and retracting valve means for controlling said flow of said pressure fluid to said second cylinder chamber for said power retraction of said feed leg, all said valve means being disposed on said apparatus in positions readily accessible to said operator while manipulating said apparatus by said manipulating means.

5. Rock drilling apparatus as recited in claim 4 in which said cylinder-and-piston means includes an elongated cylinder at the portion of said telescoping feed leg adjacent said hinged end thereof and a piston reversibly reciprocal in said elongated cylinder, and in which said telescoping extension and retraction of said feed leg are provided by an elongated member connected to said reciprocal piston in said cylinder and extending slidably out through the lower end thereof, and in which said flow passages and valve means conduct and control said flow of pressure fluid separately and individually into said elongated cylinder and selectively on either side of said reciprocal piston therein for urging said piston selectively one way or the other in said cylinder effecting said extension and retraction of said elongated member connected to said piston substantially without relative longitudinal extending or retracting movement of said elongated cylinder portion with respect to said rock drill and said hinge connection thereto.

6. Rock drilling apparatus as recited in claim 4 in which said hinge means interconnecting said feed leg with said rock drill includes a trunnion and a bearing therefor, and in which said internal flow passages through said hinge means for conducting said pressure fluid from said rock drill include separate passages through said trunnion for separately conducting said pressure fluid to each of said opposite sides of said piston in said double-acting cylinder-and-piston means, and in which said bearing for said trunnion includes separate passages in flow communication with said passages in said trunnion in all angular positions thereof for separately conducting said flow of pressure fluid selectively to said opposite sides of said double-acting cylinder-and-piston means.

7. Rock drilling apparatus as recited in claim 3 in which said feed valve means and said retracting valve means are both mounted adjacent said manipulating means on said back head for operation thereof by said operator while guiding and manipulating said drill.

8. Rock drilling apparatus as recited in claim 3 which also includes means for delivering flushing water to a drill in said drill-receiving chuck, and in which said feed valve means for controlling said extension of said feed leg is disposed on said manipulating means at said back head and associated with valve means for controlling said supplying of pressure fluid to said rock drill and for controlling said flushing water to said drill.

9. Rock drilling apparatus as recited in claim 3 which also includes main valve means at said back head for controlling said supplying of pressure fluid to said rock drill and associated with said feed valve means for said feed leg, and pressure reducing means at said main valve means.

10. In rock drilling apparatus of the character described for drilling holes in generally non-vertical directions in a rock face and under the manual guidance and control of an operator, the combination which comprises a pneumatic rock drill having a drill-receiving chuck at one end and a pneumatic motor for driving said chuck and a back head at the opposite end of said rock drill, a telescoping extendible and retractable feed leg adapted to rest at its lower end on the ground and for supporting at least a substantial portion of the weight of said rock drill and for feeding thereof toward said rock face, hinge means interconnecting the upper end of said feed leg with said rock drill for angular movement with respect thereto during said supporting and feeding thereof in various progressive positions as said rock drill drills into said rock face, a fluid pressure cylinder in said feed leg, a piston reciprocally movable in said cylinder under the operation of fluid pressure therein, an elongated piston rod movable with said piston and providing said telescoping extendible and retractable element of said feed leg as said piston is moved in said cylinder by pressure fluid acting selectively on either side of said piston in said cylinder, means for supplying pressure fluid to said apparatus for operation of said pneumatic rock drill and said piston in said cylinder, control means disposed at said back head for controlling operation of said pneumatic rock drill by said operator, separate conduit means from said pressure fluid supplying means for supplying pressure fluid into said cylinder separately and selectively on either side of said piston therein, a feed valve at said back head for controlling and regulating supply of pres-

sure fluid to said cylinder at the upper side of said piston for controlling said extending movement of said feed leg, retracting valve means at said back head for supplying pressure fluid to said cylinder at the lower side of said piston therein for controlling retraction of said feed leg, and venting valve means for selectively venting pressure fluid from said cylinder on either side of said piston therein permitting selectively said extension and retraction thereof.

References Cited in the file of this patent

UNITED STATES PATENTS

13,646	Goodrum	Oct. 8, 1885
944,750	Stephens	Dec. 28, 1909
1,150,592	Gilman	Aug. 17, 1915
1,898,999	Hulshizer	Feb. 28, 1933
1,909,179	Huffman	May 16, 1933
2,125,287	Gartin	Aug. 2, 1938
2,132,519	Stater	Oct. 11, 1938
2,208,025	Feucht	July 16, 1940
2,289,465	Slater	July 14, 1942
2,321,475	Feucht	June 8, 1943
2,610,030	Gillerstom	Sept. 9, 1952

FOREIGN PATENTS

423,578	France	Feb. 18, 1911