

May 12, 1964

J. A. LARCÉN

3,132,703

ROCK DRILLING MECHANISM

Filed May 15, 1956

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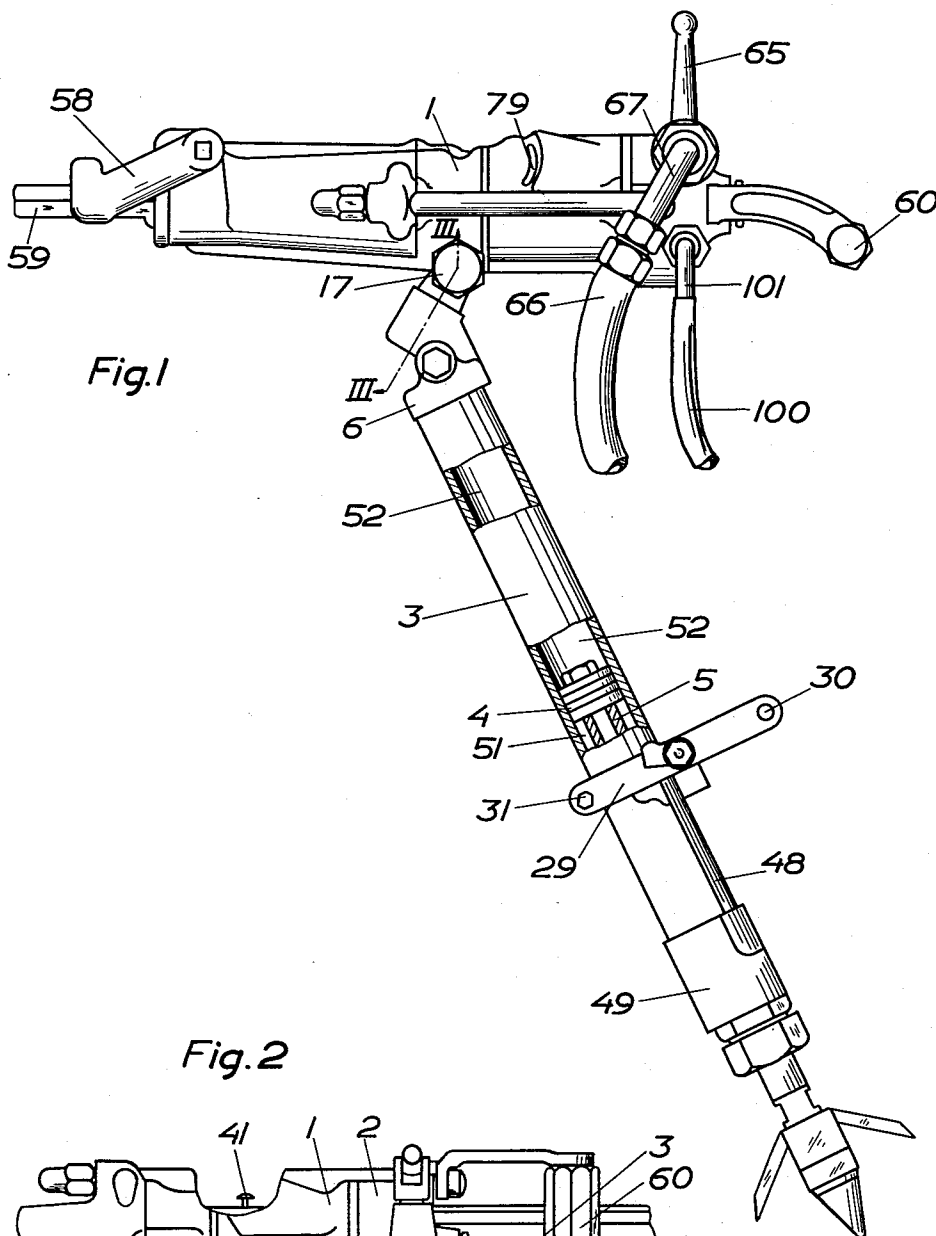


Fig. 2

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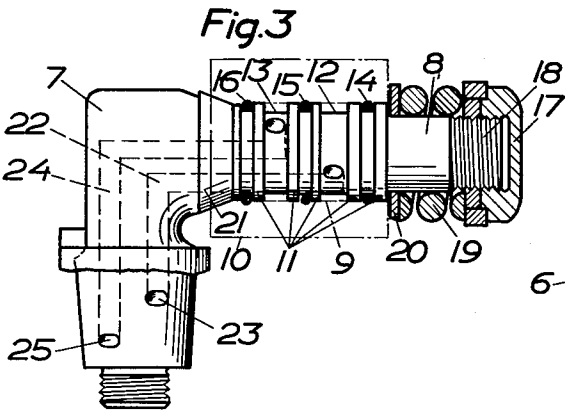
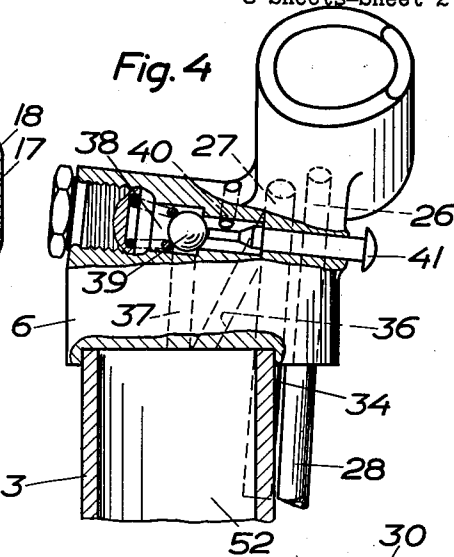
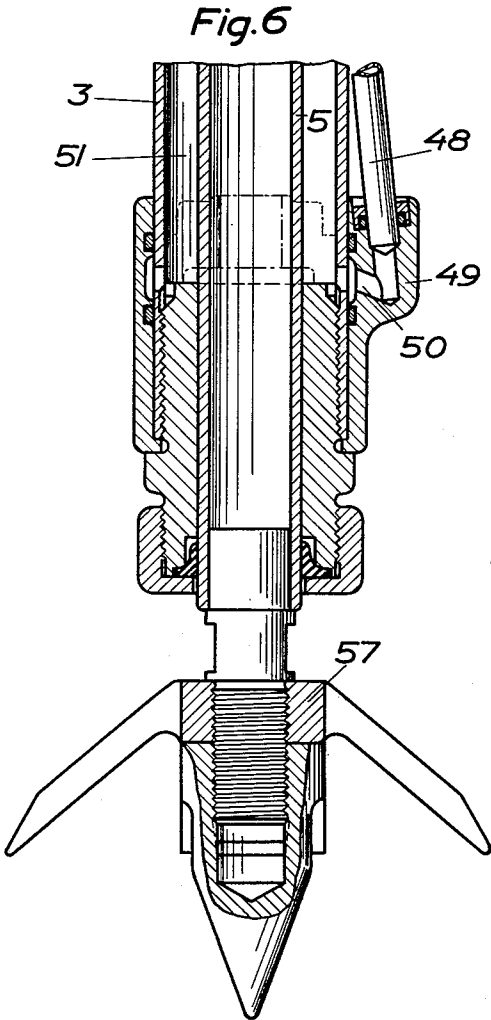
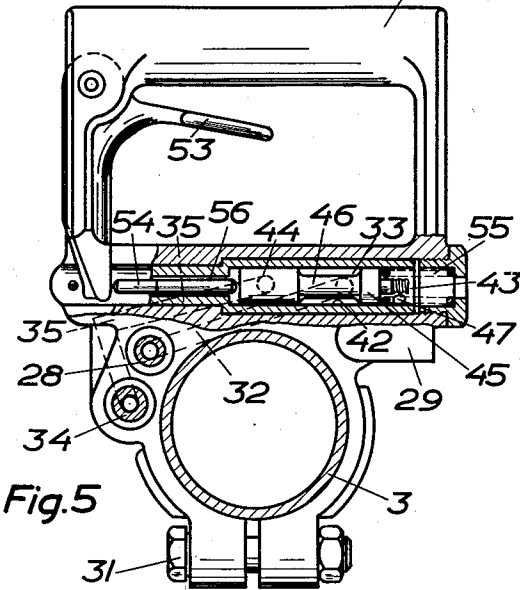
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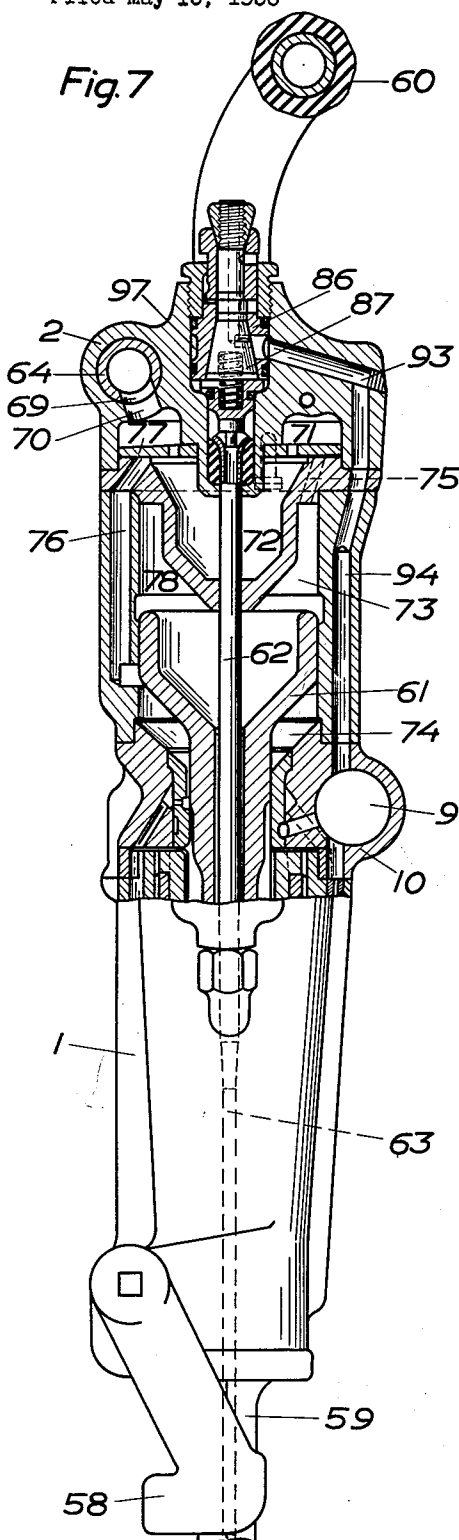
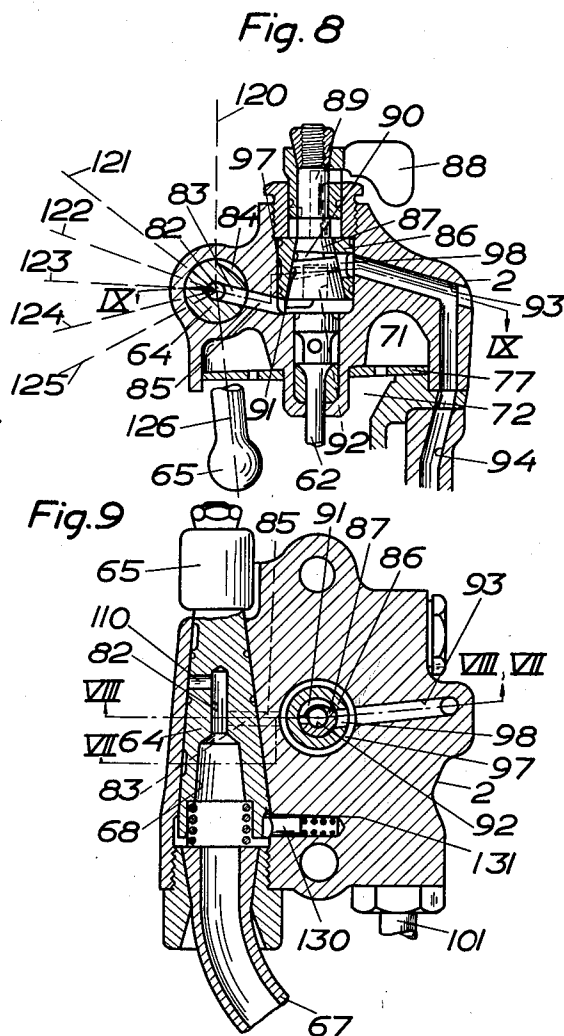
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ROCK DRILLING MECHANISM

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Fig.16

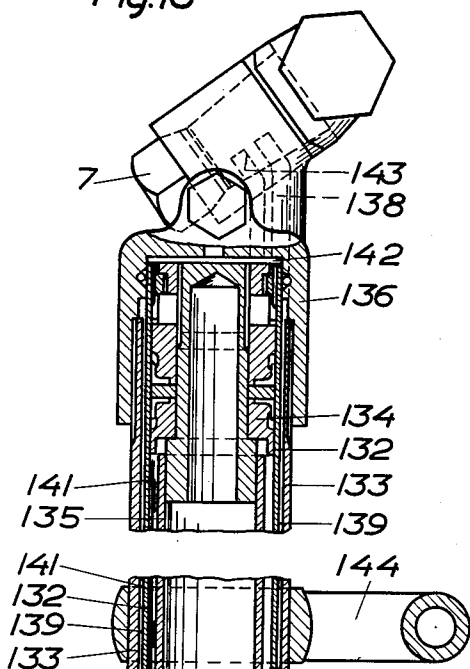


Fig.17

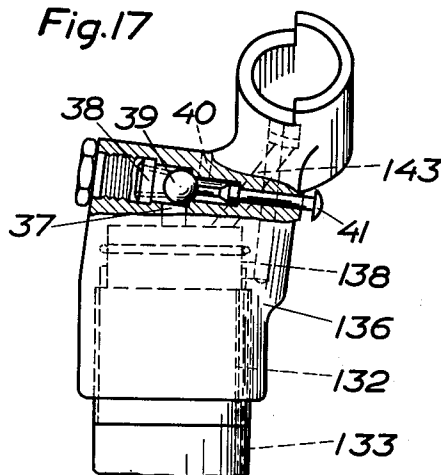


Fig.19

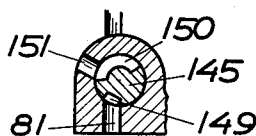


Fig.18

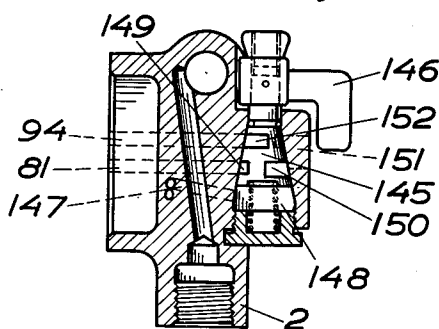
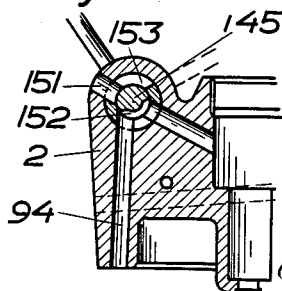


Fig.20



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Fig. 21

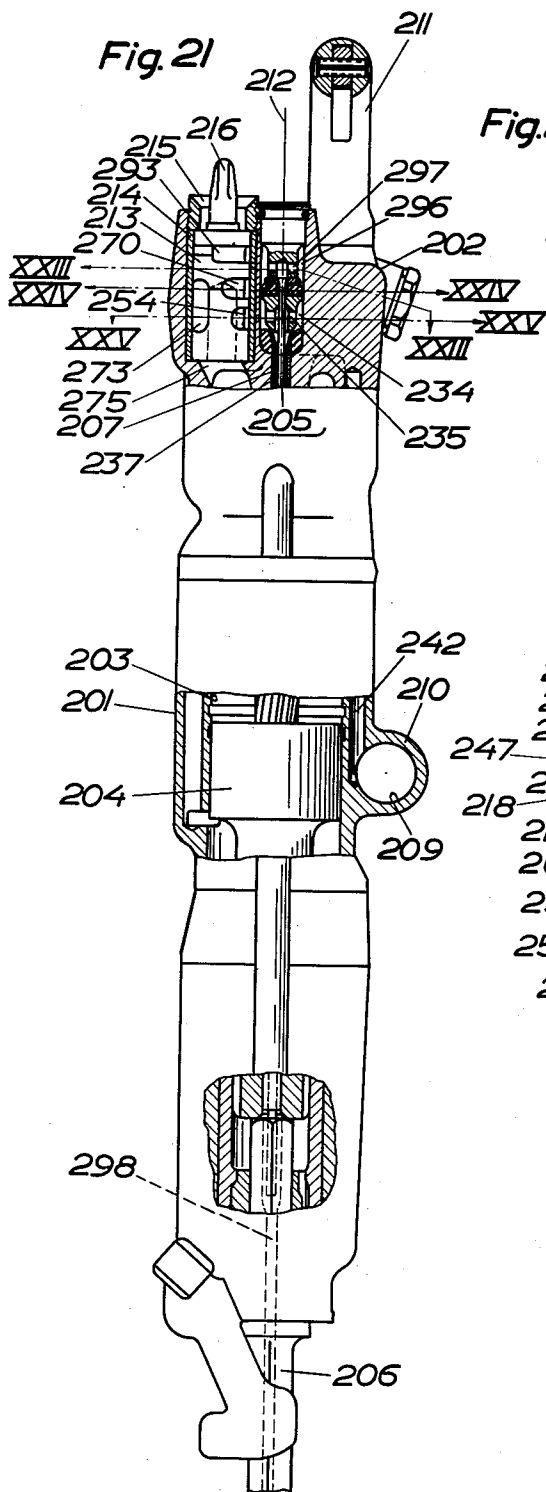


Fig. 27

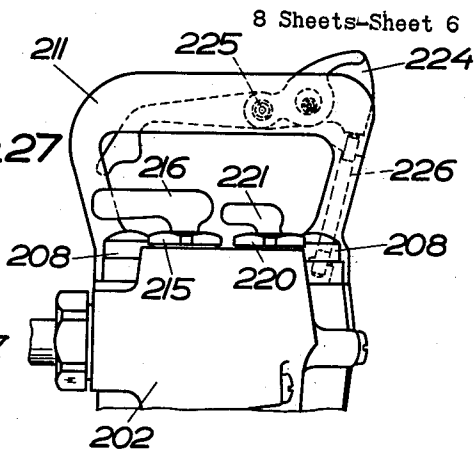
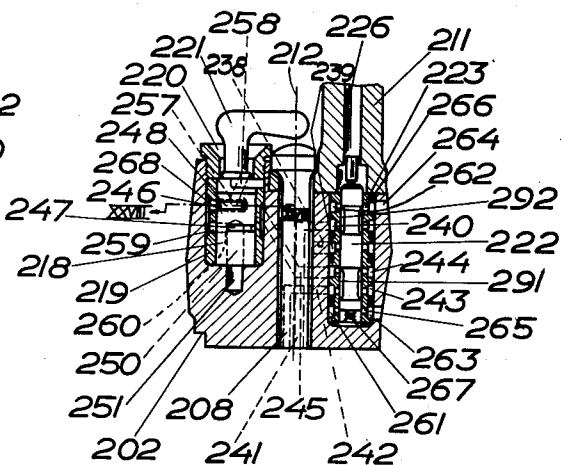


Fig. 26



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ROCK DRILLING MECHANISM

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Fig. 22

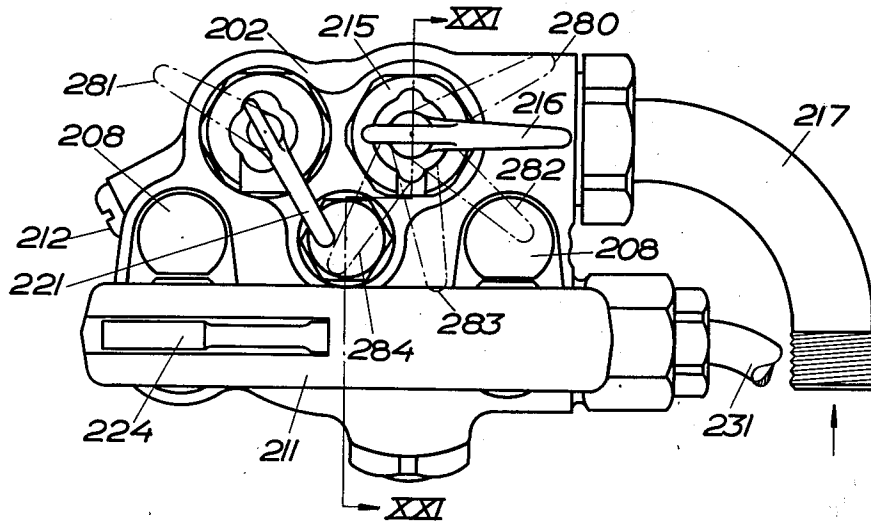
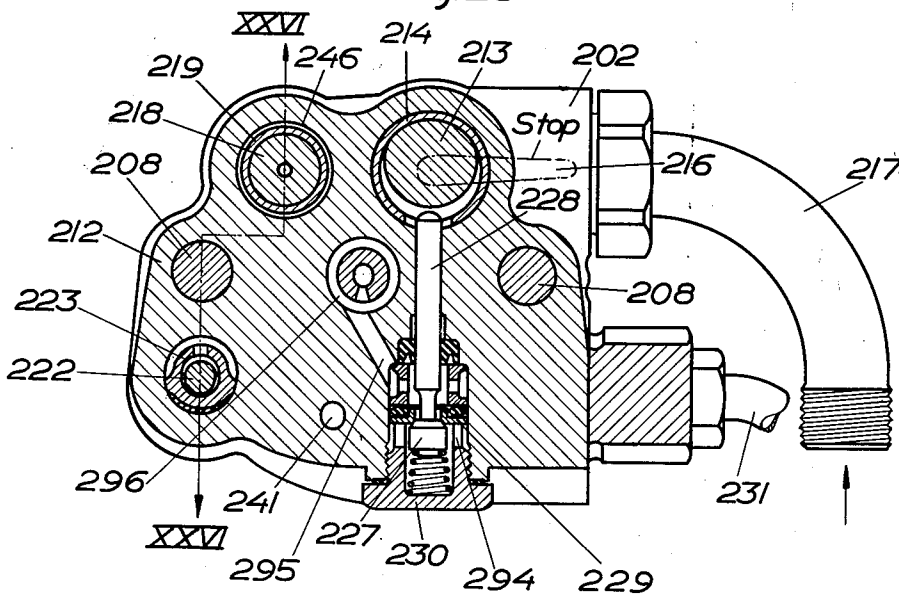


Fig. 23



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ROCK DRILLING MECHANISM

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Fig. 25

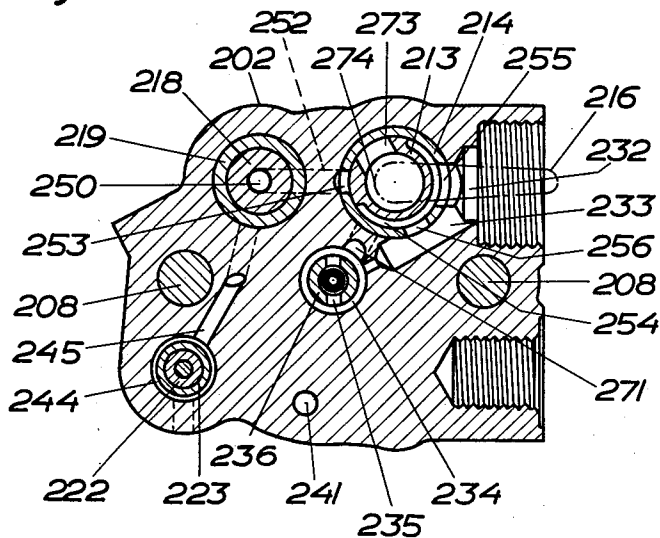


Fig. 28

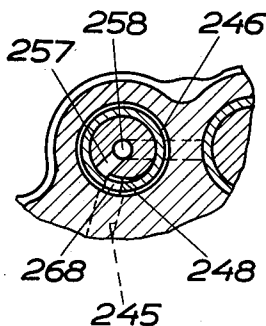
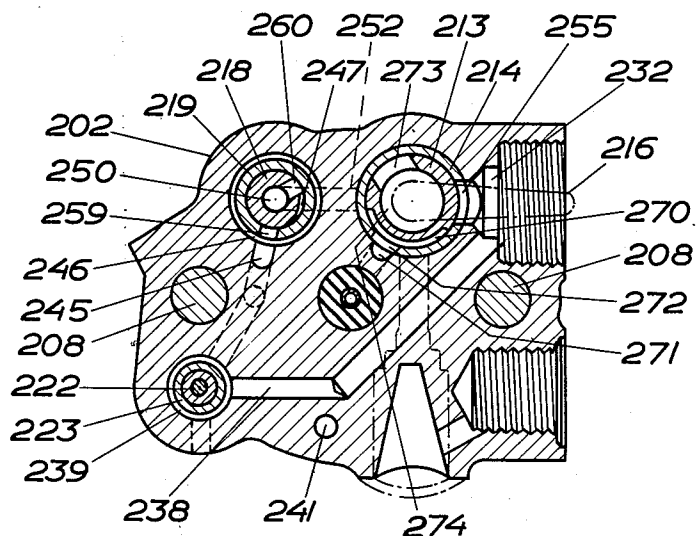


Fig. 24



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3,132,703

ROCK DRILLING MECHANISM

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Filed May 15, 1956, Ser. No. 584,970

9 Claims. (Cl. 173—62)

This invention is a continuation-in-part of Jan August Larcén's co-pending application Ser. No. 387,847, filed October 23, 1953, now Patent No. 3,085,638, and relates back thereto for all common subject matter.

The present invention relates to rock drilling mechanisms comprising a drill steel actuating motor arranged for cooperation with a pneumatic feeding device such as a feed leg, a stopper or drifter or the like serving to move the drill motor towards the rock face to be drilled. One object of the invention is to reduce the time needed by the operator for maneuvering rock drilling mechanisms of this type. A 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 further object of the invention is to provide a rock drilling mechanism which is quick and simple in operation and cheap in manufacture. A still further object of the invention is to provide a rock drilling mechanism in which the means for holding and controlling the rock drilling mechanism and for controlling a feeding device for the same are concentrated to the rear end face of the back head of the drill. A still further object of the invention is to provide a rock drilling mechanism in which the control means of the drill and feeding device are disposed in such a way in the back head that the drill may be moved very close to a wall or a roof in a working place where drilling is performed and in which the operating means of the drill and feeding device are easily accessible even in such drilling positions. Other features of the invention will be apparent from the following description of some embodiments of the invention which, however, should only be considered as examples and which by no means limit 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. 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 side view and partial section 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. 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. FIGS. 12 and 13 are similar diagrammatic sections of the back head illustrating means for venting the feed leg through the main valve. 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. 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

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leg of FIGS. 16 and 17. FIGS. 19 and 20 are detail sections of the valve device according to FIG. 18. FIG. 21 is a side view partly in section of a drilling mechanism according to a further embodiment of the invention. FIG. 22 is a rear end view of the back head of the drilling mechanism according to FIG. 21. FIG. 23 is a section on line XXIII—XXIII in FIG. 21. FIGS. 24 and 25 are sections on line XXIV—XXIV and XXV—XXV, respectively, in FIG. 21. FIG. 26 is a section on line XXVI—XXVI in FIG. 23. FIG. 27 is a partial plan view of the back head and the drill according to FIG. 21 and FIG. 28 is a section on line XXVIII—XXVIII in FIG. 26.

The drilling mechanism illustrated in FIGS. 1—20 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 illustrated 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 forming together means for connecting the cylinder 3 to the drill 1. The body 7 for this purpose has formed thereon a trunnion 8 which is journaled 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 bearing surfaces 11 separated by annular grooves 12 and 13, respectively, and provided with sealing rings 14, 15, 16 which together with the bearing surface 9 form a sealing between the grooves 12 and 13 as well as between the grooves and the atmosphere. A nut 17 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 which is indicated in chain dotted lines in FIG. 3. 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, FIG. 4. The passages 26 is connected through a pipe 28, see FIG. 4, with a bracket 29 forming a distributing valve housing and 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 distributing or shiftable 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 shiftable 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 com-

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municates through a pipe 43 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, FIG. 1, 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 grove 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 causes land 44 to uncover the opening of passage 35 thereby opening 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 back head 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 the 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 and this bore communicates 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 grove 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 mem-

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ber 87 has 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, 14 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 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 drill 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 drill 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 continues 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 position 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 in the tubular member 132 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 vent passage 37, FIG. 17, 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 conical shiftable distributing valve member 145, FIGS. 18-20, is provided in valve housing means formed in the back head 2, this valve member being rotatable by means of a handle 146. A passage 147 corresponding to passage 80 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, FIGS. 18 and 19, 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 exter-

nally disposed pipes 28, 34 and 48 have been dispensed with.

The drilling mechanism illustrated in FIGS. 21-28 consists of a drill which is arranged for cooperation with an expansible and contractible feed leg which may be hingedly connected to the drill for supporting the drill and for movement of the drill towards a rock face to be drilled and of a type illustrated in FIGS. 3, 16 and 17.

The drill illustrated in FIGS. 21-28 is a hammer rock drill having a casing 201 and a back head 202. The body 7, FIG. 3, of the feeding device may be journaled with the trunnion 8 in a bearing 209 formed by a lug 210 on the underside of the casing 201 of the drill, FIG. 21. The casing 201 forms a working cylinder 203 for compressed air in which a hammer piston 204 is reciprocable. A flushing medium tube 205 extends through the drill to the drill steel 206 which is hollow in conventional manner. A second tube 207 encloses the tube 205 and extends from the back head through the drill to the chuck chamber as is also well known in the art. The casing 201 and the back head 202 are held together by two side bolts 208 extending through the back head 202 in conventional manner. The back head is provided with a transversely extending handle 211 which is off-set to one side of a plane 212 through the centre of the side bolts 208. A cylindrical main valve member 213 is rotatable in a cylindrical bore in a sleeve 214 fixed by means of a screw threaded bushing 215 and arranged with the bore axis parallel with the axis of the working cylinder 203 and off-set to the opposite side of the plane 212 to the handle 211. The valve member 213 is provided with an operating lever 216 which may be manipulated by the fingers of a hand holding the handle 211. Compressed air is supplied to the back head through a pipe 217, FIG. 22. The valve member 213 is arranged for control of the supply of compressed air to the drill motor and to the feeding device and for the control of flushing medium supply through the flushing tube 205 and of air through the tube 207, as will be described in detail below.

A cylindrical auxiliary valve member 218, FIG. 26, is rotatable in a cylindrical bore in a bushing 219 which is secured in the back head 202 by means of a screw threaded bushing 220 with a bore axis parallel with and off-set with regard to the plane 212 to the same side of said plane as the valve member 213. The auxiliary valve member 218 is provided with a manipulating lever 221. The valve member 218 is arranged for control of the pressure of the compressed air in the feeding device, as will be described in detail hereinbelow.

A second auxiliary or distributing valve member 222 is movable in a sleeve 223 fitted in the back head 202 and kept in place by the handle 211. The valve member 222 is an air vent valve for venting the feeding device as will be described hereinbelow. A double arm lever 224 is swingable on a pivot 225 in the handle 211 for operating the valve member 222 by means of a push rod 226, FIGS. 26 and 27.

The backhead 202 also contains a flushing water control valve 227, FIG. 23, which is formed on one end of a push rod 228 actuated by the main valve member 213 as will be described hereinbelow. The valve member 227 cooperates with a seat 229 which is kept in place in the back head by a screw threaded bushing 230. Flushing water is supplied to the back head through a water pipe 231.

The rock drill according to FIGS. 21-28 cooperates in the following manner with the telescopic feeding device illustrated in FIGS. 3, 16 and 17. Compressed air supplied to the back head through the pipe 217 enters the backhead at 232, FIGS. 24 and 25, and a reduced air stream is conducted through a bore 233, FIG. 25, to an annular space 234 and openings 235 in a member 236 to a passage 237 between the flushing water tube 205 and the tube 207 to the chuck chamber of the drill causing air to flow through the chuck chamber for lubricating

the chuck and adjacent parts and for blowing the drill hole with air. An air duct 238, FIGS. 24 and 26 leads from the space 232 to a groove 239, FIG. 26, in the sleeve 223. An annular groove 240 in the sleeve 223 is connected through a passage 241 through the casing 201 to the bore 209 in which it communicates with the groove 12 and the duct 22, FIG. 3, and furthermore through the passage 138, FIG. 16, and the space 132 through openings 140 with the lower chamber 141 of the feed leg. Compressed air admitted to the chamber 141 contracts the feed leg when the space 142 is vented to the atmosphere. A duct 242 in the back head and the casing 1 which communicates with an annular groove 243 in the sleeve 223, FIG. 26, opens in the bore 209 and communicates with the groove 13, FIG. 3, and the duct 24 leading to the space 142, FIG. 16. Compressed air of suitable pressure supplied through the duct 242 causes expansion of the feed leg. The sleeve 223 has a further annular groove 244 which through a passage 245, FIG. 26, communicates with an annular space 246 in the sleeve 219. The auxiliary valve member 218 has two grooves 247 and 248 carried out in similar way as the grooves 90 and 91 of the valve member 87, FIG. 8, with oppositely decreasing area. A bore 250 in the valve member 218, FIG. 26, communicates with a bore 251 in the back head 202 and a duct 252 opening in a port 253 in the main valve sleeve 214, FIG. 25, and may be connected through a groove 254 in the main valve member to ports 255 or 256 in the sleeve 214 which are always in communication with the live air supply space 232. As soon as the main valve member 213 is moved to positions in which the groove 254 registers with the port 253 live air is supplied to the bore 250 of the auxiliary valve member 218. From the bore 250 the air is conducted to a bore 260 and the groove 247 and through a bore 259 to the space 246. More or less of the air admitted to the space 246 is vented to the atmosphere through the groove 248, a port 268, FIG. 26, a bore 257 and a vent passage 258 in the valve member 218 so that the air pressure from the passage 255 to the space 246 is reduced more or less thereby reducing the power of the feeding device according to the adjustment of the valve 218. The sleeve 223, FIG. 26, is provided with two annular grooves 261, 262 which communicate with the atmosphere through passages 263, 264 and with the bore of the sleeve through ports 265, 266. In the position of the valve 222 illustrated in FIG. 26 air is vented from the underside of the piston 134, FIG. 16, through passage 241, groove 240, a space 292, port 266 and passage 264, and when the valve 222 is depressed against a spring 267 the vent passage 264 is closed and air is instead vented through the passages 242 and 263 from the upper side of the piston 134 in FIG. 16.

The main valve member 213 has a peripheral groove 270 which may produce communication between the supply chamber 232 through the port 255, the groove 270, and a port 272 to a passage 271 leading to the space 234 and opening 235 and serving to supply live air to the chuck chamber and for full pressure air blowing through the flushing medium duct of the drill steel. The main valve member 213 has a large port 273 which may be brought to register with the port 255 in the sleeve 214 in order to supply compressed air to a bore 274 in the main valve and a passage 275 leading to the drill motor.

Operation of the device described in connection with FIGS. 21-28 hereinabove is substantially the same as the operation of the device described in connection with FIGS. 7, 8, 9, 16 and 17.

It will be appreciated, however, that all controls for the drilling mechanism illustrated in FIGS. 21-28 and 3, 16, 17 are disposed within the confines of the rear end face of the backhead 202. The provision of cylindrical valve members 213 and 218 makes possible a design of a back head in which valve adjustments are sufficiently easy to be performed with the aid of short levers provided on the valve members which may be manipulated with the

fingers of a hand holding the handle 211. It is also obvious that the valve operating levers do not project outside the confines of the back head so that the drill may be moved very close to a rock wall or roof with the upper, lower or left hand side of the drill as is often desirable.

The operating scheme of the drilling mechanism according to FIGS. 3, 16, 17 and 21-28 is easily understood with reference to FIG. 22. In this and the other figures all levers are illustrated in stop position. In said position no compressed air is supplied to the drill motor and air is vented from both cylinder chambers of the feed leg. No water is supplied to the flushing ducts but a reduced air stream flows to the chuck chamber through the small opening of passage 233. Turning of the lever 216 to the position 280 causes air to be supplied to the flushing duct of the drill steel from the space 232 through port 255, groove 270, port 272, passage 271, FIGS. 24 and 25, space 234, FIG. 21, ports 235 and passage 237 to the chuck chamber of the drill in which the piston 204 is lifted from the shank of the drill steel 206. When the lever 216 is moved to the full line position in FIG. 22 flushing air supply over the groove 270, FIG. 24, is interrupted. Upon movement of the lever 216 to the position 282 compressed air is first admitted to the feeding device from the space 232 through port 255, groove 254, port 253, passage 252, bore 251, bore 250, bore 260, groove 247, port 259, space 246, passage 245, groove 244, space 291, groove 243, passage 242, groove 13, FIG. 3, passage 24, port 25, passage 143 and space 142 on top of the piston 134. Since the underside of the piston 134 is vented the air pressure in the chamber 142 causes extension of the feed leg. The pressure of the compressed air in the chamber 142 is controlled by the handle 221. In the position of FIG. 22 all air supplied to the space 246, FIG. 26, is vented to the atmosphere through port 268 and bores 257 and 258, but as soon as the lever 221 is turned in the direction towards the position 281 the amount of air escaping from the space 246 is reduced. This is due to the fact that when the lever 221 is turned clockwise from the full line position of FIG. 22 towards the position 281 the port 268 registers with a decreasing area of the groove 248 whereas the port 259 registers with an increasing area of the groove 247 so that when the lever 221 has been turned the full way to the position 281 no air is vented from the space 246 and full line pressure is obtained in the feeding device in the space 142, FIG. 16. When the lever 216 was moved to the position 282 a cam surface 293 on the valve member 213 actuated the push rod 228 and opened the water valve 227 so that flushing water was supplied from the pipe 231 through a space 294, a duct 295, a space 296, FIG. 23, ports 297, FIG. 21, through the interior of the flushing tube 205 to a flushing duct 298 in the drill steel 206. Further movement of the lever 216 to the position 283 causes compressed air to be supplied from the space 232 through port 255, FIG. 24, port 273, bore 274, and passage 275 to the distributing valve and working chambers of the drill motor. movement of the lever 216 to the position 284, FIG. 22, brings the port 273 to register exactly with port 255, FIG. 24, so that full air supply is obtained to the drill motor.

When it is desired to momentarily contract the feed leg or to reduce the feed pressure the lever 224 may be pressed. Venting of the space 141 on the underside of the piston 134 is then interrupted and the valve 222 instead supplies compressed air to the space 141 from space 232 through passage 238, FIG. 24, annular groove 239, FIG. 26, space 292, groove 240, passage 241, groove 12, FIG. 3, passage 22, port 23, passage 138, space 139, openings 140 to the piston chamber 141. The chamber 142, FIG. 16, of the feed leg is simultaneously vented through passage 143, FIG. 17, port 25, passage 24, groove 13, passage 242, FIG. 26, groove 243, space 291, ports 265, groove 261 and passage 263 to the atmosphere. As soon

as the operator releases the lever 224 the previous feeding conditions and feed pressure are restored.

The invention may be modified in several different ways by those skilled in the art within the scope of the following claims.

What I claim is:

1. A rock drilling mechanism comprising a drill steel actuating motor and a feeding device for movement of said motor toward a rock face to be drilled, a working cylinder for compressed air in said motor, passages in the motor for conveying flushing water to a flushing medium duct in said drill steel, passages in the motor for conveying compressed air to said flushing medium duct in the drill steel, passages in the motor for supplying compressed air to said working cylinder of the motor for driving the same, passages in the motor for conveying compressed air to said feeding device and for venting air from the feeding device, compressed air and flushing water connections at one longitudinal side of said motor, means in the motor for controlling the flushing water passages, a main valve in said motor arranged for control of said flushing water controlling means and said compressed air passages and comprising a cylindrical main valve member mounted to turn in the motor in a cylindrical bore with the bore axis substantially parallel to the axis of the working cylinder, an operating lever for turning said main valve member from a position in which air is supplied to the flushing medium duct to a position in which air is supplied to the feeding device then to a position in which water is supplied to the flushing medium duct and air is still supplied to the feeding device and then to positions in which air is supplied to the motor and the feeding device and water to the flushing medium duct, a pressure reduction device provided with an operating member for controlling the pressure of the compressed air supplied to the feeding device, said feeding device being pivotally connected to the underside of said motor to allow the motor to swing on a transverse axis relative to the feeding device, and said operating means being positioned substantially within the cross section contour of the motor and accessible from the rear and upper side of the motor leaving the underside and one longitudinal side free of operating means and hose connections.

2. A rock drilling mechanism comprising a drill steel actuating motor adapted for cooperation with a pneumatic feeding device and having a casing, a working cylinder for compressed air in said casing, a member movable in said working cylinder under the action of said compressed air, a back head on the casing, a cylindrical main control valve member in said back head mounted to turn in a first cylindrical bore in the back head with the bore axis substantially parallel to the axis of the working cylinder and arranged for control of the compressed air supply to the working cylinder, a cylindrical auxiliary valve member in said back head mounted to turn in a second cylindrical bore in the back head with the bore axis substantially parallel to the axis of the working cylinder and arranged for control of the compressed air pressure in said feeding device, levers for manipulating said valve members, and a handle on the back head extending transversely to the axis of the working cylinder, said handle being off-set relative to said levers, and said feeding device being pivotally connected to the underside of said motor to allow the motor to swing on a transverse axis relative to the feeding device, and said operating means being positioned substantially within the cross section contour of the motor and accessible from the rear and upper side of the motor leaving the underside and one longitudinal side free of operating means and hose connections.

3. A rock drilling mechanism comprising a drill steel actuating motor adapted for cooperation with a pneumatic expansible and retractable feeding device and having a casing, a working cylinder for compressed air in said

casing, a member movable in said working cylinder under the action of said compressed air, a back head on the casing, a cylindrical main control valve member in said back head mounted to turn in a first cylindrical bore in the back head with the bore axis substantially parallel to the axis of the working cylinder and arranged for control of compressed air supply to the working cylinder and of flushing water or air to the drill steel and compressed air to the feeding device, a cylindrical auxiliary valve member in said back head mounted to turn in a second cylindrical bore in the back head with the bore axis substantially parallel to the axis of the working cylinder and arranged for control of the air pressure in said feeding device, a vent valve member in the back head for venting air from the feeding device, and means on the back head for manipulating said valve members to produce drilling, flushing, feeding and retraction of the drill, and said feeding device being pivotally connected to the underside of said motor to allow the motor to swing on a transverse axis relative to the feeding device, and said operating means being positioned substantially within the cross section contour of the motor and accessible from the rear and upper side of the motor leaving the underside and one longitudinal side free of operating means and hose connections.

4. A rock drilling mechanism comprising a drill steel actuating motor adapted for cooperation with an expansible and contractable pneumatic feeding device and having a casing, a working cylinder for compressed air in said casing, a member movable in said working cylinder under the action of said compressed air, a back head on the casing, two side bolts extending through said back head and casing for holding together the back head and casing, a cylindrical main control valve member in the back head mounted to turn in a first cylindrical bore in the back head off-set to one side of a plane through said side bolts and having the bore axis substantially parallel with the axis of the working cylinder and arranged for controlling the compressed air supply to the working cylinder, a cylindrical auxiliary valve member in said back head mounted to turn in a second cylindrical bore in the back head off-set to the same side of said plane as said first bore and having the bore axis substantially parallel to the axis of the working cylinder and arranged for control of the compressed air pressure in said feeding device, levers on said cylindrical valve members arranged to turn the valve members for manipulating said valves, a handle on the back head extending transversely to the axis of the working cylinder parallel with said plane and off-set to the opposite side of said plane to said valve members, a lever pivoted in said handle, and an air vent valve in the back head arranged for venting air from the feeding device to cause contraction of the feeding device and arranged to be moved to open position by means of said lever in the handle upon the swinging of said pivoted lever.

5. A rock drilling mechanism according to claim 4, in which the pivoted lever in the handle is a double armed lever extending with one end through the rear side of the handle and with the other end through the forward side of the handle.

6. A rock drilling mechanism comprising a drill steel actuating motor adapted for cooperation with a pneumatically expansible and retractable feed leg and having a casing provided with means for pivotal attachment of said feed leg at the longitudinal underside of said casing for swinging of the motor on a transverse axis relative to said feed leg, a working cylinder for compressed air in said casing, a member movable in said working cylinder under the action of said compressed air, a backhead on the casing, a main control valve member in said backhead arranged for control of compressed air supply to the working cylinder, an auxiliary valve member in the backhead arranged for control of the air pressure in said feed leg, shiftable valve means associated with said backhead

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and arranged for controlling expansion and contraction, respectively, of said feed leg and for venting the feed leg, fluid hose connections at one longitudinal side of the backhead, and operating means at the backhead substantially within the cross section contour of the motor and accessible from the rear and upper side of the motor leaving the underside and one longitudinal side free of operating means and hose connections.

7. A rock drilling mechanism comprising a drill steel actuating motor and a power expansible and power retractable feed leg, said motor having a casing with means for pivotal attachment of said feed leg for swinging of said motor on a transverse axis relative to said feed leg and to the longitudinal axis of said motor, an expansion chamber in said feed leg, a retraction chamber in said feed leg, passages in said motor and said feed leg for conveying pressure fluid to said chambers and for venting the same, a backhead and handle on said casing, a spring biased shiftable distributing valve means associated with said backhead, said valve means being arranged in said passages for normally admitting pressure fluid to said expansion chamber and venting said retraction chamber, and a push rod longitudinally movable relative to and carried by said backhead for engaging said shiftable valve means upon actuation to move said valve means to a position in which pressure fluid is admitted to the retraction chamber and vented from the expansion chamber.

8. A rock drilling mechanism according to claim 7, in which the backhead and handle has a grip portion extending transversely to the longitudinal axis of the motor, and a supporting portion extending longitudinally of the motor and carrying said grip portion, said push rod being arranged in said supporting portion, and a swingable lever mounted in said grip portion and engaging said push rod with one end for manipulating the same to actuate said valve.

9. In rock drilling apparatus of the character described having a fluid pressure drilling motor and a casing therefor, including a backhead and manipulating means to be grasped by the operator of said apparatus, and a

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power extendable and retractable feed leg pivotally connected to said casing for swinging movement with respect thereto, the combination which comprises a first fluid pressure chamber in said feed leg for extending movements thereof upon admission of pressure fluid into said chamber, a second fluid pressure chamber in said feed leg for retracting movements thereof upon admission of pressure fluid into said chamber, main conduit means for supplying fluid pressure to said apparatus for operation of said drilling motor and said feed leg, main valve means for controlling said supply of pressure fluid, internal conduit means in said casing and said feed leg for supplying pressure fluid from said main conduit means to both said chambers in said feed leg, auxiliary valve means for controlling the pressure of said pressure fluid supplied into said chamber of said feed leg, vent means for venting pressure fluid from each of said chambers, distributing valve means in flow communication with said internal conduit means and said vent means and selectively movable from a first position for supplying pressure fluid to said first chamber while venting said second chamber to a second position for venting said first chamber while supplying pressure fluid to said second chamber, and separate operating means for operating each of said main valve and auxiliary valve and distributing valve means, all said main conduit means and said operating means for each of said valve means being disposed on said apparatus adjacent one side only of said backhead and accessible to said operator while grasping said manipulating means whereby the opposite side of said backhead is substantially free of fluid conduits and valve operating means.

References Cited in the file of this patent

UNITED STATES PATENTS

1,175,745	Gilman	Mar. 14, 1916
1,407,590	Slater	Feb. 21, 1922
1,862,497	Rundqvist	June 7, 1932
3,064,741	Morrison	Nov. 20, 1962
3,065,806	Thompson	Nov. 27, 1962