Feb. 15, 1949. J. C. CURTIS ET AL 2,461,528

ROCK DRILL

Filed July 1, 1943 3 Sheets-Sheet 1

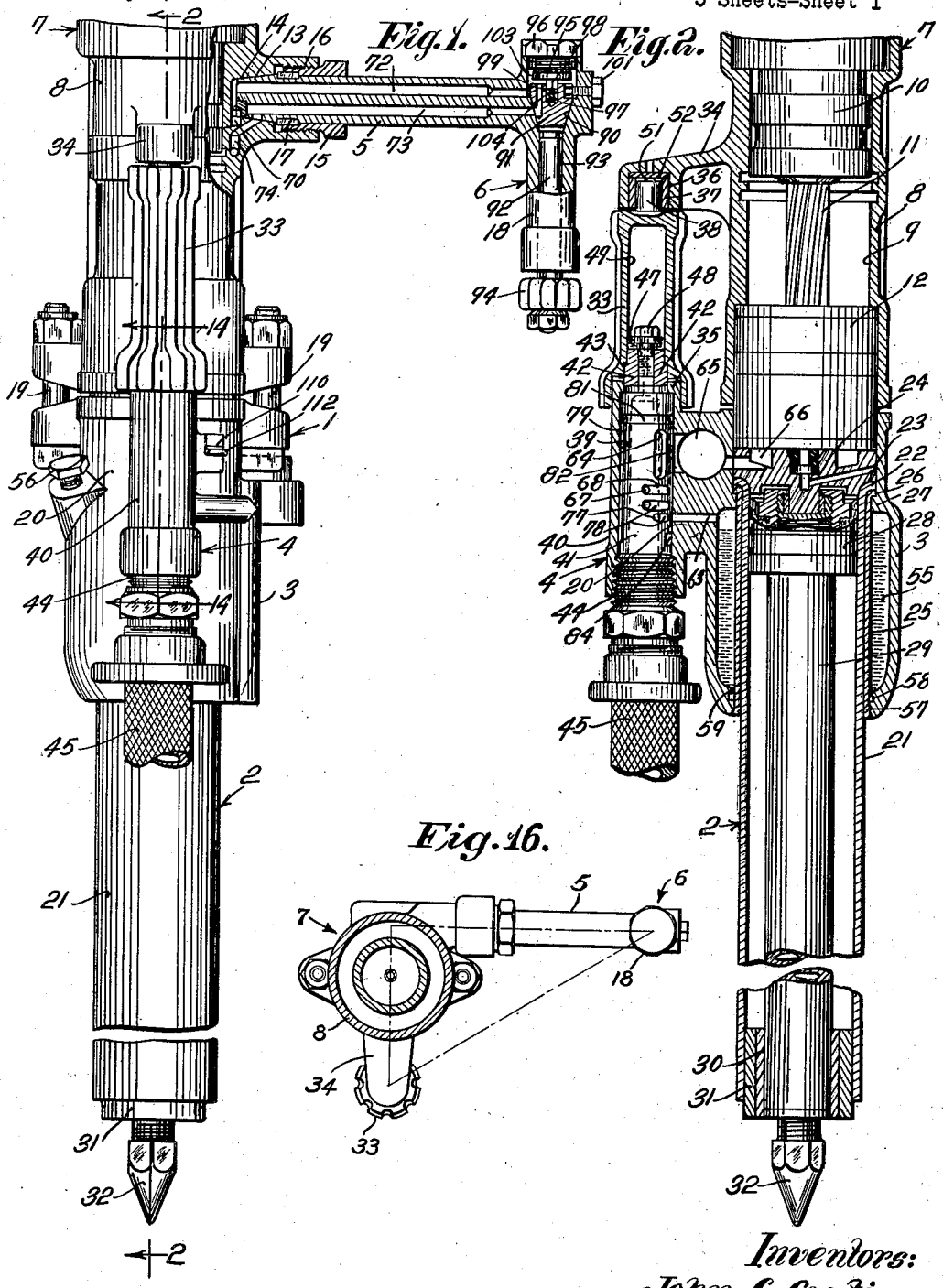


Fig. 1b.

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ROCK DRILL

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Fig. 3.

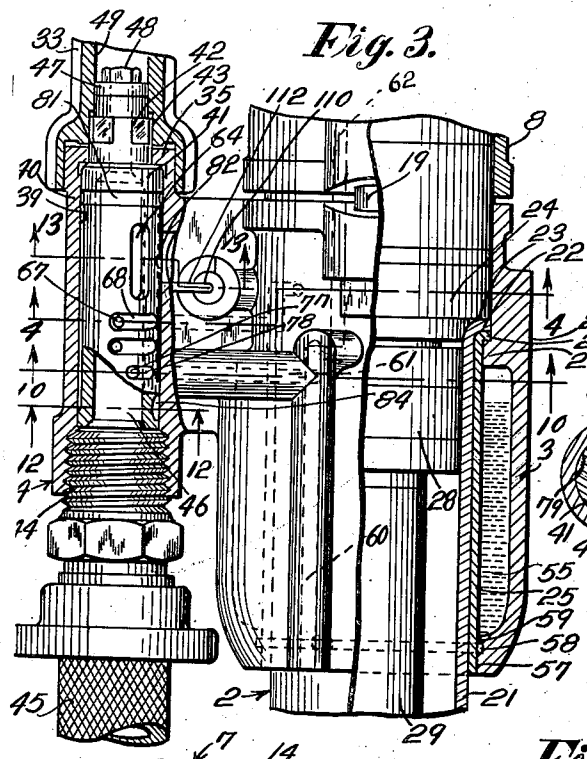


Fig. 4.

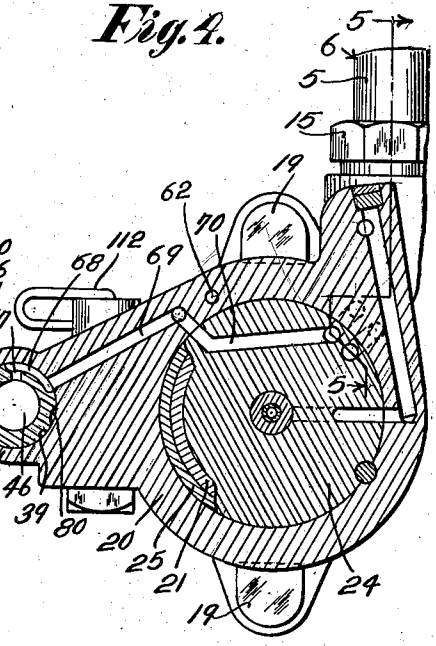


Fig. 5.

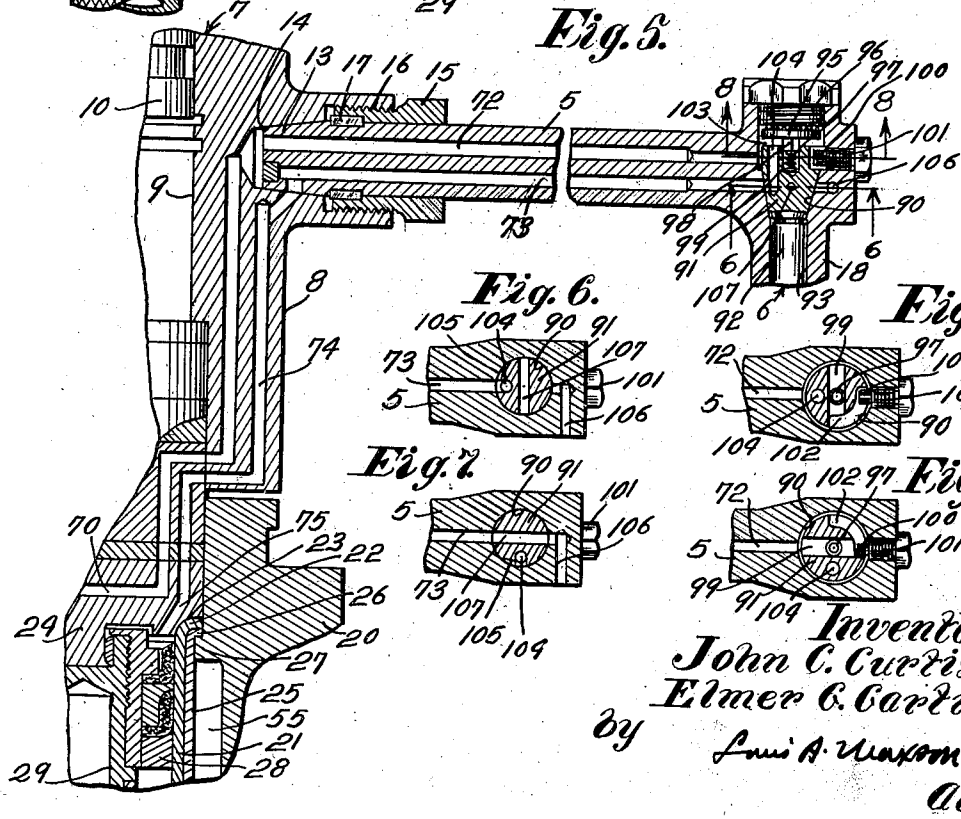


Fig. 6.

Fig. 8.

Fig. 7.

Fig. 9.

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ROCK DRILL

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Fig. 10.

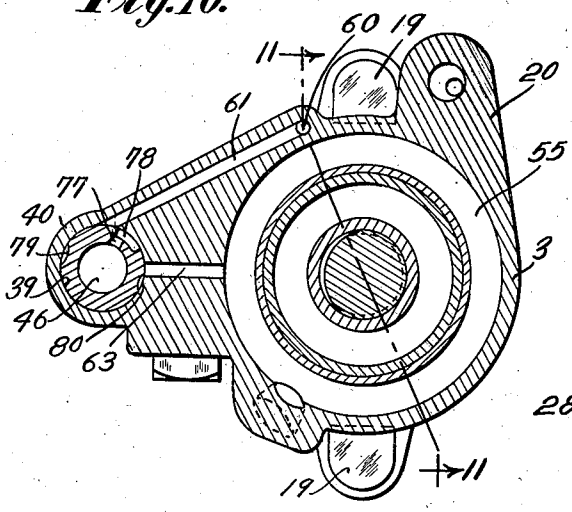


Fig. 11.

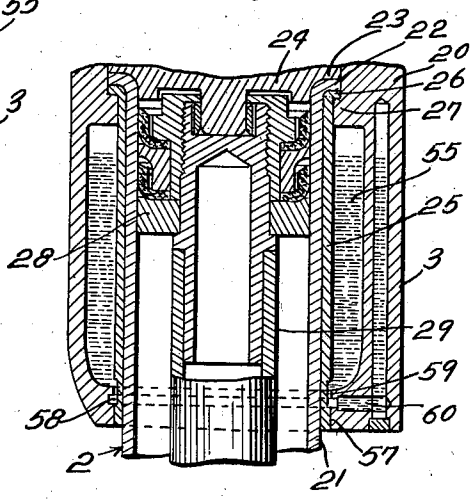


Fig. 12.

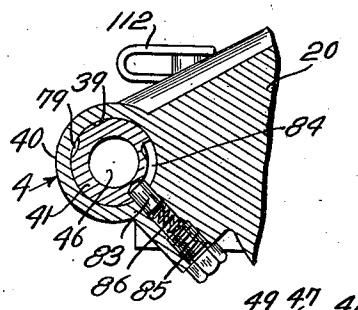


Fig. 13.

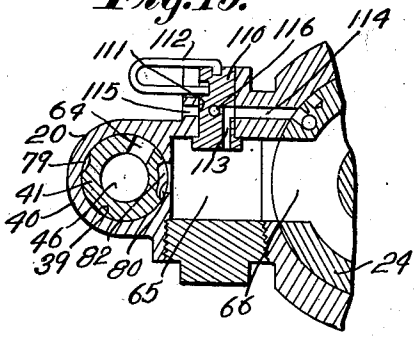


Fig. 14.

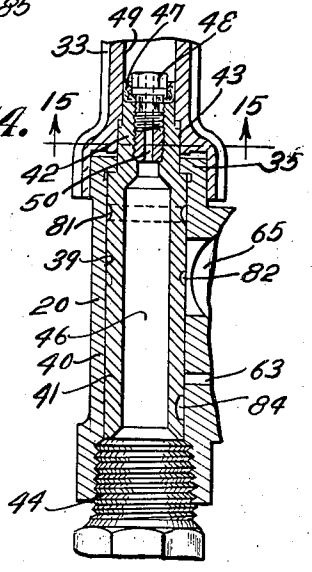
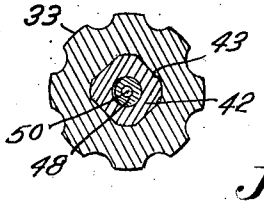


Fig. 15.



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2,461,528

UNITED STATES PATENT OFFICE

2,461,528

ROCK DRILL

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Application July 1, 1943, Serial No. 493,086

13 Claims. (Cl. 121—9)

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This invention relates to rock drills and more particularly to improvements in a hammer rock drill of the stoper type.

An object of the present invention is to provide an improved rock drill. Another object is to provide an improved stoper rock drill having improved feeding means and improved feed controlling means. Still another object is to provide an improved stoper rock drill having a novel supporting handle arrangement. A further object is to provide an improved controlling means for a rock drill. A still further object is to provide an improved throttle valve mechanism having an improved throttle valve and handle construction whereby operation of the throttle valve is facilitated. A still further object is to provide an improved drill supporting handle having an improved feed control valve associated therewith. Still another object is to provide an improved control valve mechanism for a stoper rock drill for controlling the flow of pressure fluid to the hammer motor, to the feeding means and to the drill lubricating means. Still another object is to provide an improved rock drill having novel combinations and arrangements of parts. These and other objects and advantages of the invention will, however, hereinafter more fully appear.

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

In these drawings:

Fig. 1 is an elevational view of a stoper rock drill constructed in accordance with an illustrative embodiment of the invention, the forward portion of the drill being broken away to facilitate illustration.

Fig. 2 is a vertical sectional view, with parts in side elevation, taken substantially on line 2—2 of Fig. 1.

Fig. 3 is an enlarged fragmentary sectional view taken on the plane of Fig. 2, showing details of the throttle valve mechanism and the automatic lubricator.

Fig. 4 is a horizontal sectional view taken substantially on line 4—4 of Fig. 3.

Fig. 5 is an enlarged developed vertical sectional view taken substantially on the irregular line 5—5 of Fig. 4.

Fig. 6 is a detail sectional view taken on line 6—6 of Fig. 5, showing the feed control valve.

Fig. 7 is a view similar to Fig. 6, showing the valve in a different position.

Fig. 8 is a detail sectional view taken on line 8—8 of Fig. 5.

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Fig. 9 is a sectional view similar to Fig. 8, showing the valve in a different position.

Fig. 10 is a horizontal sectional view taken substantially on line 10—10 of Fig. 3.

Fig. 11 is a detail vertical sectional view taken on line 11—11 of Fig. 10.

Fig. 12 is a detail horizontal sectional view taken substantially on line 12—12 of Fig. 3.

Fig. 13 is a detail sectional horizontal view taken substantially on line 13—13 of Fig. 3.

Fig. 14 is an enlarged detail vertical sectional view taken substantially on line 14—14 of Fig. 1.

Fig. 15 is a detail horizontal sectional view taken on line 15—15 of Fig. 14.

Fig. 16 is a cross sectional view, through the drill, showing the novel handle arrangement.

In this illustrative embodiment of the invention, there is shown a stoper rock drill, generally designated 1, generally comprising a pneumatic feeding means 2, an automatic lubricator 3, a throttle valve mechanism 4, and a supporting handle 5 carrying a feed control valve mechanism 6. The pressure fluid motor for percussively actuating and rotating the drill steel is supported and fed by the feeding means 2 and herein may be similar to that disclosed in our copending application, Serial No. 475,782, filed February 13, 1943. While the rock drill disclosed is of the stoper type, it will be evident that features of the invention may be embodied in other types of rock drills.

The hammer motor is generally designated 7, and, herein for illustrative purposes, is shown to comprise a cylinder 8 having a bore 9 containing a reciprocatory hammer piston 10 (see Fig. 2). Associated with the hammer piston is a rifle bar 11 of a conventional ratchet and pawl mechanism for imparting intermittent rotary motion to the piston, and the rotary motion of the piston is transmitted to the drill steel through transmission connections fully described in the copending application above referred to. Rotation of the hammer piston may be interrupted at will during running of the motor by means of a rotation release ring operated by pressure fluid in the manner fully disclosed in the John C. Curtis Patent No. 2,251,269, granted August 5, 1941. The throttle valve mechanism 4 of the drill controls the flow of pressure fluid to the hammer motor and the rotation release ring, and the hammer motor includes a conventional distributing valve mechanism 12 for controlling the distribution of pressure fluid to the motor cylinder. The structure of the improved throttle valve mechanism will be later described. Since the specific structures of the hammer motor, the drill steel rota-

tion mechanism and the rotation release do not per se enter into the present invention, further description and illustration thereof are herein unnecessary.

The supporting handle 5 projects laterally from one side of the hammer motor cylinder 8 and is so arranged that handling and supporting of the drill are facilitated. This handle has its inner end tapered at 13 to fit a conical bore 14 formed in the cylinder wall and is held in position by a screw plug 15 threaded at 16 within a boss projecting from the cylinder. A split ring 17 is arranged in an annular groove on the handle periphery, and the screw plug 15 engages this ring to hold the handle tightly in position. The handle has at its outer extremity a grasping portion 18 adapted to be grasped by one hand of the operator, and the feed control valve mechanism 6 is associated with this grasping portion in a manner to be later explained. Attached as by side bolts 19 to the rear end of the motor cylinder is a rear head block 20 which carries the throttle valve mechanism 4 and the automatic lubricator 3.

The pneumatic feeding means 2 comprises a tubular feed cylinder 21 axially alined with the hammer motor cylinder and having a front annular flange 22 clamped against a shoulder 23 on a rear head member 24 of the hammer motor. A cylindrical sleeve 25 has a front annular flange 26 abutting the flange 22, and the rearward portion of the feed cylinder extends through and fits the bore of this sleeve in the manner clearly shown in Fig. 3. The feed cylinder and sleeve 25 have their flanges clamped tightly against the rear head member 24 of the hammer motor by an inner flange 27 on the rear head block 20, abutting the sleeve flange 26 in the manner shown. Contained in the feed cylinder 21 is a feed piston 28 having its piston rod 29 extending rearwardly through a bushing 30 fitted in a sleeve 31 secured within the rear end portion of the feed cylinder 21 as shown in Fig. 2. Attached to the rear end of the feed piston rod is an abutment engaging point 32 adapted to engage an extraneous abutment.

Arranged with its axis lying in a longitudinal plane at right angles of a plane including the longitudinal axis of the supporting handle 5 is a rotary grasping handle 33 of the throttle valve mechanism 4. This handle is preferably of tubular form and is corrugated or longitudinally ribbed on its exterior to facilitate gripping thereof. The handle is journaled at its ends respectively in a front bracket 34 integral with the motor cylinder and upon a rear boss 35 integral with the rear head block 20. The front bracket has a bore 36 receiving a bushing 37 in which a reduced stem 38 on the handle is journaled. Axially alined with the handle is a bore 39 in a valve casing 40 integral with the head block 20, and a rotary throttle valve 41 of cylindric form is arranged in the bore. The throttle valve has a valve stem 42, generally square in cross section, slidingly fitted in a square recess 43 in the valve handle 33 so that the valve is connected to the handle for rotation thereby. Attached at 44 to the rear head block is a conventional hose connection 45 for supplying fluid under pressure to the hollow interior 46 of the throttle valve, and the fluid flowing to the valve acts on the lower end of the valve to force the latter upwardly within the valve bore. To oppose the pressure of the fluid acting on the lower end of the throttle valve, there is provided a packed piston 47 attached by a screw 48 to the valve and fitting a

bore 49 of the valve handle 33 as clearly shown in Figs. 2 and 14. Fluid under pressure may be admitted to the handle bore 49 from the valve interior 46 through an axial passage 50 in the screw 48. Pressure fluid acting on the upper pressure area of the piston 47 tends to force the throttle valve downwardly, opposing the upward pressure, and the pressure of the fluid acting on the upper wall of the handle bore 49 serves to hold the handle stem 38 upwardly in its bushing 36. To absorb the axial upward thrust of the valve handle 33, there is provided an end-thrust bearing 51 engaging a thrust washer 52 seated against the upper wall of the bracket bore 36 (see Fig. 2). Due to the provision of the opposing pressures at the opposite ends of the valve, rotation of the valve is relatively easy.

As shown most clearly in Fig. 16, the handles 18 and 33 lie in longitudinal planes disposed at right angles with respect to each other with the axes of the handles lying in a longitudinal plane disposed wholly outside of the body of the drill. Thus the handles are both located at the same side of a longitudinal plane passing through the axis of the drill body. By such an arrangement of the handles, it is possible to locate the drill close to a corner without affecting the proper handling and control of the drill.

The automatic lubricator 3 is designed to supply lubricant to the throttle valve bore and to the moving parts of the drill hammer motor. This lubricator for illustrative purposes is shown to comprise an annular lubricant reservoir 55 formed in the head block 20 and surrounding the sleeve 25, and having a conventional filler plug 56 as shown in Fig. 1. The lower part of the head block tightly fits at 57 the cylindric exterior of the sleeve 25 to prevent leakage of lubricant. There is an annular groove 58 in the block closely surrounding the sleeve 25 and connected through a restricted annular space 59 with the reservoir. A passage 60 communicates with this groove and is connected to a passage 61 (see Fig. 19) leading to the throttle valve receiving bore 39 and a branch passage 62 which extends longitudinally of the motor cylinder and is connected to ducts leading to the various surfaces of the motor to be lubricated, in a well known manner. As shown in Fig. 10, a passage 63 connects the throttle valve receiving bore 39 to the upper part of the lubricant reservoir 55 so that fluid under pressure may be admitted to the reservoir during running of the drill to act on the upper surface of the lubricant to force the lubricant through the passages 60, 61 and 62 to the various parts to be lubricated.

Now referring to the specific structure of the throttle valve mechanism 4, it will be noted that the throttle valve 41 has a port 64 (see Figs. 3 and 13) for connecting the valve interior 46 with a chamber 65 communicating with the inlet passage 66 of the hammer motor. The throttle valve has a port 67 (Fig. 4) for connecting the hollow interior 46 of the throttle valve with a circumferentially extending groove 68 on the valve periphery. The groove 68 is communicable with a feed supply passage 69 in the head block 20. The passage 69 is connected to a passage 70 in the rear motor head 24, and, as shown in Fig. 5, the passage 70 communicates with a passage 72 in the supporting handle 5 and is connectible by the control valve mechanism 6 with a passage 73 communicating with a passage 74, the latter in turn communicating with a passage 75 in the rear head member 24. The passage 75 leads to

the upper end of the feed cylinder 21 at the upper side of the feed piston. The specific structure of the feed control valve mechanism will be later explained.

As shown in Fig. 10, the throttle valve has a port 77 communicating with a peripheral groove 78 on the valve, and this groove is communicable with the passage 63 leading to the upper side of the lubricant reservoir. When the groove 78 is in communication with the passage 63, fluid under pressure may flow from the interior of the throttle valve to the reservoir. Extending longitudinally along the exterior periphery of the throttle valve are shallow lubricant grooves 79 and 80 communicating at their upper ends with an annular groove 81, and lubricant may flow through these grooves to lubricate the walls of the valve receiving bore in an obvious manner. The groove 80 communicates with a peripheral groove 82 which is communicable with the motor inlet passage 66. This enables the reservoir to be connected to atmosphere through the motor exhaust whenever the drill hammer motor is not running. As shown in Fig. 12, rotary movement of the throttle valve 41 is limited by a spring pressed detent element 83 projecting within a peripheral groove 84 on the valve. A screw plug 85 holds the spring 86 under compression and is removable to attain access to the parts. This detent element also serves to hold the throttle valve in its different positions of adjustment.

The feed control valve mechanism 6 will now be described in detail. As shown in Figs. 1 and 5, the supporting handle 5 has at its outer end a conical bore 90 which receives a conical feed control valve 91. This valve is rotatably mounted in the bore and has a stem 92 arranged in a bore 93 extending longitudinally through the grasping portion 18 of the handle 5. Secured to the lower end of the valve stem 92 is a knoblike handle 94 conveniently arranged in adjacency to the grasping portion 18 so that the operator may readily control the feed without removing his hand from the supporting handle. The valve is held in its adjusted position by a serrated plate 95 yieldingly held in engagement with a plug 96 by a coil spring 97 acting on the plate. This plate is connected for rotation with the valve by a square stem 98 thereon slidingly fitted in a square bore 99 in the valve. A pin 100 on a screw plug 101 projects into a circumferential slot 102 on the valve (Figs. 8 and 9) for limiting rotary valve movement. The fluid supply passage 72 in the handle 5 communicates with a bore 103 at the upper side of the valve, and the valve body has a passage 104 therethrough for connecting the bore 103 with the feed passage 73. The valve has a peripheral V-notch 105 communicating with the passage 104 so that graduated flow of fluid may be attained. A vent passage 106 connects the valve receiving bore 90 to atmosphere, and the valve is traversed by a passage 107 for connecting the feed passage 73 to the vent passage 106. Thus the flow of pressure fluid from the throttle valve to the feed cylinder may be regulated as desired, and when the fluid supply to the feed is cut off by said control valve, the feed cylinder may be vented, thereby to attain an extremely sensitive control of the feed.

Rotation release is controlled by a valve 110 rotatably mounted in a bore 111 in the head block 20 (Fig. 13). The valve has a handle 112 and has a passage 113 for connecting the fluid chamber 65 to a passage 114 leading to the rotation release ring in the manner fully disclosed in the Curtis

patent above referred to. Communicating with the valve receiving bore 111 is a vent passage 115, and the valve is traversed by a passage 116 for connecting the passage 114 to this vent passage. It is accordingly evident that the rotation release ring may be either supplied with fluid or vented to atmosphere under the control of the valve 110.

The general mode of operation of the improved rock drill is as follows: The rock drill may be suitably positioned and supported with respect to the work by the operator grasping the supporting handle 5 in one hand and the throttle valve handle 33 in the other hand. When the drill is in upright drilling position, the operator may turn the throttle valve handle 33 to rotate the throttle valve 41 into a position wherein the port 64 communicates with the chamber 65, thereby to admit pressure fluid from the supply hose 45 through the valve interior to the motor inlet passage 66, to effect running of the motor. During running of the hammer motor, pressure fluid may flow through port 77, groove 78 and passage 63 to the upper side of the lubricant reservoir 55 so that pressure fluid acting on the surface of the lubricant forces the lubricant through groove 58, passages 60, 61 and 62 to the parts of the drill to be lubricated. The passage 61 supplies lubricant to the throttle valve while the passage 62 supplies lubricant to the moving motor parts. Concurrently pressure fluid may flow through port 67, groove 68, passages 69, 70, 71, 72, to the bore 103 and through the passage 104 in the feed control valve 91 to passages 73, 74 and 75 leading to the feed cylinder to effect movement of the feed cylinder with respect to the feed piston to feed the drill hammer motor toward the work. The flow of pressure fluid to the feed cylinder may be regulated by the control valve 91, and in the event it is desired to stop suddenly the feed, the valve 91 may be turned into a position to effect venting of the feed cylinder to atmosphere through vent passage 106. Whenever the throttle valve 41 is rotated into a position to shut down the flow of pressure fluid to the drill hammer motor, the lubricant reservoir is vented through passage 63, groove 80, groove 82, motor inlet passage 66 and the motor exhaust. Thus lubricant flow ceases when the drill is not running. Rotation of the drill steel may be interrupted at will during running of the motor simply by turning the control valve 110 into a position to supply pressure fluid from the chamber 65 to the passage 114 leading to the rotation release ring. By the novel arrangement of the handles 33 and 5 the drill may be readily positioned and supported with respect to the work, and the throttle valve 41 and the feed control valve 91 may be readily adjusted without the operator removing his grasp on the handles. After the drill is started to run by turning on the throttle valve, feed may be controlled entirely by the feed control valve. By the provision of the valve-piston 47 in the bore 49 of the throttle valve handle 33, the pressure acting on the lower end of the throttle valve is to a substantial extent counterbalanced so that the valve may be easily turned and at the same time the throttle valve handle is held upwardly in position against its upper bearing. The novel arrangement of the automatic lubricator with respect to the feed cylinder results in a drill structure which is extremely compact. Other modes of use and advantages of the invention will be clearly apparent to those skilled in the art.

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

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

1. In a rock drill, the combination comprising a fluid actuated steel actuating motor, fluid actuated feeding means therefor, a pair of lever arms projecting laterally from the side of the drill and disposed at a substantial angle with respect to each other, with the drill arranged at least substantially at the apex of the angle, a throttle valve mechanism for controlling fluid flow to said motor including a throttle valve having a control handle carried by one of said lever arms, and feed control means for controlling fluid flow relative to said feeding means including a feed control valve having a control handle carried by said other lever arm, said handles being disposed in fixed spaced relation and having grasping portions at all times extending in parallelism longitudinally of the drill.

2. In a rock drill, the combination comprising a fluid actuated steel actuating motor, fluid actuated feeding means therefor, a pair of lever arms projecting laterally from the side of the drill and disposed at a substantial angle with respect to each other, with the drill arranged at least substantially at the apex of the angle, one of said lever arms carrying a drill supporting handle, a throttle valve mechanism for controlling fluid flow to said motor including a throttle valve having a control handle carried by one of said lever arms, and feed control means for controlling fluid flow relative to said feeding means including a feed control valve having a control handle carried by said other lever arm, all three of said handles having their grasping portions extending longitudinally of the drill always in parallelism and in fixed spaced relation to the longitudinal axis of the drill.

3. In a rock drill, the combination comprising a fluid actuated steel actuating motor, fluid actuated feeding means therefor, a pair of lever arms projecting laterally from the side of the drill and disposed at a substantial angle with respect to each other, with the drill arranged at least substantially at the apex of the angle, one of said lever arms carrying a drill supporting handle, a throttle valve mechanism for controlling fluid flow to said motor including a throttle valve having a control handle carried by one of said lever arms, and feed control means for controlling fluid flow relative to said feeding means including a feed control valve having a control handle carried by said other lever arm, all three of said handles having their grasping portions extending longitudinally of the drill always in parallelism and in fixed spaced relation to the longitudinal axis of the drill, and said handle for said feed control valve being arranged in juxtaposition to said drill supporting handle whereby the feed may be controlled and the drill may be supported with but one hand of the operator.

4. In a rock drill, the combination comprising a fluid actuated steel actuating motor, fluid actuated feeding means therefor, a pair of lever arms projecting laterally from the side of the drill and disposed at a substantial angle with respect to each other, with the drill arranged at least substantially at the apex of the angle, one of said arms carrying a drill supporting handle, and control valve means including a control valve having an operating handle carried by said other lever arm, the axes of said handles disposed in fixed spaced relation with respect to the longitudinal axis of the drill and respectively lying in longitudinal planes including the longitudinal axes of said lever arms.

5. In a rock drill, the combination comprising a fluid actuated steel actuating motor, fluid actuated feeding means therefor, a pair of lever arms projecting laterally from the side of the drill and disposed at a substantial angle with respect to each other, with the drill arranged at least substantially at the apex of the angle, one of said arms carrying a drill supporting handle, and control valve means including a control valve having an operating handle carried by said other lever arm, the axes of said handles disposed in fixed spaced relation with respect to the longitudinal axis of the drill and respectively lying in longitudinal planes including the longitudinal axes of said lever arms, and said control valve means also including a control valve arranged at the outer extremity of said lever arm which carries the drill supporting handle.

6. In a rock drill, the combination comprising a steel actuating motor, feeding means therefor, a pair of lever arms projecting laterally from the side of the drill and disposed at a substantial angle with respect to each other, with the drill arranged at least substantially at the apex of the angle, and controlling means for said motor and said feeding means including control valves having control handles carried at the outer extremities of said lever arms respectively and extending longitudinally of the drill in fixed spaced relation in all positions of said valves, one handle for the motor control valve and the other for said feed control valve, and said handles adapted to be grasped by the operator, one in each hand, whereby the drill may be positioned and supported with respect to the work.

7. In a stoper rock drill, the combination comprising a fluid actuated steel actuating motor, fluid actuated feeding means for said motor arranged in axial alinement therewith, a drill supporting handle secured to and disposed laterally of the drill, and control valve means including a control valve having an operating handle disposed laterally of the drill, said handles arranged in fixed relation, and the axes of said handles respectively lying in planes extending longitudinally of the drill and disposed at a substantial angle with respect to each other and with said handle axes both wholly at one side of a longitudinal plane including the longitudinal axis of the drill.

8. In a stoper rock drill, the combination comprising a fluid actuated steel actuating motor, fluid actuated feeding means for said motor arranged in axial alinement therewith, a drill supporting handle secured to and disposed laterally of the drill, and control valve means for the drill having a control valve operating handle disposed laterally of the drill at a substantial angle with respect to said supporting handle, said handles having grasping portions spaced at substantial distances laterally from the drill axis and disposed in fixed relation both at one side of a vertical plane including the longitudinal axis of the drill.

9. In a stoper rock drill, the combination comprising a fluid actuated steel actuating motor, fluid actuated feeding means for said motor arranged in axial alinement therewith, a drill supporting handle secured to and disposed laterally of the body of the drill, and control valve means for the drill having a control valve operating handle disposed laterally of the body of the drill at a substantial angle with respect to said supporting handle, said handles disposed in fixed relation with respect to the drill body and having grasping portions spaced at substantial distances laterally from the drill axis with the axes of said grasping portions lying in a longitudinal vertical plane located wholly outside of the body of the drill.

10. In a rock drill, the combination comprising a fluid actuated steel actuating motor, fluid actuated feeding means therefor, a throttle valve mechanism for controlling fluid flow to said motor including a throttle valve having a control handle, and feed control means for controlling fluid flow to said feeding means including a feed control valve having a control handle, said handles being disposed with their axes in fixed spaced relation and lying in angularly related longitudinal planes both at one side of a longitudinal plane including the longitudinal axis of the drill, and said handles having grasping portions, one adapted to be gripped in the palm of each hand of the operator whereby the drill may be readily supported and controlled.

11. In a rock drill, the combination comprising a fluid actuated steel actuating motor, fluid actuated feeding means for said motor, lever arms projecting laterally from the sides of the drill and disposed at a substantial angle with respect to each other, a throttle valve mechanism for controlling fluid flow to said motor and including a throttle valve carried at the outer extremity of one of said lever arms and having a control handle, and feed control means for controlling fluid flow to said feeding means including a feed control valve carried at the outer extremity of the other lever arm and having a control handle, said handles being disposed with their axes in fixed spaced relation and in parallelism, said handles extending longitudinally of the drill and both being located wholly at one side of a longitudinal plane including the longitudinal axis of the drill, and said handles having grasping portions, one adapted to be gripped in each hand of the operator whereby the drill may be readily supported and controlled, and said lever arms being so arranged with the drill at least substantially at the apex of the angle that the side of the drill at the opposite side of said longitudinal plane may be placed close to a corner.

12. In a rock drill, the combination comprising a fluid actuated steel actuating motor, fluid actuated feeding means for said motor, lever arms projecting laterally from the side of the drill in right angular relation both at one side

of a longitudinal plane including the longitudinal axis of the drill thereby leaving the opposite side of the drill free and clear, a throttle valve mechanism for controlling fluid flow to said motor including a throttle valve having a control handle carried at the outer extremity of one lever arm, and feed control means for controlling fluid flow to said feeding means including a feed control valve having a control handle carried at the outer extremity of the other lever arm, said handles being disposed with their axes in fixed spaced relation and in parallelism and extending longitudinally of the drill, and said handles having grasping portions, one adapted to be grasped in each hand of the operator whereby the drill may be readily supported and controlled.

13. In a stoper rock drill, the combination comprising a fluid actuated steel actuating motor, fluid actuated feeding means secured to said motor for feeding the drill steel toward the work as the steel is percussively actuated, and a pair of lever arms projecting laterally from the side of the drill in right angular relation to the longitudinal axis of the drill, said lever arms disposed in V-relation at a substantial angle with respect to each other, with the drill arranged at least substantially at the apex of the angle, said lever arms carrying handles at their outer extremities, said handles at all times extending longitudinally in parallelism and in fixed spaced relation to the longitudinal axis of the drill, one adapted to be grasped in each hand of the drill operator whereby the drill may be positioned and supported with respect to the work, and said lever arms being so arranged that the drill may be placed close to a corner with the drill operator stationed at the side of the drill opposite from the apex.

JOHN C. CURTIS.
ELMER G. GARTIN.

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