July 15, 1941. G. C. PEARSON 2,249,716

ROCK DRILL FEED MECHANISM

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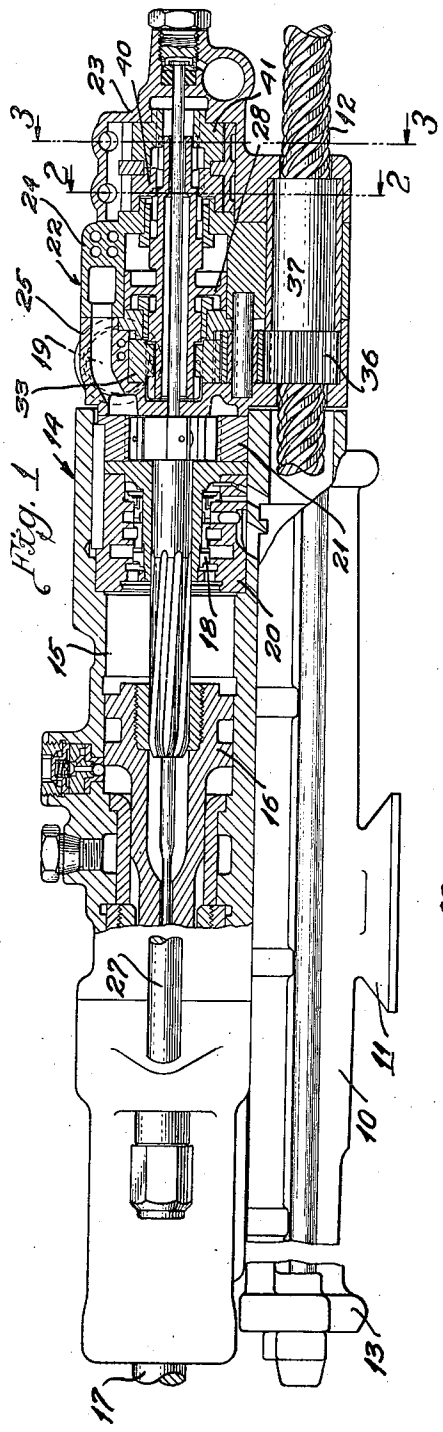


Fig. 1

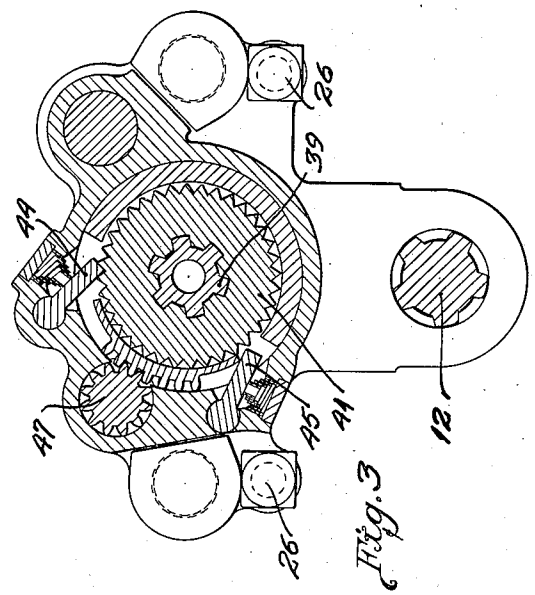


Fig. 3

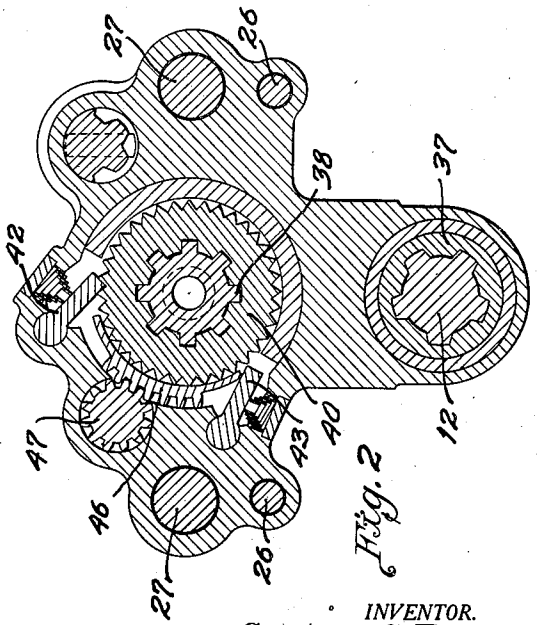


Fig. 2

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Fig. 4

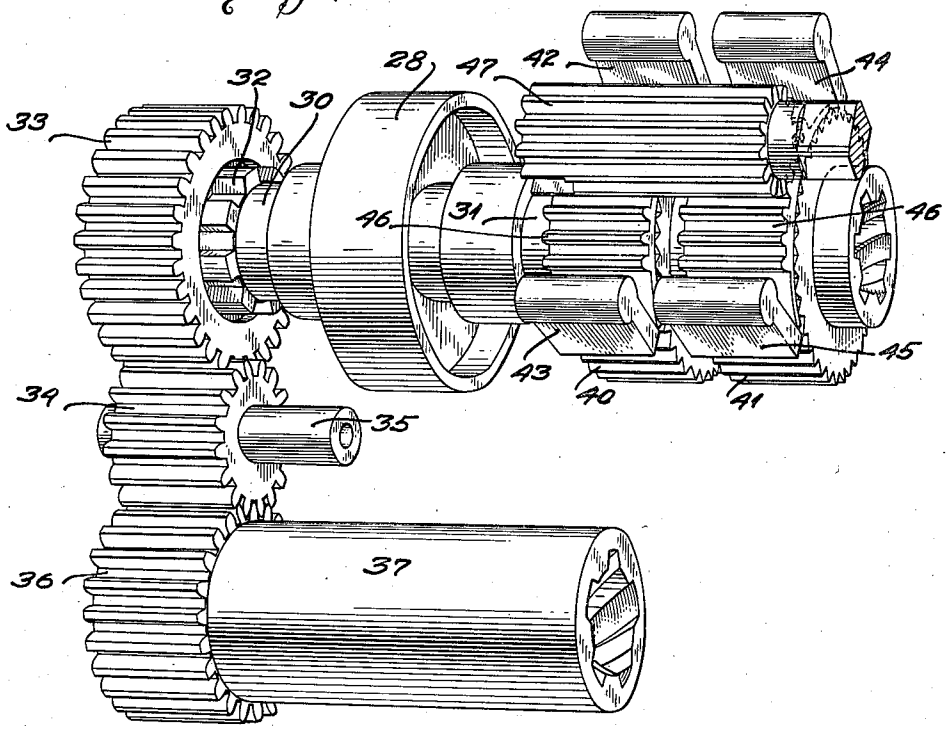
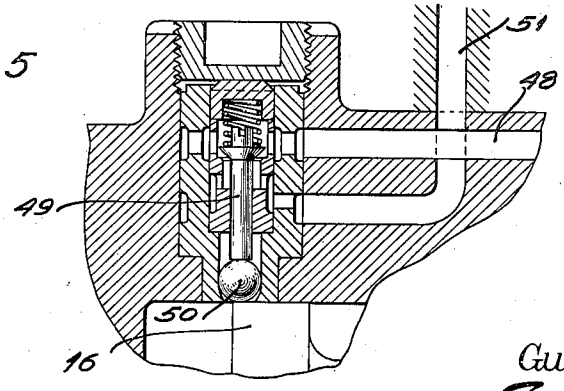


Fig. 5



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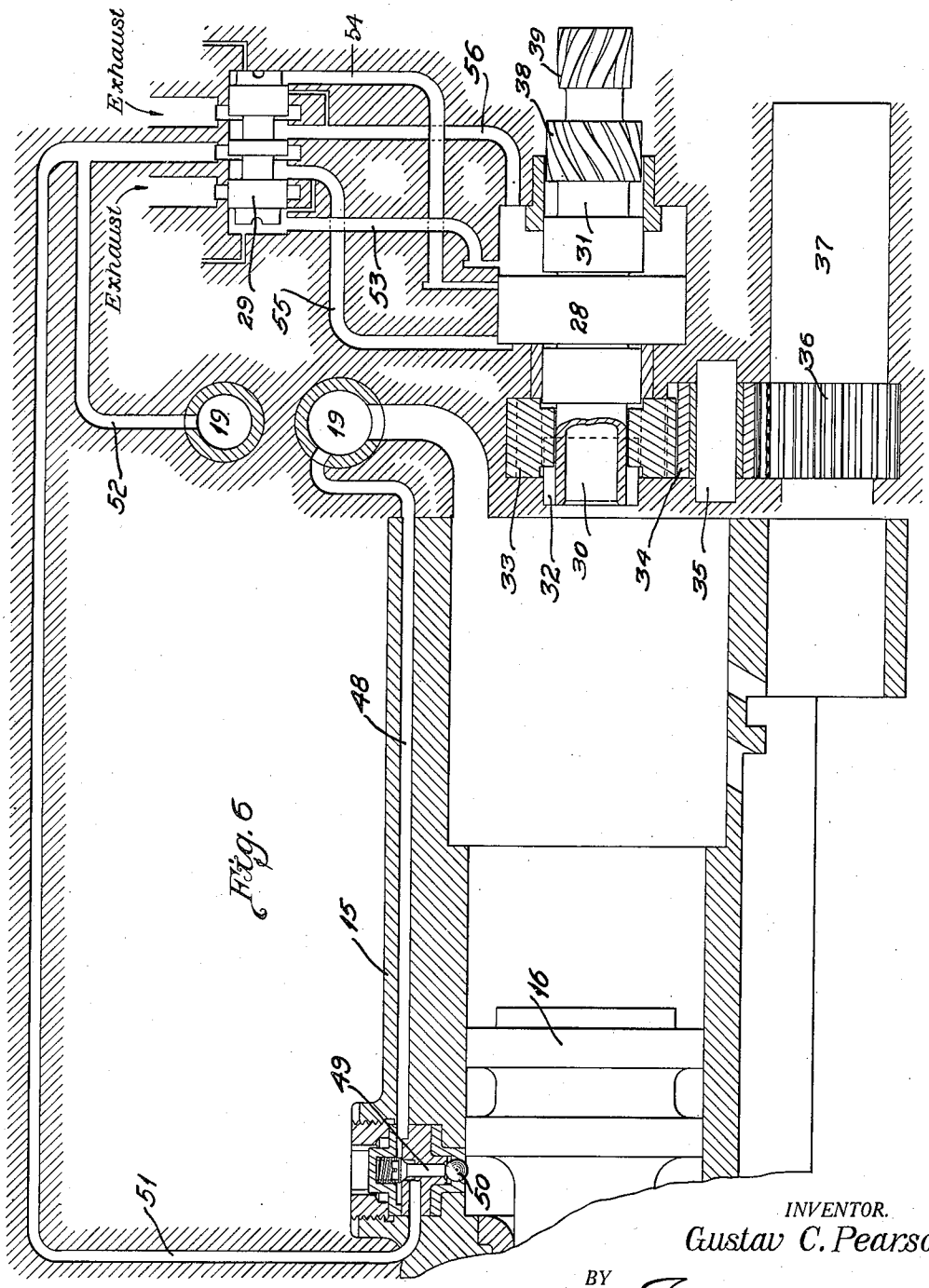


Fig. 6

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UNITED STATES PATENT OFFICE

2,249,716

ROCK DRILL FEED MECHANISM

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Application June 14, 1940, Serial No. 340,521

12 Claims. (Cl. 121—9)

This invention relates to improvements in rock drills and is more particularly directed to mechanical means for feeding such drills to and from the work.

The principal object of the invention is to provide means whereby the drill may be automatically advanced according to the speed at which the drilling operation occurs, while maintaining the most desirable relation between the drill steel and the hammer piston of the drill.

Another object of the present invention is to provide a feeding mechanism for a drilling unit which embodies two methods of control, both being automatic, one dependent upon the advancement of the drill with respect to its work, while the other is solely under the control of the operator.

Another object of the invention is to provide a fluid actuated reciprocating element for moving the drilling unit longitudinally upon its support and such element being controlled by an element of the drilling unit.

Further objects of the invention will hereinafter appear, and to all of these ends the invention consists of the features of construction, arrangement of parts, and combination of elements, substantially as hereinafter fully described and claimed in the specification and shown in the accompanying drawings, in which:

Figure 1 is a longitudinal sectional view, partly in elevation, showing a drilling unit with its feeding mechanism associated therewith.

Figure 2 is a sectional view taken on the line 2—2 of Figure 1.

Figure 3 is a sectional view taken on the line 3—3 of Figure 1.

Figure 4 is an enlarged perspective view showing the particular elements of the feeding mechanism.

Figure 5 is an enlarged detailed view showing the piston hammer control valve admitting motive fluid to the feeding mechanism and

Figure 6 is a diagrammatic view illustrating the automatic valve for controlling the operation of the feeding mechanism and the piston hammer control valve permitting the flow of operating fluid to the automatic valve. It also discloses, briefly, the association of the feeding mechanism and its automatic valve with the piston hammer valve.

Briefly the invention hereinabout to be described contemplates the provision of a fluid actuated means for moving a drilling unit to and from its work. In this particular instance the fluid actuated means derives its motive fluid from the throttle valve through a passageway having therein a valve actuated by the piston hammer of the drilling unit. The Clark patent, No. 1,733,402 of October 29, 1929, discloses a mechanism whereby the feeding of a drilling unit is controlled by the piston hammer but in this particular patent the operating fluid passing to the feeding mechanism is a part of the fluid operating the drilling unit.

The present invention differs from the Clark patent in that the operating fluid for the feeding mechanism is taken directly from the throttle valve but in its passage to the automatic valve of the feeding mechanism, it is controlled by a valve actuated by the piston hammer and in such an instance the operating fluid in the drilling unit is not disturbed.

It is, of course, understood that the feeding mechanism shown may be of any desired type but one incorporating a reciprocating piston or element, for it has been found in the operation of such feeding mechanisms that the progress of the drill towards its work is more accurately maintained, insuring correctly the striking relation of the piston hammer with the steel. Such a mechanism is disclosed in the patent to Pearson, No. 2,115,231 of April 26, 1938, and it will be observed that the feeding mechanism is one whereby the drill might be moved in any longitudinal direction upon its support, locked against movement or moved freely by hand.

The present invention deals with a provision of means adapted to control the flow of operating fluid passing from a supply to the distributing valve of the feeding mechanism such means being actuated by a reciprocating hammer of the drilling unit. The specific means hereinafter disclosed is positioned in such a manner that it is operable upon both strokes of the reciprocating piston hammer, assuming, of course, that the hammer moves down to deliver its full blow to the steel. When such action occurs the valve is momentarily held open permitting the passage of fluid from the supply to the automatic distributing valve.

The invention further contemplates a structure wherein operating fluid for the feeding motor, while under control of the reciprocating piston hammer does not in any way impair the efficiency of the drilling unit. The fluid operating the feed motor is entirely independent of that operating the drilling unit, thus permitting both the operation of the feeding mechanism and the drilling unit under the most desirable conditions.

Furthermore the feeding mechanism may operate while the drilling unit is idle.

Referring to the drawings in detail, particularly Figure 1, the numeral 10 indicates a conventional rock drill support having the usual cone 11 by which the support may be suitably secured to any type of mounting. As is customary the support includes upstanding side walls forming guideways for both the rock drill and its feeding mechanism and, while not shown, the support carries a rearwardly extension having a cross bar in which is fixedly secured a feed screw 12. The front end of the feed screw is mounted in a conventional cross head 13 at the front end of the support. Slidable in the support is a rock drill 14 of any desired construction. In the present embodiment the drill 14 includes a cylinder 15 having the usual outstanding flanges, not shown, slidable and engaging in the upstanding walls of the support. The cylinder 15 has positioned therein the usual reciprocating piston hammer 16 intended to impart blows to a drill steel 17 supported in the front end of the drill.

The movement of the piston hammer within its cylinder 15 is controlled by an automatic valve 18 of any desired construction to which operating fluid is admitted through the usual passageways from a throttle valve indicated at 19.

In rear of the valve 18 and its supporting chest 20 is the usual ratchet means indicated at 21 for imparting rotary movement to the hammer and ultimately to the drill steel 17. To move the drill 14 longitudinally of its support 10 there is arranged in rear of the cylinder 15 a complete fluid operated motor indicated at 22.

Briefly, the fluid operated motor 22 includes a suitable housing consisting of housing elements 23, 24 and 25 abutting one against the other and secured together by tie rods 26. The housing of the feeding motor is maintained in place upon the rear of the cylinder 15 by the usual side rods 27 of the drilling unit.

Positioned within a cylinder formed by the elements 23, 24 and 25 is a reciprocating piston 28 controlled by an automatic valve 29 disclosed in Figure 6 to which motive fluid is admitted either directly from the throttle valve 19 or through a passageway having therein the piston hammer control valve hereinafter described.

As disclosed in Figure 4 the reciprocating piston 28 includes oppositely projecting stems 30 and 31, the former 30 having formed about its periphery straight flutes 32 engageable by the hub of a gear 33. The gear 33 meshes with a small pinion 34 rotatable about a fixed shaft 35 carried by the elements 24 and 25 and this gear 34 further meshes with an enlarged gear 36 formed exteriorly about one end of a sleeve 37 journaled for rotary movement within a bore formed within the elements 23 and 24. The sleeve 37 is internally threaded to receive therein the threaded feed screw 12 rigidly supported by the support 10.

The projecting stem 31 of the piston 28 is formed of two diameters, the larger of which has formed about its periphery spiral flutes 38, while the smaller diameter has formed about its extremity spiral flutes 39. From Figure 6 it will be observed that the spiral flutes 38 and 39 are oppositely arranged.

Engageable with the flutes 38 is a ratchet ring 40 the hub of which is internally fluted to receive the fluted portion 38 and positioned in rear of the ratchet wheel 40 is a second ratchet wheel 41 of the same diameter having its hub internally fluted to receive the fluted portion 39 of the piston stem.

Engageable with the periphery of the ratchet ring 40 are spring pressed pawls 42 and 43 while the ratchet wheel 41 is similarly engaged by spring pressed pawls 44 and 45.

Normally all pawls are engageable with the peripheries of their respective ratchet wheels. However to control the selective engagement of these pawls there is provided about each ratchet wheel an oscillating ring segment 46, each of which is provided with an external rack engageable by a common pinion 47 having a reduced portion or shaft projecting through the rear wall of the element 23 and upon this projecting end is affixed a suitable operating lever.

As shown in Figures 2 and 3, it is of course obvious that when the pinion 47 is rotated by its operating lever in any selected direction, it assumes a position midway between the two pawls and upon the continued movement of the pinion in any direction it moves either the pawl 42 or 43 in Figure 2 from engagement with the ratchet 40 and at the same time the corresponding one of the pawls 44 and 45 is removed from engagement with its ratchet 41.

It is through the medium of these ratchets 40 and 41 that rotary movement is imparted to the piston 28 in its reciprocations and by reason of the gears 33, 34 and 36 rotation is likewise imparted to the sleeve 37 moving the feeding unit longitudinally upon the support, and of course, the drilling unit in advance thereof.

Controlling the flow of operating fluid to the automatic valve 29 is the common throttle valve 19 so formed as to permit the flow of operating fluid to the valve 18 of the drill 14 and at the same time permitting the passage of fluid to a passageway 48 leading to a poppet valve 49 formed in the front end wall of the cylinder 15. Passing from the poppet valve 49 is a second passageway 51 leading to the supply port of the automatic valve.

The throttle valve is further provided with ports whereby the flow of operating fluid to the drill and the passageway 48 might be interrupted to permit the passage of motive fluid from the valve through a passageway 52 direct to the automatic valve 29. This position of the throttle valve is assumed when it is desired to move the rock drill longitudinally of the support without operating the drill.

As disclosed in Figures 1 and 6 of the drawings the poppet valve 49 is provided with its usual stem resting upon a ball 50 confined within the wall of the cylinder 15 in such a manner that a small portion of the ball projects into the path of the piston 16 reciprocating therein. From this structure it will be apparent that as the piston 16 reciprocates it will engage the ball 50 lifting the poppet valve from its seat, permitting the flow of motive fluid through the passageway 48 to the passageway 51 leading to the automatic valve 29. It is further obvious that the valve 49 is held in this open position by the piston until its stroke is reversed, thus holding for a limited period the poppet valve 49 in an open position, permitting the continued flow of motive fluid to the valve 29. In the event the piston hammer 16 should not for any particular reason complete its advancing stroke to contact the steel, the ball 50 is of course not engaged by the hammer and when such occurs the valve remains closed, thus the valve 49 only opens when the

piston moves to such a position as to definitely strike the steel.

The operating valve 29 as disclosed in Figure 6 is merely of the piston type such as disclosed in the Pearson patent mentioned above and has the supply passageways 55 and 56 leading to the front and rear walls of the cylinder within which the piston 28 reciprocates and controllable by the piston 28 are trip passageways 53 and 54 leading respectively to the front and rear ends of the piston valve. Thus the valve 29 becomes an automatic valve operating to control the flow of fluid active upon the piston 28.

Assuming now that the feeding mechanism as shown in Figures 1 and 6 is in a position whereby movement of the mechanism and drill upon the support is desirable. To do this, the throttle valve 19 is moved to the position shown in Figure 6 whereby motive fluid from the valve is permitted to operate the valve 18, controlling the reciprocations of the piston hammer 16. As the piston hammer moves down the peripherial portion of its head, engages the ball 50 lifting the poppet valve 49 from its seat and permitting the passage of operating fluid from the throttle valve through passageway 48, poppet valve 49 and the passageway 51 to the automatic valve 29, the latter controlling its admission to the cylinder containing the reciprocating feeding piston 28 moving the same therein and imparting rotation to the sleeve 37, moving the drill and feeding mechanism longitudinally of the support. It is of course apparent from the preceding description that the direction in which the drill moves is controllable by the selective means operating the various pawls engageable with the ratchet rings constituting a part of the feeding mechanism.

Inasmuch as the reciprocation of the piston hammer is rather rapid, a short impulse of motive fluid will be permitted to flow from the throttle valve to the automatic valve and on the first admission of this motive fluid to the automatic valve should the valve be in the position as shown in Figure 6, the fluid will be directed to the front face of the feeding piston moving the same backwardly. Should this impulse of motive fluid be insufficient to move the piston its full stroke the piston will remain in an inactive position until the second impulse of motive fluid is admitted thereagainst by the operation of the poppet valve upon the second stroke of the piston hammer. This cycle continues until the piston 28 completes its full stroke. Continued impulses of motive fluid admitted into the cylinder will of course impart reciprocation to the piston 28.

Movement of the piston 28 may be interrupted or delayed due to the fact that in some periods of operation, the piston hammer may not complete its full stroke and when such occurs the poppet valve of course remains closed. It is only upon the completion of each down stroke of the piston hammer that the poppet valve opens and motive fluid is active upon the piston 28.

From the foregoing it is thought that the construction, operation and many advantages of the herein described invention will be apparent to those skilled in the art without further description, and it will be understood that various changes in the size, shape, proportion and minor details of construction may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention.

What I claim is:

1. In a feed mechanism for rock drills, the combination of a support having movable thereon a drill, a reciprocating hammer piston within the drill, a motor including a reciprocating piston for moving the drill on the support, an automatic valve controlling the flow of operating fluid to the motor piston, a conduit leading from a fluid supply to the automatic valve, a valve within the conduit, and said valve being held open by the hammer piston during a part of its movement in both directions.

2. In a feed mechanism for rock drills, the combination of a support having movable thereon a drill, a reciprocating hammer piston within the drill, a piston motor for moving the drill on the support, a fluid distributing valve controlling the operation of the piston motor, a conduit leading from a fluid supply to the distributing valve, and said conduit having therein a valve held open during certain movements of the hammer piston.

3. In a feed mechanism for rock drills, the combination of a support having movable thereon a drill, a hammer piston reciprocating within the drill, fluid actuated means moving the drill upon the support, said means including a reciprocating member, an automatic valve controlling the flow of fluid active upon said member, and an operable element positioned in advance of said valve and engageable by the hammer piston for controlling the flow of fluid to the fluid actuated means.

4. In a feed mechanism for rock drills, the combination of a support having movable thereon a drill, a hammer piston reciprocating within the drill, fluid actuated means moving the drill upon the support, said means including a reciprocating member, an automatic valve controlling the flow of fluid active upon said member, and an operable element positioned in advance of said valve and engageable by the piston hammer for controing the flow of fluid to the valve and member.

5. In a feed mechanism for rock drills, the combination of a support having movable thereon a drill, a fluid actuated motor moving the drill upon the support, said motor including a reciprocating member, an automatic valve controlling the flow of fluid active upon said member, and an operable element positioned in advance of said valve and engageable by the piston hammer controlling the flow of fluid to the automatic valve and member.

6. In a feed mechanism for rock drills, the combination of a support having movable thereon a drill, a motor including a reciprocating element for moving the drill on the support, a common valve controlling the flow of operating fluid to both drill and motor, means actuated by the drill for further controlling the flow of fluid to the motor, and said common valve being movable to a position insuring the operation of the feed motor independently of the drill.

7. In a feed mechanism for rock drills, the combination of a support having movable thereon a drill, a motor including a reciprocating piston for moving the drill on the support, an automatic valve controlling the reciprocations of said piston, a common valve controlling the flow of operating fluid to the drill and the automatic valve, a second valve in advance of the automatic valve functioning during the operation of the drill to control the flow of fluid to the automatic valve, and said common valve being movable to

either one of two functioning positions whereby the flow of fluid to the automatic valve might include or exclude said second valve.

8. In a feed mechanism for rock drills, the combination of a support having movable thereon a drill, a motor including a reciprocating element for moving the drill on the support, a common valve establishing communication for the flow of operating fluid from a supply to the drill and motor, an actuated member between the valve and motor controlling the flow of fluid to the latter, and said common valve being movable to a position insuring the operation of the feed motor independently of the drill and the actuated member.

9. In a feed mechanism for rock drills, the combination of a support having movable thereon a drill, a motor including a reciprocating piston for moving the drill on the support, an automatic valve controlling the reciprocations of said piston, a common valve controlling the flow of operating fluid to the drill and the automatic valve, a second valve controlling the flow of operating fluid from the common valve to the automatic valve, and said second valve functioning during the operation of the drill.

10. In a feed mechanism for rock drills, the combination of a support having movable thereon a drill, a motor including a reciprocating element for moving the drill on the support, a common valve controlling the flow of operating fluid to both drill and motor, an actuated member between the valve and motor for further controlling the flow of operating fluid to the motor, and said actuated member functioning during the progress of drilling.

11. In a feed mechanism for rock drills, the combination of a support having movable thereon a drill, fluid actuated means for moving the drill on the support, said means including a reciprocating member, an automatic valve controlling the flow of fluid active upon said member, and an operable element actuated during the operation of the drill for controlling the flow of fluid to the valve and member.

12. In a feed mechanism for rock drills, the combination of a support having movable thereon a drill, a motor including a reciprocating element for moving the drill on the support, an automatic valve controlling said element, a conduit for fluid from a supply to the automatic valve, a controlling element within the conduit, and said controlling element being actuated during the operation of the drill.

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