Nov. 2, 1937. J. C. CURTIS 2,097,561

FEEDING MECHANISM FOR ROCK DRILLS

Filed Nov. 12, 1934 3 Sheets-Sheet 1

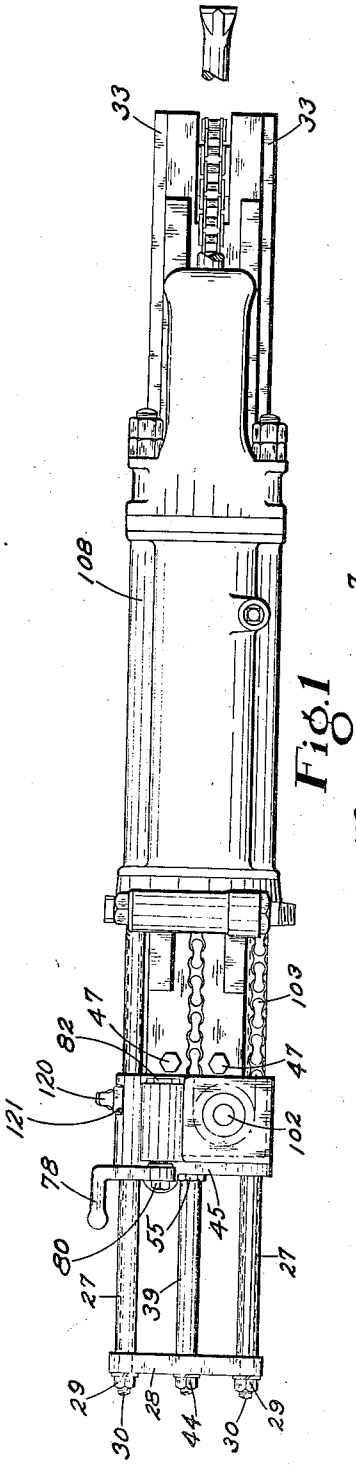


Fig. 1

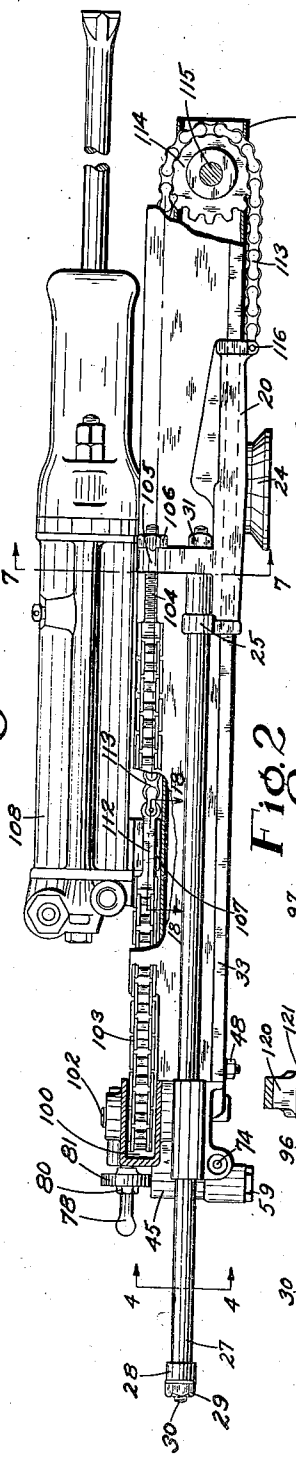


Fig. 2

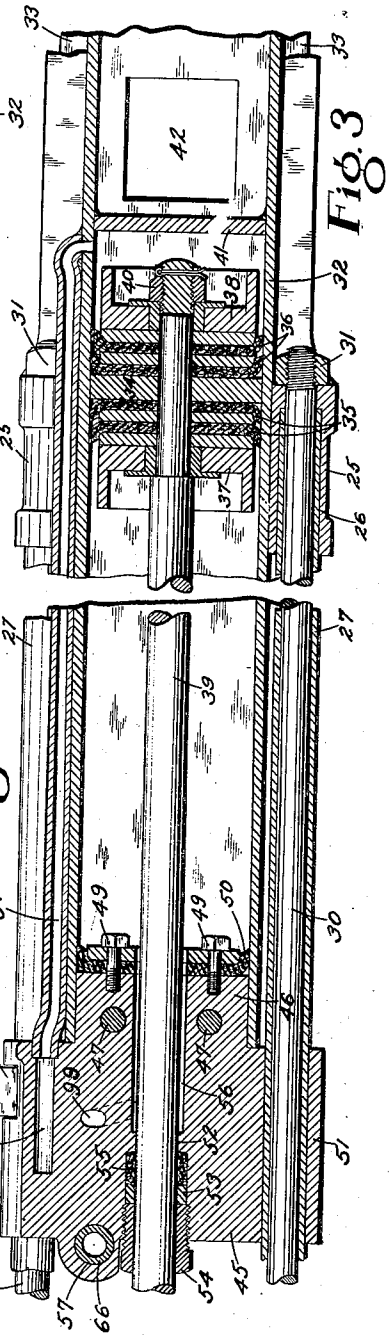


Fig. 3

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FEEDING MECHANISM FOR ROCK DRILLS

Filed Nov. 12, 1934 3 Sheets-Sheet 2

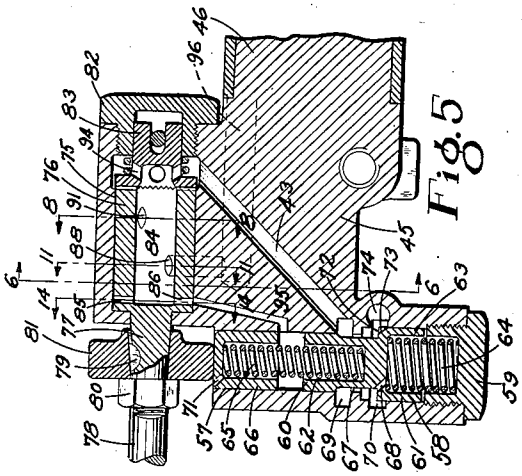


Fig. 5

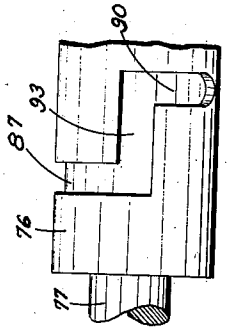


Fig. 17

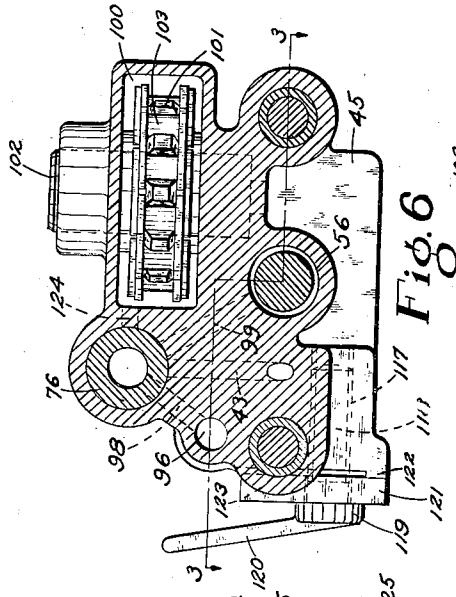


Fig. 6

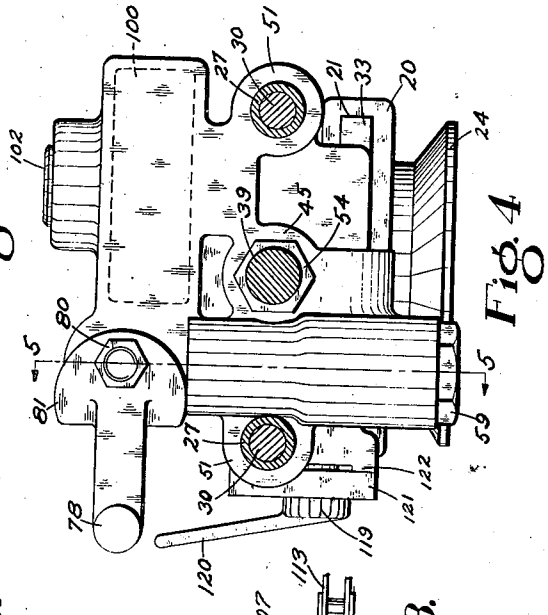


Fig. 4

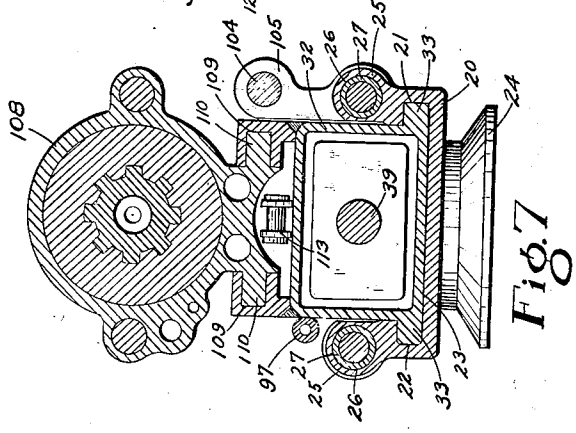


Fig. 7

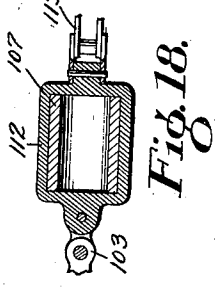


Fig. 18.

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FEEDING MECHANISM FOR ROCK DRILLS

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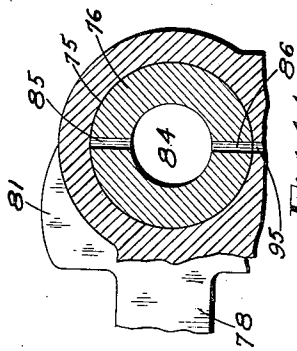


Fig. 14

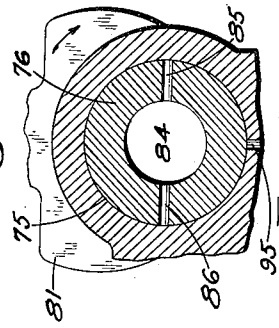


Fig. 15

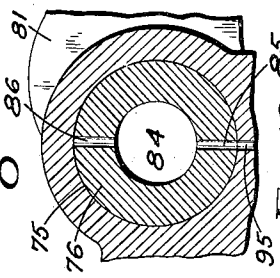


Fig. 16

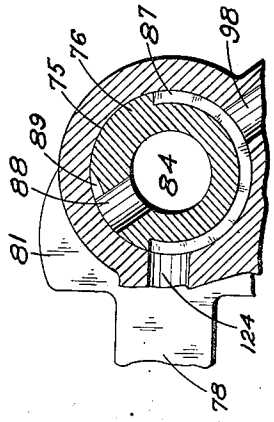


Fig. 11

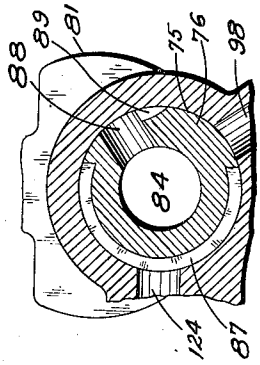


Fig. 12

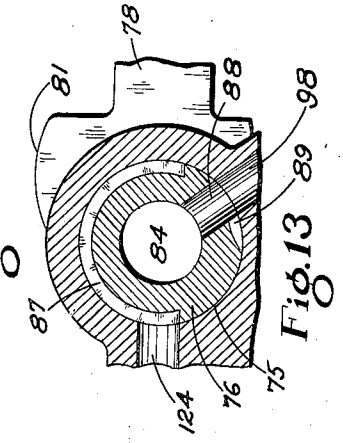


Fig. 13

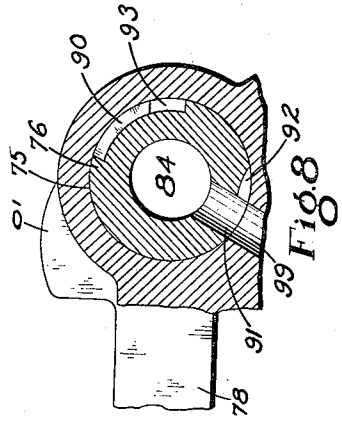


Fig. 8

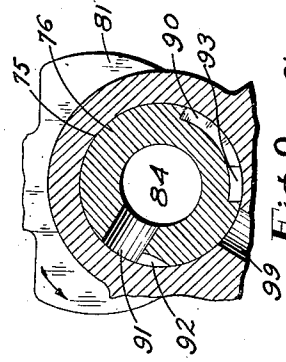


Fig. 9

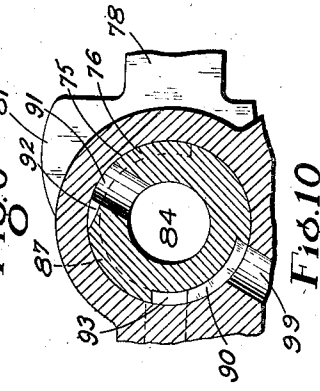


Fig. 10

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UNITED STATES PATENT OFFICE

2,097,561

FEEDING MECHANISM FOR ROCK DRILLS

John C. Curtis, Garfield Heights, Ohio, assignor to The Cleveland Rock Drill Company, Cleveland, Ohio, a corporation of Ohio

Application November 12, 1934, Serial No. 752,662

16 Claims. (Cl. 121—9)

This invention relates broadly to rock drills, but more particularly to feeding mechanism and mounting therefor.

One object of this invention is to produce an improved and compact feeding mechanism for rock drills, wherein the overall length of the assembly is materially shorter than that of similarly actuated feeding mechanisms of equal feeding range.

Another object of this invention is to construct a fluid actuated feeding mechanism for rock drills in a manner whereby the movable parts of the mechanism are efficiently guided against lateral movement irrespective of their relative position, eliminating thereby undue vibrations to be imparted thereto during the operation of the rock drill fed thereby.

Another object of this invention is to provide a motive fluid actuated mechanism for rock drills with a device operable for controlling the pressure of the motive fluid actuating the former in either direction.

Another object of this invention is to produce a fluid actuated feeding mechanism for rock drills of compact and sturdy construction, wherein the rock drill is adapted to travel at a greater rate of speed than that of the feeding element.

Other objects and advantages reside in the specific construction and aggroupment of the elements peculiar to this structure as will become apparent from a more complete examination of this specification, wherein there are assembled and pointed out certain combinations of parts and specific constructions indicative of the scope and spirit of the invention.

In the drawings:

Fig. 1 is a plan view of the drilling apparatus having the invention applied thereto.

Fig. 2 is a side elevational view of the drilling apparatus.

Fig. 3 is an enlarged longitudinal sectional view taken in a plane indicated by line 3—3 in Fig. 6.

Fig. 4 is an enlarged cross sectional view taken in a plane indicated by line 4—4 in Fig. 2.

Fig. 5 is a cross sectional view taken in a plane indicated by line 5—5 in Fig. 4.

Fig. 6 is a cross sectional view taken in a plane indicated by line 6—6 in Fig. 5.

Fig. 7 is an enlarged cross sectional view taken in a plane indicated by line 7—7 in Fig. 2.

Figs. 8 to 16 inclusive are enlarged cross sectional views showing the throttle valve in different positions, Figs. 8, 9, 10 being taken in a plane indicated by line 8—8 in Fig. 5; Figs. 11, 12, 13 being taken in a plane indicated by line 11—11 in the same figure; and Figs. 14, 15, and 16 being taken in a plane indicated by line 14—14 also in Fig. 5.

Fig. 17 is an enlarged longitudinal view of a portion of the throttle valve shown in Figs. 8 to 16.

Fig. 18 is an enlarged sectional view taken in a plane indicated by line 18—18 in Fig. 2.

Referring to the drawings in which like symbols designate corresponding parts throughout the several views, 20 designates a stationary shell or support being formed with a duality of longitudinally disposed slots or guideways 21 and 22 internally united by a flat surface 23 formed therebetween. Located in equidistant relation from the ends thereof, the stationary support 20 is formed with a cone 24 depending from the lower wall thereof, by which the support 20 may be affixed to a suitable mounting, such as a tripod or the like. Extending above the guideways 21 and 22, the left end portion in Fig. 2 of the support 20 is formed with longitudinal apertured lugs 25, each being formed with a counterbore 26 having secured therein a tube 27 with the face end wall thereof mounted in abutting engagement with the bottom of the counterbore 26. The two tubes 27 extend toward the left in Fig. 1 to receive, in abutting engagement with the other end thereof, a cross plate 28, which is secured thereto by nuts 29 in screw tight engagement with the screw threaded end of a rod 30 located within each of the tubes 27, while the other end of each rod extends through the apertured lugs 25 respectively, to receive a nut 31. By tightening the nuts 29 and 31, it will be understood that the cross plate 28 and tubes 27 may be clamped rigidly to the support 20.

Slidable on the flat surface 23 of the support 20, there is a feed tube 32 having guides 33 in slidable engagement within the guideways 21 and 22. The guides 33 are integral with the feed tube 32 in longitudinal alignment therewith and extend substantially the full length thereof. The feed tube 32 is preferably made of a rectangular internal cross section, and has located therein a rectangular piston 34 comprising two pairs 35 and 36 of packings capable of fluid tight engagement with the inner wall of the tube, and two rubber buffers 37 and 38, the purpose of which will be explained later. The packings and buffers are secured in clamped relation to the end of a stationary piston rod 39 by a nut 40. Adjacent the cone 24 of the support 20, the feed tube 32 has secured therein in fluid tight engagement with the inner wall thereof a vertical plate

41, which may be welded thereon through openings 42 formed through the upper and lower walls of the feed tube at a place adjacent the plate 41. The other end of the piston rod 39 extends through the cross plate 28 to which it is rigidly affixed by a nut 44, preventing thereby the movement of the piston 34 relative to the support 20.

The other end of the feed tube 32 adjacent the cross plate 28 is closed by a head 45 having a rectangular projection 46 extending partway within the feed tube 32, and drilled to receive two bolts 47 transversally disposed through the tube 32, and adapted to receive cooperating nuts 48 by which the head 45 is secured to the feed tube 32. To assure a fluid tight joint between the projection 46 and the inner wall of the feed tube 32, there is affixed to the end face of the former by screws 49 a packing member 50. Located in coaxial alignment with the rods 30 or tubes 27, the head 45 is formed with longitudinal apertured lugs 51 capable of slidable engagement with the tubes 27 extending therethrough, affording thereby guiding and supporting means for the head 45 and the end portion of the feed tube connected thereto. Located between the apertured lugs 51, the head 45 is provided with a longitudinally disposed bore 52, through which the piston rod 39 passes. For a portion of its length, the bore 52 is enlarged to form a counterbore 53 having, compressible therein by a screw threaded plug 54, packing material constituting a stuffing box 55 assuring a fluid tight joint between the piston rod 39 and the internal wall of the bore 52. Leading from the end of the rectangular portion 46 of the head 45 to a place adjacent the stuffing box 55, the bore 52 is also enlarged, thus providing a clearance 56 around the piston rod 39 extending through the packing member 50 into the rear end of the feed tube 32, the purpose of which will be explained later.

Located between one of the tubes 27 and the piston rod 39, the head 45 is provided with a vertically disposed cylindrical bore 57 formed with a counterbore 58, the latter being terminated by a screw threaded portion adapted to receive a plug 59. Slidably mounted within the bore 57, there is a valve 60 formed with a head 61 slidable within the counterbore 58. Both valve and head are provided with counterbores or internal chambers 62 and 63 leading from the ends thereof toward each other. The chamber 63 is properly machined to accommodate a compression spring 64 having one end thereof seated on the bottom of the chamber 63, while the other end thereof is seated on the bottom of a similarly disposed counterbore formed within the plug 59. Similarly seated on the bottom of the valve counterbore 62, there is one end of a compression spring 65, while the other end thereof is engaging the bottom of a counterbore formed within a cap 66 slidably mounted in the bore 57 between the valve 60 and the end of the bore through which the cap 66 is free to pass. Starting from the end of the head 61 and leading toward the small end of the valve 60, the latter is provided with an external annular groove 67 which is in constant communication with the interior of the head 61 or counterbore 63, through a restricted port 68. The portion of the cylindrical bore 57 within which the valve groove 67 is slidable, is equipped with an internal annular groove 69, while the counterbore 58 is provided with a similar groove 70 formed adjacent the bottom of the counterbore 58 with which the annular shoulder 72 of the valve 60 is capable of abutting engagement. The outer annular edge of the valve shoulder 72 is povided with a duality of angularly disposed small V-shaped grooves 73. Leading into the internal annular groove 70, the head 45 is provided with a screw threaded bore 74 to which may be connected the end of a pressure fluid conveying conduit. Provided through the cap 66, there is a restricted port 71, the purpose of which will be explained later.

Disposed above the cylindrical valve bore 66 in transversal relation therewith, the head 45 is provided with a throttle valve chamber 75 having a throttle valve 76 rotatable therein formed with a tapered shank 77 extending therefrom and adapted to receive a handle 78, which is secured thereon against rotation by a key 79, and against longitudinal movement by a nut 80. The handle 78 is formed with a partly circular flange disposed in eccentric relation with the shank 77 of the throttle valve 76, the peripherial wall of said flange constituting a cam 81 capable of engagement with the cap 66 slidable within the cylindrical bore 57. The throttle valve bore or chamber 75 is terminated by a screw threaded portion adapted to receive a plug 82 having mounted therein a locking mechanism 83 associated with the end face of the throttle valve 75 for locking the latter in any desired position. Centrally disposed within the throttle valve 76, there is a port 84 in constant communication with the peripherial wall of the throttle valve through two restricted ports 85 and 86 located in a cross plane indicated by line 14—14 in Fig. 5. In the cross plane indicated by line 11—11 in Fig. 5, the throttle valve 76 is provided with a semi-peripheral groove 87, and a radially disposed port 88 having a V-shaped groove 89 in constant communication therewith. In the cross plane indicated by line 8—8 in Fig. 5, the throttle valve 76 is provided with a groove 90 and a radially disposed port 91 having a V-shaped groove 92 opening therein. The throttle valve groove 87 is in constant communication with the groove 90 through a longitudinally disposed slot 93.

Leading from the annular groove 69 formed within the valve bore 57, there is a port 43 opening into the throttle valve chamber 75 from where pressure fluid may be admitted into the central bore 84 of the throttle valve 76 through ports 94 provided within the locking mechanism 83. Opening into the throttle valve chamber 75 at a place permitting its registration with the throttle valve port 85 or 86, there is a restricted port 95 leading into the cylindrical bore 57 at a place adjacent the end of the valve 60. Formed within the head 45, there is a bore 96 having a counterbore adapted to receive one end of a small tube 97 having the other end thereof opening into the feed tube 32 at a place adjacent the vertical end plate 41. The bore 96 is connected with the throttle valve chamber 75 through a port 98, while the clearance 56 existing around the piston rod 39 within the head 45 is connected with the throttle valve chamber 75 through a port 99.

Located within the upper portion of the head 45 there is an enlarged chamber 100 in constant communication with the throttle valve chamber 75 through a port 124. This chamber has the side thereof toward the feed tube 32 open to permit the insertion of a sprocket wheel 101 therein, which is rotatably mounted on a vertical shaft 102 secured within the head 45 and extending centrally through the chamber 100. This last chamber is large enough to accommodate a chain 103 passing over the sprocket wheel 101 in opera-

tive engagement with the teeth thereof. To one end of the chain 103 is affixed a bolt 104 which is slidably mounted through an apertured lug 105 formed integral with the support 20 on one side of the feed tube 32. The bolt 104 is adapted to receive a nut 106 by which the bolt may be pulled through the apertured lug 105. In this manner, one braid or portion of the chain 103 is located on one side of the feed tube 32, while the other portion thereof extends over the feed tube and is affixed to a lug 107 depending from a fluid actuated rock drill or drilling motor 108. The upper wall of the feed tube 32 is provided with longitudinally disposed guideways 109 extending the full length thereof and adapted to receive in slidable engagement therewith corresponding guides 110 integral with the drilling motor 108 which is thereby slidably guided on the upper face of the feed tube 32. The lug 107 depending from the drilling motor 108 is machined to about engage the upper wall of the feed tube 32 between the guideways 109. Surrounding this lug and carried thereby, there is a yoke 112 having attached to one end thereof the last mentioned end of the chain 103. Since the sprocket wheel 101 is disposed horizontally, the links of the chain 103 are disposed vertically relative to the feed tube 32. Secured to the other end of the yoke 112 in longitudinal alignment therewith, there is the last link of another chain 113 which extends therefrom between the guideways 109 over a sprocket wheel 114 for operative engagement with the teeth thereof. This last sprocket wheel is rotatably mounted on a shaft 115 transversally disposed through the feed tube 32 at a place adjacent the end thereof away from the head 45. After passing over the sprocket wheel 114, the chain 113 extends under the feed tube 32 and has that end thereof affixed to support 20 as at 116.

Formed within the head 45 ahead of the chamber within which the valve 60 is slidably mounted, there is a screw threaded bore 117 adapted to receive a bolt 118 formed with a head 119 having a handle 120 integral therewith. The bolt 118 extends through a plate 121 engageable with a step 122 formed on the head 45, and having an arcuated portion 123 capable of forcible engagement with one of the tubes 30 by the action of the bolt head 119 on the plate 121.

In the operation of the mechanism, assuming that the throttle valve handle 78 is positioned as shown in Fig. 9, the valve cap 66 is maintained partly out of the cylindrical bore 57 in engagement with the cam 81 by the action of the compression spring 65 on the cap 66. In this instance, the action of the spring 64 is calculated to be somewhat stronger than that of the spring 65, thus maintaining the valve shoulder 72 in abutting engagement with the bottom of the counterbore 58. The pressure fluid admitted into the groove 70 through the connection 74 is thereby prevented to flow into the supply groove 69, and consequently prevented to be admitted into the throttle valve 76 through the port 43. When the valve handle 78 is slowly rotated in either direction, the cam 81 engaging the cap 66 will cause the inward movement of the latter, compressing thereby the spring 65 which will cause the gradual movement of the valve 60 or of its shoulder 72 away from the bottom of the counterbore 58. The amount of the pressure fluid flowing from the groove 70 into the groove 69 may thus be regulated by the position of the valve shoulder 72 relative to the groove 70. When the throttle handle is positioned at 90 degrees from the position shown in Fig. 9, the head 61 of the valve 60 is intended to fully uncover the groove 70, permitting thereby a free passage of the pressure fluid from the groove 70 into the groove 69 via the annular valve recess 67. When the valve handle 78 is positioned at only a small angle from the position shown in Fig. 9, the groove 70 is intended to be only slightly uncovered by the valve head 61, causing thereby a restricted amount of the pressure fluid to be admitted into the groove 69 through the small V-shaped grooves 73. The pressure admitted into the groove 69 via the valve external annular recess 67, is admitted into the valve head 61 through the restricted port 68, exerting pressure therein. That pressure together with the effort of the compression spring 64 will tend to shift the valve in a closed position, that is, will tend to cause the engagement of the shoulder 72 with the bottom of the counterbore 58. By positioning the pressure controlling valve 60 ahead of the throttle valve 76, it will be understood that the amount of pressure fluid admitted into the latter from the groove 69 through the port 43, is first controlled by the valve 60.

Referring now to the throttle valve proper, it will be seen that when the latter is positioned as shown in Figs. 9, 12, and 15, a position which corresponds to vertical position of the valve handle 78, the ports 95, 98, and 99, are closed by the throttle valve. If some pressure fluid was to escape past the valve 60, which is in this instance maintained in a closed position, it would be arrested by the throttle valve 76.

During the rotation of the throttle valve 76 in the direction of the arrow shown in Fig. 9, the port 91 thereof will register with the port 99 through the groove 92. In this instance, the action of the cam 81 on the cap 66 is not sufficient to cause the movement of the valve 60 in an open position, thus it will be understood that the throttle valve 76 is moved in an open position relative to the port 99 before pressure fluid is admitted into the throttle valve through the port 43. Simultaneously the groove 87 is moved in communication with the port 98, permitting thereby the pressure fluid previously admitting into the front end of the feed tube 32 to exhaust therefrom before the admission of the pressure fluid into the rear end of the feed tube, this exhaust taking place through the tube 97, the bore 96 and port 98 into the throttle valve groove 87, from where it will flow into the sprocket wheel chamber 100 via the port 124, and from there to the atmosphere through the open side of the chamber. When the throttle valve 76 and its appurtenant handle 78 is rotated sufficiently to cause the compression of the spring 65 by the cam 81 forcing the cap 66 inwardly, the valve shoulder 72 will move away from its valve seat as previously explained, admitting thereby pressure fluid from the groove 70 into the groove 69 from where it will flow in the throttle valve bore 84 via the ports 43 and 94. From the throttle valve 76, the pressure fluid is free to flow through the throttle valve port 91 and groove 92 into the clearance 56 existing around the piston rod 39 via the port 99, from where it is free to be admitted into the rear end of the feed tube 32. The pressure fluid admitted therein will act on the pair of packing members 35 and 50, affording thereby a fluid tight joint preventing the pressure fluid to escape from the feed tube, the piston rod 39 being packed by the stuffing box 55. The pressure

fluid thus admitted into the rear end of the feed tube 32 will cause the slidable movement of the latter within the guideways 21 and 22 of the support 20 toward the left in Fig. 3 or away from the work. The sprocket wheel 101 being carried by the feed tube will move therewith causing thereby the chain 103 engaging the latter to pull the drilling motor 108 within the guideways 109 of the feed tube 32 in the same direction or away from the work, but at a greater rate of speed than that of the feed tube 32. The other chain 113 being pulled by the drilling motor 108 to which one end is attached, will simply pass over the sprocket wheel 114 without affecting the operation of the mechanism.

Referring now to the operation of the fluid controlling valve, assuming that the pressure fluid was admitted into the rear end of the feed tube 32 to move the drilling motor 108 away from the work. In this instance the throttle valve handle 78 would be positioned in a manner whereby the cam 81 would cause the valve head 61 to uncover the groove 70. Should for instance the pressure of the fluid thus admitted into the rear end of the feed tube be increased due to some adverse conditions retarding the slidable movement of the drilling motor away from the work, the pressure of the fluid admitted into the valve head 61 through the restricted port 68 will increase proportionally, thus causing the movement of the valve 60 and its appurtenant head 61 to move toward the bottom of the counterbore 53 for partly closing the groove 70, reducing thereby the amount of the pressure fluid flowing from the groove 70 into the rear end of the feed tube via the groove 69. In this instance, since the amount of the pressure fluid admitted into the feed tube is restricted due to an increase of the pressure of the fluid admitted therein, it will be understood that the pressure within the feed tube will remain substantially constant for a predetermined position of the throttle valve handle 78. Should the pressure of the fluid within the feed tube decrease due to working conditions permitting a freer slidable movement of the drilling motor, the pressure of the fluid within the head 61 of the valve 60 will also decrease, permitting thereby the valve 60 to move toward the plug 59. In this instance the groove 70 is more fully uncovered by the head of the valve, thus permitting an increased amount of the pressure fluid to flow into the groove 69, and therefrom into the feed tube 32 for maintaining the pressure of the fluid therein substantially constant. When the throttle valve handle is finally positioned at the extreme end of its rotation in a counterclockwise direction, the port 86 of the throttle valve is in communication with the port 95, thus admitting pressure fluid into the cylindrical bore 57, between the valve 60 and the cap 66, for shifting and maintaining the valve 60 in its extreme open position, assuring thereby an unrestricted flow of the pressure fluid from the groove 70 into the groove 69 and therefrom into the feed tube 32 via the throttle valve 76. When the handle 78 is again rotated in a clockwise direction, the pressure fluid previously admitted into the cylindrical bore via the throttle valve port 86 and the port 95, is now free to exhaust therefrom through a vent 71 provided through the cap 66, permitting thereby the normal operation of the valve 60 responsive to the effort of the compression springs 64 and 65.

When it is desired to feed the drilling motor toward the work, the throttle valve from its vertical or off position may be rotated in the direction of the arrow shown in Fig. 15. In this instance, the port 88 through its groove 89 will be moved in registration with the port 98, permitting thereby the pressure fluid flowing from the groove 70 into the groove 69 to be admitted into the front end of the feed tube 32 via the port 98, bore 96, and tube 97. The pressure fluid admitted therein will act on the pair of packing members 36 to afford a fluid tight joint with the internal wall of the feed tube 32. Similarly the pressure fluid will act on the plate 41 which is integral with the feed tube 32 to cause the slidable movement of the latter within the guideways 21 and 22 of the support 20 in a rightward direction or toward the work. The sprocket wheel 114 carried by the feed tube 32, will cause the chain 113 to impart slidable movement to the drilling motor 108 within the guideways 109 of the feed tube 32 in the same direction but at a greater rate of speed than that of the feed tube 32. During this slidable movement of the drilling motor, the chain 103 engaging the sprocket wheel 101 will simply pass thereover without affecting the operation of the mechanism.

In this instance, the operation of the pressure controlling valve 60 is identical to that previously described, consequently no further explanation is thought necessary other than pointing out that the pressure controlling valve being located ahead of the throttle valve 76, is capable of controlling the pressure of the fluid within both ends of the feed tube 32 or irrespective of the direction of the slidable movement thereof.

When the throttle valve is positioned for admitting pressure fluid into the front end of the feed tube 32, the pressure fluid previously admitted into the rear end of the feed tube is free to exhaust therefrom through the clearance 56 existing around the piston rod 39, the port 99 into the throttle groove 90, from where it will flow into the groove 87 via the slot 93. The groove 87 being constantly in communication with the exhaust port 124, the exhausting fluid is free to flow therethrough into the chamber 100, and therefrom to the atmosphere via the open side of the chamber through which the chain 103 passes. When the throttle valve handle is located at the extreme end of its rotation in a clockwise direction, the port 85 is in communication with the port 95 for admitting pressure fluid between the valve 60 and the cap 66 as previously explained.

The feed tube 32 together with the drilling motor 108 may be locked against slidable movement relative to the support 20 by rotating the handle 120 of the bolt 118 in a predetermined direction, effecting thereby the clamping action of the plate 121 on the tube 123 for preventing the slidable movement of feed tube 32 relative to the support 20. In this instance since the feed tube 32 is locked against slidable movement, the drilling motor is prevented to move relatively to the feed tube by the chains 103 and 113 uniting the former to the latter.

The tension of the two chains 103 and 113 may be varied by rotating the nut 106, thus causing the slidable movement of the bolt 104 through the apertured lug 105, and thereby varying the tension of the chains 103 and 112.

Although the foregoing description is necessarily of a detailed character, in order to completely set forth the invention, it is to be understood that the specific terminology is not in-

tended to be restrictive or confining and it is to be further understood that various rearrangements of parts and modification of structural detail may be resorted to without departing from the scope or spirit of the invention as herein claimed.

I claim:

1. In a rock drill, a support, a tube slidably guided thereon, a drilling motor slidably guided on said tube, a feeding mechanism for said drilling motor including said slidable tube, a stationary element within the latter, means for effecting the slidable movement of said tube relative to said element, and means receiving motion from the slidable movement of said tube for effecting the slidable movement of said drilling motor relative to said tube.

2. In a feeding mechanism for a rock drill, a stationary member, a slidable element carried by said member, a drilling motor carried by said element in slidable engagement therewith above said member, and means actuated by said element for imparting slidable movement to said drilling motor relative to said element.

3. In a feeding mechanism for a rock drill, a stationary member, a feeding element carried by said member normally extending beyond the ends of the latter, a drilling motor carried by said element, means for effecting relative motion between said member and element, and means deriving motion from said relative motion for imparting feeding motion to said drilling motor relative to said element.

4. In a rock drill, a stationary elongated support, a fluid actuated feeding element slidably guided on and carried by said support, a drilling motor slidably guided on and carried by said element, and means deriving motion from the slidable movement of said element for imparting feeding motion to said drilling motor in a manner whereby the relative rate of speed between the interengaging guiding surfaces of said element and support is equal to the relative rate of speed between the interengaging guiding surfaces of said element and motor.

5. In a rock drill, a stationary elongated support, a fluid actuated feeding element slidably guided on and carried by said support, a drilling motor carried by said element, interengaging walls on said motor and element for slidably guiding the former relative to the latter, and means deriving motion from the slidable movement of said element for imparting feeding motion to said drilling motor in a manner whereby the relative rate of speed between the interengaging walls aforesaid is less than the rate of speed of the motor relative to the support.

6. In a rock drill, a support, a drilling motor slidable relatively thereto, a reversible feeding mechanism for said motor including an element slidably guided on and carried by said support, said element carrying said motor in relative slidable engagement therewith, and means for transmitting the slidable movement of said element to said drilling motor in a manner whereby the speed of the latter is substantially multiplied.

7. In a rock drill, a support, a feeding element slidably guided thereon, a drilling motor slidably guided on said element, and a feeding mechanism for said drilling motor including said feeding element, a stationary piston member within the latter, and a speed multiplying device including a flexible member connecting said support to said drilling motor and associated with rotatable members carried by said element for rotation one in a horizontal and the other in a vertical plane relative to said support.

8. In a drilling apparatus, the combination with a drilling motor having a fluid actuated feeding mechanism associated therewith for feeding the latter toward or away from the work, and means including a valve for controlling the pressure of the fluid actuating said feeding mechanism irrespective of the direction of feed imparted to said drilling motor, said valve having differential opposed areas subjected to pressure conditions within said mechanism for automatically actuating the valve.

9. In a feeding device for a rock drill, the combination with a stationary support, of a cylinder element carried by said support, a drilling motor slidably guided on said cylinder element, a motive fluid actuated feeding mechanism for said drilling motor including a piston element within said cylinder element, means for admitting motive fluid to said elements for causing the slidable movement of one relatively to the other in either direction, means receiving motion from said slidable element for imparting feeding motion to said drilling motor relative to said slidable element, and means for maintaining substantially constant the pressure of the motive fluid actuating said slidable element irrespective of the speed and the direction of travel of the latter.

10. In a drilling apparatus, the combination with a drilling motor having a fluid actuated feeding mechanism associated therewith for feeding the latter toward or away from the work, said feeding mechanism including a piston element and a cylinder element one slidable relatively to the other in either direction, passages for admitting motive fluid to said slidable element for effecting its slidable movement, means for transmitting said slidable movement to said drilling motor, means including a valve for maintaining substantially constant the pressure of the motive fluid actuating said element irrespective of the direction of travel of the latter, means resiliently supporting said valve, and actuating areas on said valve subjected to pressure conditions within said feeding mechanism for actuating the valve.

11. In a drilling apparatus, the combination with a rock drill, of a motive fluid actuated feeding mechanism associated with the drill for imparting feeding motion thereto in two directions, and means including a valve automatically operated due to a variation of the pressure of the motive fluid actuating said feeding mechanism for maintaining said pressure substantially constant irrespective of the direction of said feeding motion.

12. In a drilling apparatus, the combination with a drilling motor, of a power actuated feeding mechanism associated therewith for imparting feeding motion thereto in two directions, means movable in different positions for varying the power of said feeding mechanism, and means automatically operated to maintain said power substantially constant for each position of said first mentioned means irrespective of the speed and direction of the feeding movement imparted to said drilling motor.

13. In a drilling apparatus, the combination with a drilling motor, of a fluid actuated feeding mechanism associated therewith for imparting feeding motion thereto, passages for admitting

pressure fluid in either end of said feeding mechanism, a primary valve movable in more or less complete open position for controlling the amount of the pressure fluid adapted to be admitted through either of said passages, a secondary valve controlling said passages movable in open position with either one thereof before said primary valve is moved in an open position, an adjustable compression spring acting on said secondary valve normally effecting the opening thereof relative to said passages, common means for operating said primary valve and adjusting the compression of said spring, and means assuring the complete open position of said primary valve during a pre-determined position of said secondary valve.

14. In a drilling apparatus, the combination with a rock drill, of a reversible pressure fluid actuated feeding motor for said rock drill, means including a duality of passages for admitting fluid to and exhausting fluid from said feeding motor to actuate the latter, a throttle valve controlling said passages and adjustable for effecting feed in either direction, an automatic valve subjected to pressure conditions within said feeding motor for controlling the supply of fluid through either of said passages for automatically regulating the feeding pressure within said motor, a load acting on said automatic valve adjustable for changing the feeding pressure within said motor, and a single element for operating said throttle valve and adjusting the load acting on said automatic valve.

15. In a drilling apparatus, the combination with a drilling motor, of a pressure fluid actuated feeding mechanism associated with the motor for feeding it in two directions, a throttle valve for controlling the direction of travel of said motor, a spring loaded valve subjected to pressure condition within said feeding mechanism for maintaining said pressure substantially constant irrespective of the direction of travel of said motor, and a single element manually operable for actuating said throttle valve and for varying the load of the spring acting on said valve for changing the pressure of the fluid actuating said feeding mechanism.

16. In a drilling apparatus, the combination with a rock drill, of a reversible pressure fluid actuated feeding motor for said rock drill, means including passages for admitting and exhausting pressure fluid to and from said motor for actuating the same, a primary valve normally actuated by virtue of pressure conditions within said motor for automatically controlling the feeding pressure of the motor irrespective of the direction of movement of the latter, a manually operated secondary valve controlling said passages for effecting forward or rearward movement of said motor, and means controlled by said secondary valve for rendering said primary valve inoperative.

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