

April 2, 1957

J. E. FEUCHT ET AL
ROCK DRILLING APPARATUS

2,787,250

Filed Feb. 23, 1955

3 Sheets-Sheet 1

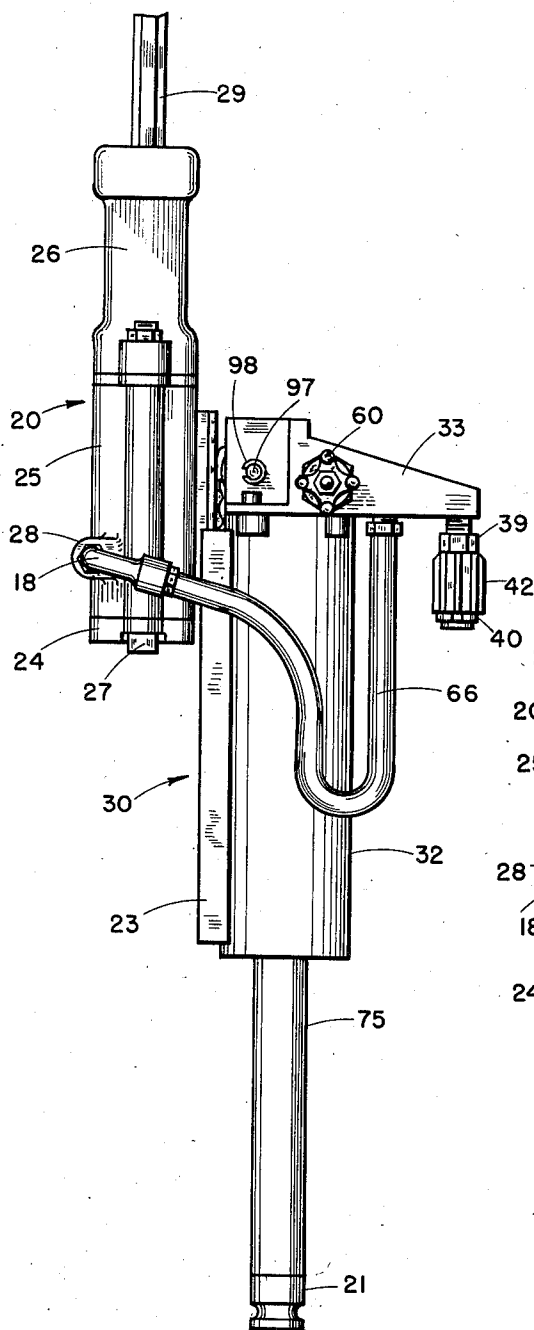


FIG. 1

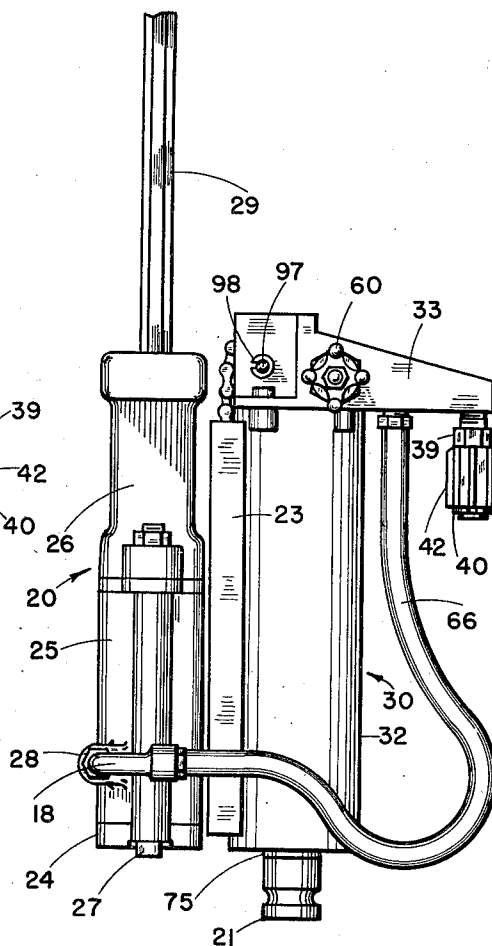


FIG. 2

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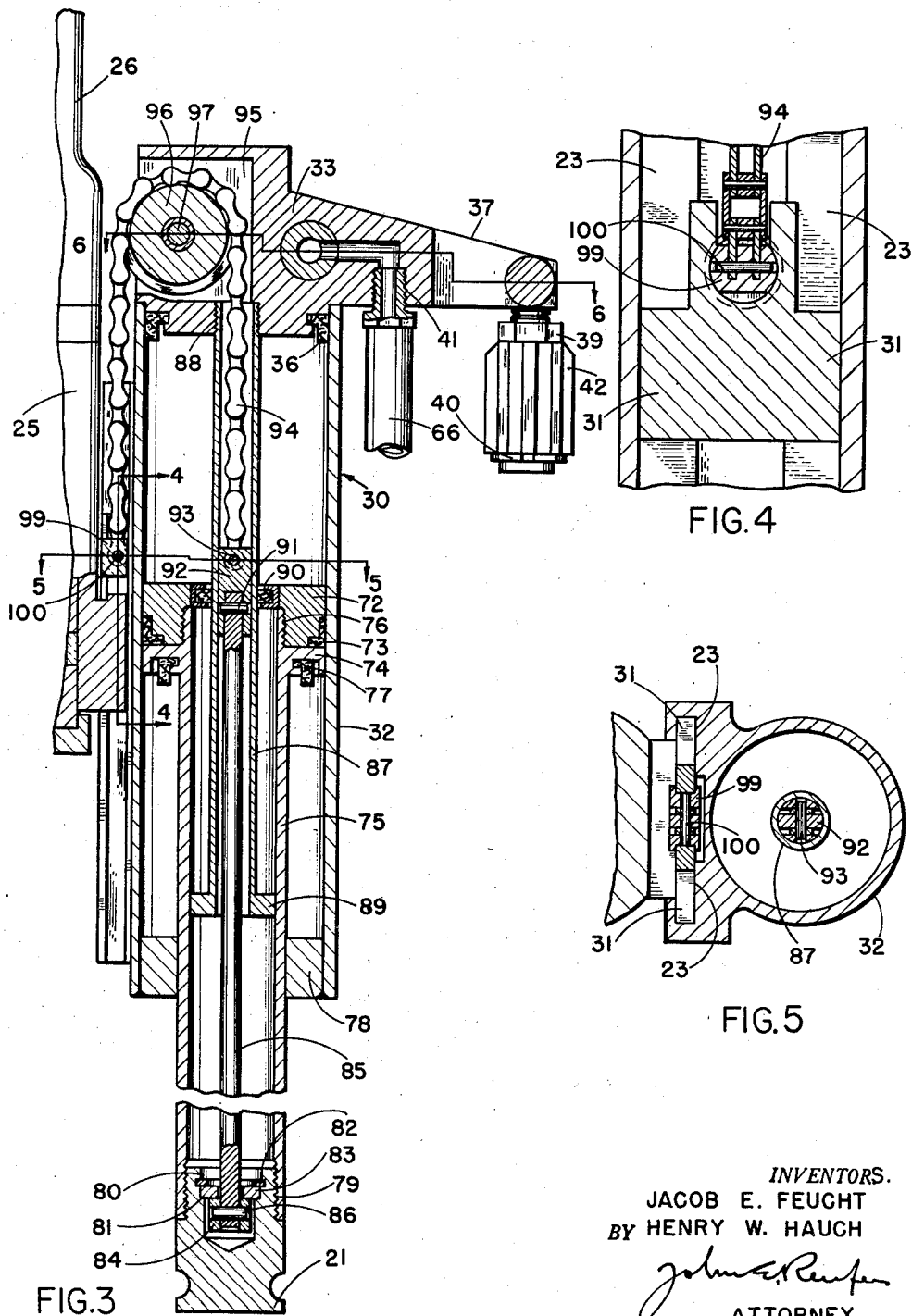
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3 Sheets-Sheet 3

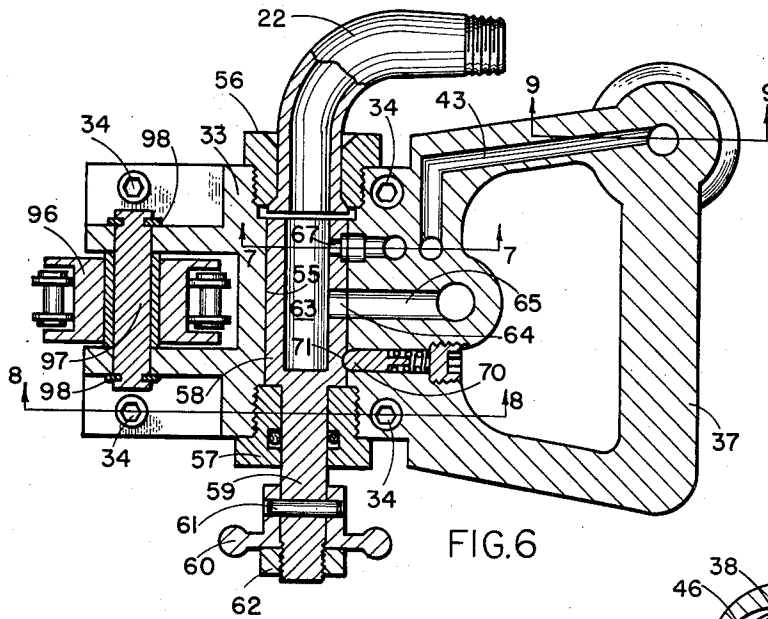


FIG. 6

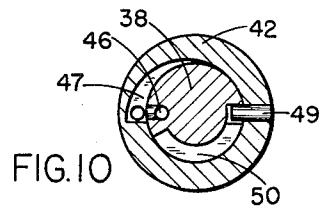


FIG. 10

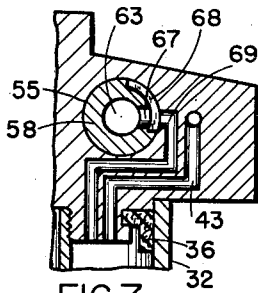


FIG. 7

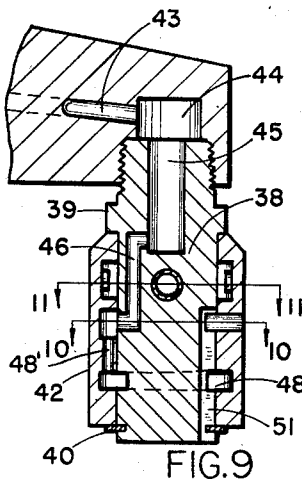


FIG. 9

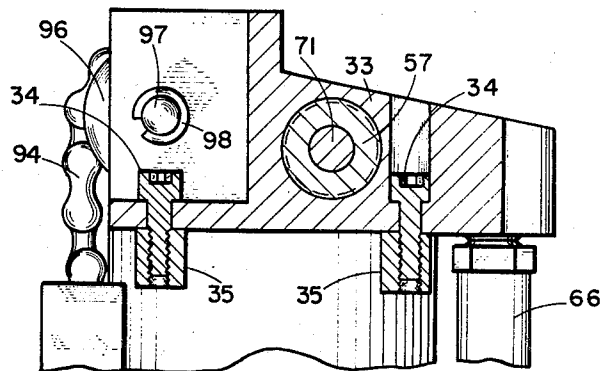


FIG. 8

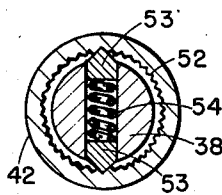


FIG. 11

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ROCK DRILLING APPARATUS

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Application February 23, 1955, Serial No. 490,032

6 Claims. (Cl. 121—9)

This invention relates broadly to rock drilling apparatus, but more particularly to a drilling apparatus especially designed for either stoper or horizontal drilling where short overall length of the apparatus and relatively long feed are desirable. It is an improvement in the drilling apparatus forming the basis of co-pending application Ser. No. 468,080, filed November 10, 1954.

One object of this invention is to provide a drilling apparatus with a feeding mechanism of the single power cylinder type, but arranged and constructed in a manner whereby the maximum feed of the drilling motor is materially greater than that of the feed cylinder.

Another object of this invention is to produce a feeding mechanism resulting in a possible feed length greater than the length of travel of its single power cylinder and piston unit, the piston being equipped with efficient packings adapted to resist wear and generally of better construction than is possible with feed mechanism of the telescopic cylinder type.

Another object of this invention is to produce a feed mechanism of a short overall length but capable of a relatively long feed such as heretofore obtained with feed mechanism of the telescopic cylinder type, this feeding mechanism being characterized by the use of a single power cylinder and piston unit whereby the feed pressure remains constant throughout the entire length of feed.

Another object of this invention is to produce such a feed mechanism with a flexible member or chain adapted to transmit feeding motion to the drilling motor, the chain being arranged and disposed for protection against drilling dust and other foreign matter.

Another object of this invention is to design such drilling apparatus and a feeding mechanism therefor forming a relatively simple, well balanced and compact assembly readily operable with minimum effort on the part of the operator.

Other objects of this invention will be apparent from the following detailed description wherein similar characters of reference designate corresponding parts and wherein:

Figure 1 is a side elevational view of a drilling apparatus embodying the invention and shown in an extended position.

Figure 2 is a view similar to Figure 1, but showing the drilling apparatus in a retracted position.

Figure 3 is an enlarged longitudinal sectional view of the feeding mechanism.

Figure 4 is an enlarged longitudinal sectional view taken on line 4—4 in Figure 3 and illustrating the connection between one end of the chain and the drilling motor.

Figure 5 is a cross sectional view taken on line 5—5 in Figure 3.

Figure 6 is an enlarged cross sectional view taken on line 6—6 in Figure 3 illustrating the throttle valve and handle by which the drilling apparatus is held in drilling position.

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Figure 7 is a cross sectional view taken on line 7—7 in Figure 6.

Figure 8 is a cross sectional view taken on line 8—8 in Figure 6, showing how the cylinder head is fastened to the upper end of the cylinder.

Figure 9 is a longitudinal sectional view taken on line 9—9 in Figure 6 showing detailed construction of the feed regulating valve.

Figures 10 and 11 are cross sectional views taken on lines 10—10 and 11—11 respectively in Figure 9.

Referring to the drawings, 20 designates generally a fluid actuated rock drill or drilling motor of the percussive type, and 30 the supporting and feeding mechanism for the motor. While this drilling apparatus has been designed primarily for stoper drilling, it is apparent that it can just as well be used for horizontal drilling or for any other type of drilling where short overall retracted length of the apparatus and relatively long feeds are desirable. When used for stoper drilling, the apparatus may be used in the form shown in the drawings, that is with the lower end of the support provided with a terminal abutment or end shank 21 adapted for connection with a socket mounted on any suitable wheel supporting frame from which the drilling apparatus extends upwardly to form with such frame a mobile drilling apparatus for drilling upright holes, such as are required for roof bolting and the like operation. If desired, the shank 21 may be replaced by the usual and well known ground engaging pointed end adapted to rest on the ground or floor of the mine with the apparatus maintained upwardly by the operator.

The drilling motor 20 is of the well known percussive type. It can briefly be described as comprising a back head 24, a cylinder 25 and a front housing 26 held together by side bolts 27. A pressure fluid actuated piston, not shown, is reciprocable within cylinder 25 to deliver impacts in rapid succession to a tool implement or drill steel 29 which has a shank slidably mounted within front housing 26. Adjacent the back head 24, cylinder 25 is provided with a transverse boss 28 having swivelly mounted therein a pressure fluid connection 18.

Formed integrally with cylinder 25 and extending longitudinally thereof, is a pair of laterally spaced parallel guides 31, Figure 5, slidably fitted within corresponding guideways 23 provided on a feed cylinder 32. This cylinder, as shown in Figures 1 and 2, extends alongside of the drilling motor 20 and affords a support on which the motor is slidably guided for longitudinal movement thereon from one to the other end thereof. As shown in Figures 3 and 8, the upper end of cylinder 25 is closed by a head 33 secured thereon by retaining screws 34 which are threaded into bosses 35 formed on the external wall of the cylinder. This head is made air tight with the upper end of cylinder by an adequate seal or packing 36.

Head 33 is formed with a laterally extending spade handle 37 (Fig. 6) adapted to be grasped by the operator for holding or steadying the drilling apparatus into operative position. In one of its outside corners, spade handle 37 has screwed therein a stub arbor 38 (Fig. 9) which depends therefrom and has rotatably mounted thereon, between two longitudinally spaced annular shoulders 39 and 40, a feed controlling sleeve valve 42. This valve is intended to control a port 43 which leads from the upper end of feed cylinder 32, Figure 7, through one branch of handle 37 into a cylindrical recess 44, and therefrom through stub arbor ports 45 and 46, the latter opening on the peripheral wall of the arbor. Valve 42 has its internal wall provided with a half crescent groove 47, Figure 10, affording communication between port 46 and an exhaust groove 48 through a port 48'. A pin 49 carried by the valve, extends radially into a partly cir-

cular groove 50 formed on stub arbor 38, the pin being engageable with the ends of the groove to limit the extent of rotation of the valve on the arbor. Groove 50 is connected with the free end of arbor 38 through a longitudinally extending groove 51, which forms a passage for the pin 49 when assembling the valve on the arbor and also connects exhaust groove 48 to the atmosphere. As shown in Figure 11, adjacent its upper end, valve 42 has its internal wall provided with small ratchet teeth 52 engageable by adequately shaped diametrically opposed plungers 53 carried by stub arbor 38 and urged outwardly by a spring 54.

Head 33 is also provided with a cylindrical bore 55 extending transversely thereof and terminated by enlarged threaded ends having screwed therein gland nuts 56 and 57. In the bore 55 is rotatably fitted a cylindrical throttle valve 58 having a shank 59 extending through gland nut 57 and carrying, on its free end, an operating handle or knobbed wheel 60 retained thereon by a cross pin 61 and nut 62. Throttle valve 58 is provided with a central inlet chamber 63 into which opens a radial port 64 capable of communication with a passageway 65 which ends into a threaded bore 41 (Fig. 3) having screwed therein one end of a motive fluid conveying conduit 66, while its other end is secured to the motive fluid connection 18, Figures 1 and 2. Another radial port 67 leads from the throttle valve inlet chamber 63 into a valve half crescent groove 68, Figure 7, which is capable of communication with a port 69 opening into the upper end of feed cylinder 32. The usual spring biased detent 70 is slidably mounted within head 33 for engagement with peripherally spaced notches 71 provided on the throttle valve for holding it in predetermined positions. A motive fluid connection 22 has one end portion swivelly mounted within gland nut 56, while its other end is threaded for connection with a motive fluid conveying conduit adapted to supply motive fluid to the throttle valve inlet chamber 63.

As shown in Figure 3, a piston member 72 is slidable within feed cylinder 32 in fluid tight engagement therewith by a packing 73 retained on the piston by the annular flange 74 of a piston tube 75, on the upper end of which piston member 72 is affixed by a screw threaded connection 76. This flange also carries a bumper stop 77 depending therefrom for engagement with a guide bushing 78 closing the lower end of feed cylinder 32 and having the piston tube 75 slidable therethrough. Piston tube 75 has affixed to its lower end, by a threaded connection 79, the terminal or end shank 21, which is provided with a central bore 80 forming an annular shoulder 81 on which is retained, by a split spring ring 82, a washer 83. A slotted cylindrical bushing 84 is loosely fitted within bore 80 below washer 83 to receive the lower end of a rod 85 pivotally connected thereto by a cross pin 86. This rod or rigid connector extends upwardly into piston tube 75 and into an inner tube or guard 87, which has its upper end fixed to the head 33, as at 88, and depends from the head through piston 72 into piston tube 75 where it is terminated by an annular flange 89 forming a sliding bearing with the inner wall of piston tube 75. Piston 72 carries a suitable packing 90 affording a fluid tight joint between the piston and inner tube 87.

The upper end of rod 85 has secured thereon by a cross pin 91 a cylindrical head 92 slidably guided within inner tube 87 and having pivotally connected thereto, by a cross pin 93, one end of a chain 94. From rod head 92, chain 94 extends upwardly through inner tube 87 into a cavity 95 provided with cylinder head 33, where it is reversed over a roller 96 mounted on a shaft 97 operatively carried by the head 33 and retained against axial movement by split rings 98, Figure 6. From roller 96, chain 94 extends outside of cylinder 32 between the guideways 32 and has its other end pivotally connected to the cylinder 25 of the drilling motor 20 by a slotted connecting member 99 located between and secured to the upper ends of the guides 31 by a cross pin 100.

In the operation of the drilling apparatus, with the abutment terminal 21 of the piston tube 75 fastened on a wheel supported frame or the like, prior to admission of pressure fluid into feed cylinder 32, the drilling apparatus by virtue of its own weight will assume the retracted position shown in Figure 2. After the drill steel 29 has been inserted into the chuck housing 26, the operator with one hand on handle 37 and the other on the knobbed wheel 60 may rotate the throttle valve 58 into the position shown in Figure 6. In this instance, motive fluid admitted into the throttle valve inlet chamber 63, through connection 22, will flow to the drilling motor 20 through throttle valve radial port 64, port 65 and conduit 66, thereby actuating the drilling motor for delivering impacts to the drill steel 29 in rapid succession. Radial port 64 is relatively long peripherally, so that the throttle valve 58 may be rotated clockwise about 90° from the position shown in Figures 6 and 7 with the port 64 remaining in communication with the port 65. During the position of the throttle valve shown in Figure 7, motive fluid is also admitted into the upper end of feed cylinder 32 through the throttle valve radial port 67, groove 68 and port 69. Since the piston 72 is rigidly connected on the upper end of the piston tube 75, which has its lower end 21 resting on either the ground or a supporting frame, it will be understood that the effect of the pressure fluid within the upper end of feed cylinder 32 will cause extension of the feed mechanism, that is, upward movement of cylinder 32, head 33 and inner tube 87 relative to the piston 33. In this instance, because chain 94 is passing over the upwardly moving roller 96, upward movement of feed cylinder 32 is translated into upward movement of the drilling motor 20 at a rate of speed double that of the feed cylinder relative to the piston 72.

The rate of speed and power at which the drilling motor 20 is fed to the work, can first be regulated by turning the throttle valve 58 to cause more or less complete communication of radial port 67 with port 69 through half crescent groove 68. During the drilling operation, the rate of feed can additionally be adjusted by controlling the exhaust of the pressure fluid from feed cylinder 32 through port 43. This may be accomplished by manipulating the sleeve valve 42, mounted on handle 37, to afford more or less complete communication between port 46 and vent 48.

When it is desired to retract the apparatus, that is, lower the drilling motor, the throttle valve 58 can be rotated to shut off motive fluid from both the drilling motor 20 and feed cylinder 32, and the feed control valve 42 positioned to exhaust the feed cylinder through port 43, recess 44, passage 45, port 46 crescent groove 47, port 48, exhaust groove 48 and longitudinal groove 51. In this instance, pressure fluid exhausting from the upper end of feed cylinder will enable downward movement of the cylinder and head 33 by gravity relative to the stationary piston 72 and piston tube 75, and the consequential downward movement of the drilling motor. In the fully retracted or collapsed position, the pumper stop 77, which is made of resilient material such as rubber, engages the guide bushing 78 to prevent a metal to metal impact of the piston on the bushing.

From the foregoing it will be understood that chain 94 has two parallel taut runs extending from roller 96. One run extends alongside of cylinder 32 with its end fastened to the drilling motor by cross pin 100 and the other run extending into inner tube 87 with its end fastened to the piston tube through rod 85. That last run is free to move in and out of feed cylinder 32 through the upper end of inner tube 87 without danger of motive fluid escaping from the feed cylinder. The inner tube 87 is slidable through a usual packing 90, which affords a fluid tight joint between the piston and the tube. The rod 85, which has its upper end slidably guided within inner tube 87, is of a length calculated to remain short of the roller 96 when the apparatus is

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fully retracted and within the inner tube 87 when fully extended. It will also be understood that since the lower end of the rod 85 is rotatable mounted within the bore 80, it is free to rotate on its own axis to enable self adjustment of the chain over roller 96 without being subjected to twisting forces.

While feeding mechanism imparting feeding motion to the drilling motor at a greater rate of speed than that of the feed motor, have been used before and are well known in this art, by the disposition and aggroupment of parts as above described, it is possible to obtain a greater feed length of the drilling motor for a given retracted length of the entire apparatus, than heretofore possible with feed mechanisms of this type. This is possible because in the retracted position as shown in Figure 2, the lower end of the feed cylinder 32 is adjacent the terminal 21 of the piston tube 75 and flush with the back head 24 of drilling motor 20, while the upper end of cylinder 32 is only slightly beyond the corresponding end of the drilling motor 20. In the fully extended position, the drilling motor extends well beyond the upper end of the feed cylinder, in fact it extends beyond that upper end more than one-half the length of the drilling motor.

The cylindrical connector 92 mounted on the upper end of rod 85 provides a guide bearing for the end of the chain slidable within inner cylinder 87, while the inner tube 87 has longitudinally spaced guide bearings 89 and 90 maintaining the tube coaxial within the piston tube 75.

As clearly shown in Figures 1 and 2, the chain 94 having one run self contained within feed cylinder 32 and the other located between the cylinder guideways 32, is well protected from the drilling dust and other foreign matter and forms together with the feed cylinder and drilling motor a relatively light and compact assembly.

The details of structure and arrangement of parts shown and described may be variously modified without departing from the spirit and scope of the invention.

We claim:

1. In a drilling apparatus, a feed cylinder formed with first and second closed ends, a stationary piston in said cylinder, a piston tube fixed to said piston and extending through said cylinder first end, an abutment terminal on the free end of said tube, means admitting pressure fluid between said piston and said cylinder second end for effecting feeding motion of the cylinder relative to said piston, a drilling motor, interengaging guiding means between said motor and cylinder enabling longitudinal guided movement of the former on the latter, a roller operatively carried by said cylinder second end, an inner tube fixed to said second end extending through said piston into said piston tube, and a chain fitting over said roller having one end fixed to said motor and the other end fixed to said piston tube.

2. In a drilling apparatus, a feed cylinder formed with first and second closed ends, a stationary piston in said cylinder, a piston tube fixed to said piston and extending through said cylinder first end, an abutment terminal on the free end of said tube, means admitting pressure fluid between said piston and said cylinder second end for effecting feeding motion of the cylinder relative to said piston, a drilling motor, interengaging guiding means between said motor and cylinder enabling longitudinal guided movement of the former on the latter, a roller operatively carried by said cylinder second end, an inner tube fixed to said second end extending through said piston into said piston tube, a chain fitting over said roller having two taut runs extending from the roller alongside of said cylinder, one of said runs having its end fixed to said drilling motor and the other run extending into said inner tube, and a rigid member having one extremity slidably guided within said inner tube and fastened to the end of said other run and its other ex-

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trinity fastened to said piston tube near the free end thereof.

3. In a drilling apparatus, a feed cylinder formed with first and second closed ends, a stationary piston in said cylinder, a piston tube fixed to said piston and extending through said cylinder first end, an abutment terminal on the free end of said tube, means admitting pressure fluid between said piston and said cylinder second end for effecting feeding motion of the cylinder relative to said piston, a drilling motor, interengaging guiding means between said motor and cylinder enabling longitudinal guided movement of the former on the latter, a roller operatively carried by said cylinder second end, an inner tube fixed to said second end extending through said piston into said piston tube, a fluid tight seal between said piston and inner tube, a sliding bearing between the free end of said inner tube and piston tube, and a flexible member fitting over said roller having two taut runs extending from said roller, one into said inner tube with its end fastened to said piston tube, and the other alongside of said cylinder with its end fastened to said drilling motor.

4. In a drilling apparatus, an upright feed cylinder, a head closing the upper end of said cylinder, a stationary piston in said cylinder, a piston tube fixed to said piston extending through the lower end of said cylinder, an abutment terminal on the free end of said piston tube, a drilling motor slidable on said cylinder, a throttle valve within said head having pressure fluid supplied thereto, means including a flexible conduit from said head to said motor controlled by said valve for admitting pressure fluid to said motor, passage means controlled by said valve for admitting pressure into said cylinder between said piston and head for effecting feeding motion of the cylinder relative to said piston, an exhaust port leading from said cylinder, an exhaust valve on said head for controlling said exhaust port, a roller operatively carried by said head, and a flexible member fitting over said roller having one end fixed to said motor and the other end extending through said piston and fixed to said piston tube.

5. In a drilling apparatus, an upright feed cylinder, a head closing the upper end of said cylinder, a stationary piston in said cylinder, a piston tube fixed to said piston and extending through the lower end of said cylinder, an abutment terminal on the free end of said piston tube, a drilling motor slidable on said cylinder, a throttle valve within said head having pressure fluid supplied thereto, means including a flexible conduit from said head to said motor controlled by said valve for admitting pressure fluid to said motor, passage means controlled by said valve for admitting pressure into said cylinder between said piston and head for effecting feeding motion of the cylinder relative to said piston, a handle laterally of said head, an exhaust port leading from said cylinder, an exhaust valve on said handle for controlling said exhaust port, a roller operatively carried by said head, an inner tube fixed to said head extending through said piston into said piston tube, and a chain fitting over said roller having two taut runs extending from said roller one into said inner tube with its end fastened to said piston tube and the other run alongside of said cylinder with its end fastened to said motor.

6. In a drilling motor, an upright feed cylinder, a head closing the upper end of said cylinder, a piston and a piston tube assembly stationary within said cylinder with said tube having a free end portion extending through the lower end of said cylinder, an abutment terminal on the free end portion of said tube, means admitting pressure fluid between said piston and head for effecting feeding motion of the cylinder relative to said piston, a drilling motor, interengageable means between said motor and cylinder enabling longitudinal guided movement of the former on the latter, a roller operatively carried by said head, a flexible member fitting over said roller having

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two runs extending from said roller one into said cylinder through said piston with its end fastened to said piston tube and the other alongside of said cylinder with its end fastened to said motor, and means surrounding the run within said cylinder in fluid tight engagement with said head and extending through said piston in fluid tight engagement therewith.

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