Jan. 7, 1958 J. E. FEUCHT 2,819,042

ROCK DRILLING APPARATUS

Filed Nov. 10, 1954 2 Sheets-Sheet 1

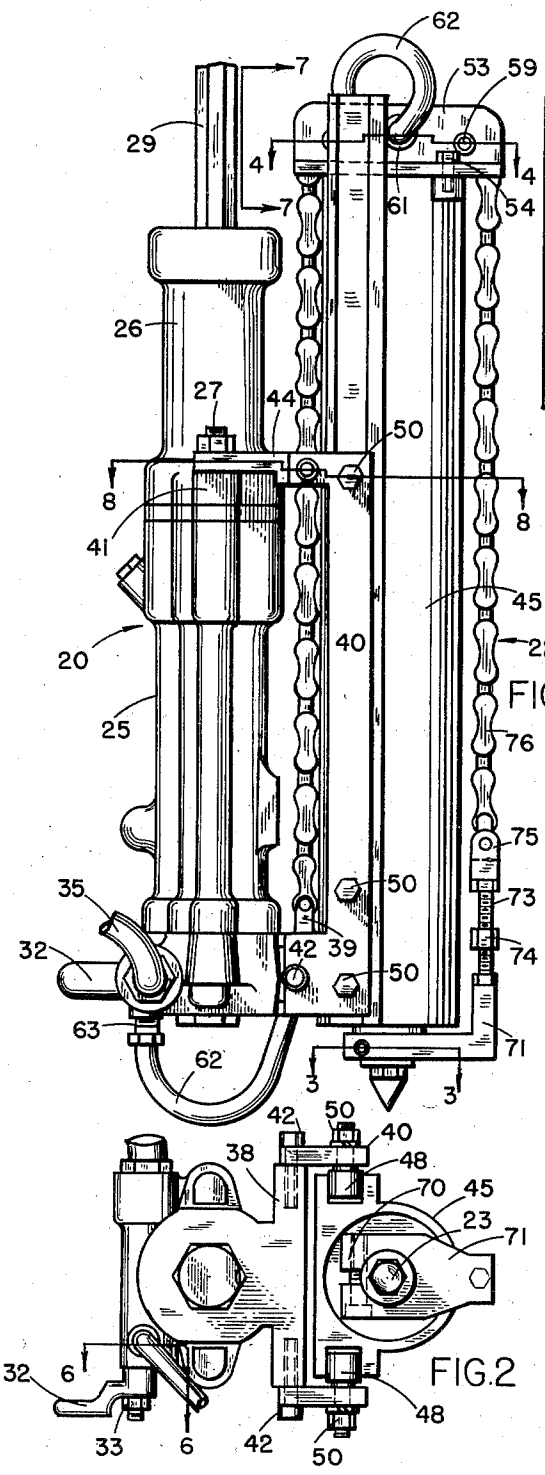


FIG.1

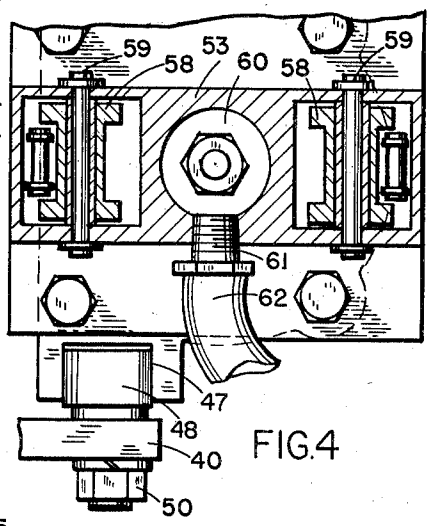


FIG.4

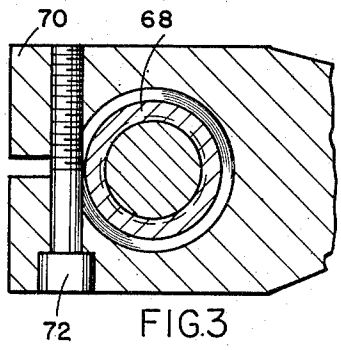


FIG.3

FIG.2

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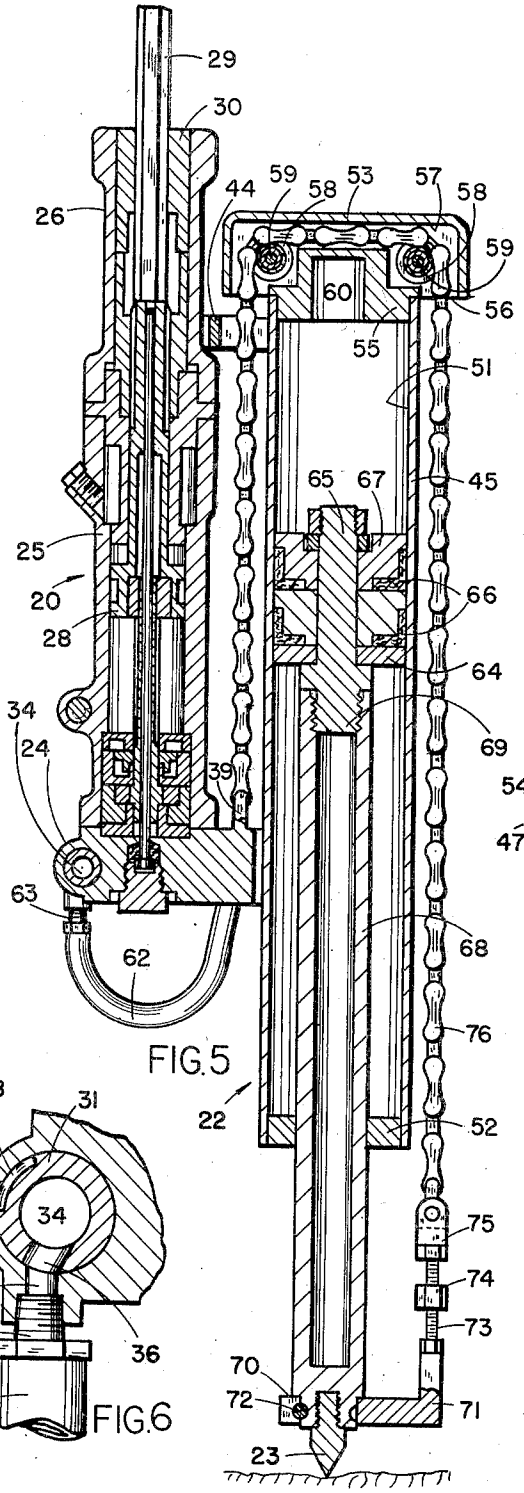


FIG. 5

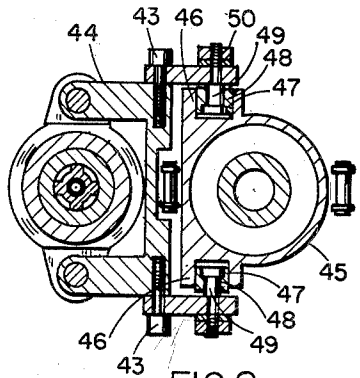


FIG. 8

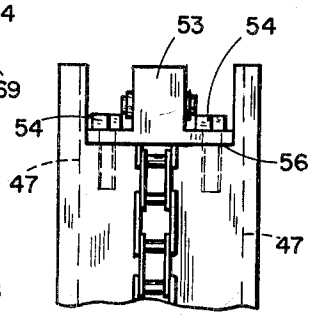


FIG. 7

FIG. 6

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2,819,042

Patented Jan. 7, 1958

2,819,042

ROCK DRILLING APPARATUS

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Application November 10, 1954, Serial No. 468,080

6 Claims. (Cl. 255—52)

This invention relates broadly to rock drilling apparatus, but more particularly to an improved drilling apparatus especially designed for either stoper or horizontal drilling where short overall length of the apparatus and relatively long feeds are desirable.

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 feed mechanism of a short overall length but capable of a relatively long feed such as heretofore obtained with feed of the telescopic cylinder type, the improved 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.

These objects are accomplished by a construction free of complication, and by an arrangement of parts resulting in a compact unit which is strong, durable and efficient.

In the drawings:

Figure 1 is a side elevational view of a drilling apparatus embodying the invention, while Figure 2 is an end elevational view thereof.

Figure 3 is an enlarged cross sectional view taken on line 3—3 in Figure 1.

Figure 4 is an enlarged cross sectional view taken on line 4—4 in Figure 1.

Figure 5 is a longitudinal sectional view of the drilling apparatus shown in Figure 1, with parts in different positions.

Figure 6 is an enlarged longitudinal view taken on line 6—6 in Figure 2.

Figure 7 is a top view of the end of the cylinder as viewed from line 7—7 in Figure 1.

Figure 8 is a cross sectional view taken on line 8—8 in Figure 1 and looking in the direction of the arrows.

Referring to the drawings, in which like symbols designate corresponding parts throughout the several views, 20 designates generally a fluid actuated rock drill of the percussive type, and 22 the supporting and feeding mechanism for the drill. While this improved apparatus has been designed primarily for stoper drilling, it is apparent that it can just as well be used in horizontal drilling or for any other type of drilling where short overall retracted length of the appaatus and relative long feeds are desirable. When used for stoper drilling, the apparatus may be used in the form shown in the drawings by resting the pointed or abutment engaging end 23 of the feed mechanism on the ground or floor of the mine and the apparatus maintained in an upward position by the operator. The abutment-engaging pointed end 23, which as shown in Figure 5 is screwed in the extreme end of the feed mechanism, is removable and may be replaced by any suitable clamping device through which the entire apparatus may be affixed to any suitable wheel supporting frame to form therewith a mobile drilling apparatus

for drilling upright holes, such as are required for roof bolting and the like operations.

The drilling motor 20 is of the usual type well known in this art. Briefly it comprises a back head 24, a cylinder 25 and front housing 26 held together by side bolts 27. A pressure fluid actuated piston 28 is reciprocable within cylinder 25 to deliver impacts in rapid succession to a drill steel 29 which is slidably mounted within a chuck 30 fitted within front housing 26. Within the back head 24 is rotatably mounted a throttle valve 31 having one end projecting from the back head to receive an operating handle 32 fixed thereto by a nut 33, while its other end has an inlet passage 34 leading inwardly therefrom, in which opens a radial port 36 capable of registry with a back head passage 37. Formed on the peripheral wall of the valve is an exhaust groove 78 affording possible registration of passage 37 with a vent 79.

In order to provide mounting means for the drilling motor 20 on the improved support and feeding mechanism about to be described, the back head 24 is different from the conventional type, to the extent that its right side in Figure 2 is provided with two rib like portions 38 extending laterally in opposite directions. Equally spaced between the ribs 38 and extending longitudinally below the cylinder 25 in Figures 1 and 5, is a lug 39 formed as an integral part of back head 24.

Referring now more particularly to the invention, the drilling motor 20 is provided with a drill mount which includes two parallel laterally spaced sides 40 extending longitudinally of the motor from the back head 24 thereof to the lugs 41 of its front housing 26. Both sides have their lower ends, as seen in Figure 1, connected to the ribs 38 of the back head 24 by bolts 42, while their upper ends are rigidly fastened by bolts 43 to the cross arm of a U-shaped bracket 44, which bracket is fastened against the lugs 41 of the front housing 26 by the bolts 27.

The drill support and feeding mechanism 22 comprise a relatively long tubular housing or cylinder 45 located alongside the drilling motor in parallel relation therewith and somewhat longer than the motor. As shown in Figure 8, housing 45 has its left side formed with two projections 46 extending laterally in opposite directions and longitudinally the full length of the housing, each projection being machined to form a guideway 47 of substantially square cross section. These guide-ways are accurately machined and have closely fitted therein guide rollers 48 mounted on the inner wall of the drill mount sides 40 for rotation on trunnions 49 fixed to the side 40 by any suitable means such as nuts 50. As shown in Figure 1, each drill mount side 40 is provided with three rollers, one at each end thereof and a third one near the lower end. It will thus be understood that the drilling motor is guided on the support or housing 45 for free longitudinal movement thereon with the rollers 48 within the guideways 47 limiting it to a minimum frictional resistance to such movement.

Support housing 45 is formed with a cylindrical chamber 51 extending the full length thereof and closed at its lower end by an end plate 52. The upper end of this chamber is closed by a front head 53 fixed to the support by bolts 54. This head has a back face 56 formed with a cylindrical pilot 55 fitting closely within the upper end of cylindrical chamber 51. Within a plane at right angles with the guideways 47, head 53 has its rear face 56 extending laterally beyond both sides of housing 45. Within the aforesaid plane, this head is also provided with a U-shaped passage 57 having its ends opening through the lateral projections of the back face 56 as clearly shown in Figure 5, and having mounted therein near each opening a chain roller 58 operatively carried by a cross pin 59. Pilot 55 is provided with a

central cylindrical recess 60 in which opens a motive fluid connection 61 secured to one end of a flexible conduit 62, the other end of which is fixed to a connection 63 screwed into drilling motor back head 24 and opening into inlet port 37. As shown in Figure 7, the guide-ways 47 extend somewhat beyond the upper end of cylindrical chamber 51 to end substantially flush with the head 53.

A piston 64 is slidably mounted within cylindrical chamber 51. This piston is of the usual single acting face type, that is, it comprises central stem 65 having mounted thereon two or more cup-shaped packings 66 facing toward the upper head 53 and separated by the usual followers 67. A tubular piston rod 68 is slidable through cylinder lower end plate 52, and has its inner end fixed to piston 64 by a screw threaded connection 69, while its outer or free end, which carries the removable pointed end piece 23, is slightly reduced in diameter to receive the apertured slotted end 70 of a bracket 71 which is fixed on the end of the piston tube by a cross bolt 72. This bracket extends radially from piston rod 68 within the plane coincident with the longitudinal center axes of the drilling motor 20 and support 22, where its free end has a stem 73 screwed therein. This stem carries a check nut 74 and a turn buckle 75 to which is affixed one end of a flexible member or chain 76. From bracket 71 chain 76 is taut upwardly alongside of housing 45 to the front head 53, then through U-shaped passage 57 over the rollers 58 and downwardly alongside housing 45 where its other end is attached to the lug 39 of drilling motor back head 24.

In the operation, with the drilling apparatus in the retracted position shown in Figure 1, with the pointed end 23 of the piston rod 68 resting on the ground or floor of the mine, when the throttle valve 31 is turned to the position shown in Figure 6, pressure fluid admitted to the valve through conduit 35, will be free to flow to the upper end of cylindrical chamber 51 through conduit 62, connection 61 and recess 60. The effect of the pressure fluid within the upper end of cylindrical chamber 51 will cause extension of the feed mechanism, that is, upward movement of cylinder 45 relative to piston 64 and piston rod 68. In this instance, because of the chain 76 passing over the upper end of cylinder 45, that is, over the rollers 58 and having one end attached to the lower end of the stationary piston rod 68 and the other end attached to the back head 24 of the drilling motor, upward movement of the cylinder 45 is translated into upward feeding motion of the drilling motor 20 at a speed double that of the cylinder relative to the piston rod 68. As the cylinder 45 reaches the end of its feeding motion by engagement of its end plate 52 with the piston 64, the drilling motor 20 or more particularly the drill mount has the two lower rollers 48 carried by each of its sides 40 still in operative engagement with the guide-ways 47, thereby providing adequate bearing means between drilling motor 20 and cylinder 45 during the entire possible feed motion of the former. This feature is made possible without undue increase in the length of the feed cylinder, by extending the guide-ways 47 beyond the upper end of the cylindrical chamber 51.

When it is desired to retract the apparatus, that is, lower the drilling motor, the throttle valve 31 may be rotated to a position affording more or less complete registration of passage 37 with exhaust port 79 through valve groove 78. In this instance, pressure fluid exhausting from the upper end of cylinder 45 will enable downward movement of the cylinder by gravity relative to the stationary piston 64 and piston rod 68, and the consequential downward movement of the drilling motor. It will be understood that by more or less complete registration of the groove 78 with the passage 37, the retraction of the apparatus may be duly controlled by the operator. In the fully collapsed position, the piston stem 65 engages the bottom of the cylindrical recess 60 of the upper head 53, while the lower end plate 52 is only slightly spaced from the bracket 71 mounted on the lower end of the piston rod 68.

While feeding mechanisms 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 1, the lower end of the cylinder 45 is adjacent the free end of the piston rod 68 and flush with the back head 24 of drilling motor 20, while the upper end of the cylinder 45 is only slightly beyond the corresponding end of the drilling motor. 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.

By providing a drill mount consisting of side members 40 carrying rollers fitted within the guide-ways 47 located within the diametrically opposed sides of housing 45, it is possible to provide adequate clearance between the drilling motor and feed mechanism to accommodate the chain 76 without materially increasing the usual distance between the longitudinal center axes of the drilling and feeding motors.

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

I claim:

1. In a drilling apparatus, a feed cylinder formed with first and second closed ends, a stationary piston in said cylinder and a piston rod extending through said cylinder first end, an abutment-engaging point on the free end of said rod, means admitting pressure fluid between said piston and said cylinder second end for effecting feeding motion of said 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 roller means within said cylinder second end, and means translating feeding motion of said cylinder into said longitudinal movement of the motor at a greater rate of speed including a taut flexible member passing over said roller means and extending therefrom along diametrically opposed sides of said cylinder with one end attached to said motor and the other end attached to the free end of said piston rod.

2. In a drilling apparatus, a feed cylinder formed with first and second ends, a stationary piston in said cylinder and a piston rod extending through said cylinder first end, an abutment-engaging point on the free end of said rod, a head closing said cylinder second end, means admitting pressure fluid between said piston and head for effecting feeding motion of said cylinder relative to said piston, a drilling motor, guiding means extending longitudinally on said cylinder beyond the second end thereof, means on said motor operatively engaging said guiding means whereby said motor is guided for longitudinal movement on said cylinder, a passageway through said head, roller means within said passageway, and means translating feeding motion of said cylinder into said longitudinal movement of the motor at a greater rate of speed relative to said piston including a flexible member passing through said passageway over said roller means, said member having two parallel taut portions extending from said head alongside of said cylinder, one portion being attached to said motor and the other portion to the free end of said piston rod.

3. In a drilling apparatus, an elongated housing, a

cylindrical chamber within said housing, an end member and a head fixed to said housing constituting the ends of said chamber, a stationary piston in said chamber and a piston rod extending through said end member, an abutment-engaging point on the free end of said rod, a rock drilling motor, a back head for said motor and a throttle valve in said back head, guide-ways on said housing extending the full length thereof, a drill mount fixed on said motor in straddle relation with said guide-ways, antifriction means carried by said mount fitted within said guide-ways whereby said motor is guided for longitudinal movement on said housing, means controlled by said throttle valve admitting pressure fluid in said chamber between said piston and head for effecting longitudinal movement of said housing relative to said piston, a pair of rollers carried by said head within a plane at right angles with said guide-ways, and a flexible member taut over said rollers having one end attached to said back head and the other end to the free end of said piston rod whereby longitudinal movement of said housing is transmitted to said motor at twice the rate of speed of the housing relative to said stationary piston.

4. In a drilling apparatus, an elongated housing, a cylindrical chamber within said housing, an end member and a head fixed to said housing constituting the ends of said chamber, a stationary piston in said chamber and a piston rod extending therefrom through said end member, an abutment-engaging member on the free end of said rod, a rock drilling motor, a back head for said motor and a throttle valve within said back head, guide means on said housing extending the full length thereof, antifriction means carried by said motor cooperating with said guide means whereby said motor is guided for longitudinal movement on said housing, means controlled by said throttle valve admitting pressure fluid in said chamber between said piston and head for effecting longitudinal movement of said housing relative to said piston, a passageway through said head, rotatable means within said passageway, and a flexible member through said passageway taut over said rotatable means having one end attached to said back head and the other end to the free end of said piston rod whereby longitudinal movement of said housing is transmitted to said motor at twice the rate of speed of the housing relative to said stationary piston.

5. In a drilling apparatus, a drilling motor having a drill steel carried by the front end thereof and a throttle valve within its rear end, a supporting and feeding mechanism for said motor comprising a feed cylinder formed with front and rear ends, a stationary piston in said cylinder and a piston rod extending through the cylinder rear end, an abutment-engaging point on the free end of said rod, guiding means extending longitudinally on said cylinder beyond the front end thereof, means on said motor operatively engaging said guiding means whereby said motor is guided for longitudinal movement on said cylinder, a head closing the front end of said cylinder, a passageway through said head, a pair of rollers within said passageway, means admitting pressure fluid from said throttle valve between said piston and head for effecting feeding motion of said cylinder relative to said piston, and means translating said feeding motion into said longitudinal movement of the motor at a different rate of speed relative to said piston including a flexible member passing through said passageway over said rollers, said flexible member having two parallel taut portions extending one from each of said rollers alongside of said cylinder, one portion being attached to said motor and the other portion to the free end of said piston rod, said piston rod, cylinder and motor being of such lengths and dispositions enabling said cylinder, when retracted on its piston to have its rear end substantially flush with the rear end of said motor and its front end beyond the motor front end, and when extended on its piston to have the motor front end materially beyond the cylinder front end.

6. A drilling apparatus comprising, a drilling motor having a drill steel carried by the front end thereof and a throttle valve within its rear end, a supporting and feeding mechanism for said motor comprising a feed cylinder formed with front and rear ends, a stationary piston in said cylinder and a piston rod extending through the cylinder rear end, an abutment-engaging point on the free end of said rod, guiding means extending longitudinally on said cylinder beyond the front end thereof, means on said motor operatively engaging said guiding means whereby said motor is guided for longitudinal movement on said cylinder, a head closing the front end of said cylinder, a passageway through said head, a pair of rollers within said passageway, said apparatus in a retracted position having the rear end of said cylinder adjacent the free end of said rod and flush with the rear end of said motor and the front end of said cylinder beyond the front end of said motor, means effecting extension of said apparatus whereby said motor projects beyond the front end of said cylinder more than half the length of said motor including means admitting pressure fluid from said throttle valve between said piston and head for effecting feeding motion of said cylinder relative to said piston, and means translating said feeding motion into said longitudinal movement of the motor at a greater rate of speed relative to said piston including a flexible member passing through said passageway over said rollers, said flexible member having two parallel taut portions extending one from each of said rollers alongside of said cylinder, one portion being attached to said motor and the other portion to the free end of said piston rod.

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