June 1, 1937. E. G. GARTIN 2,081,917

ROCK DRILL

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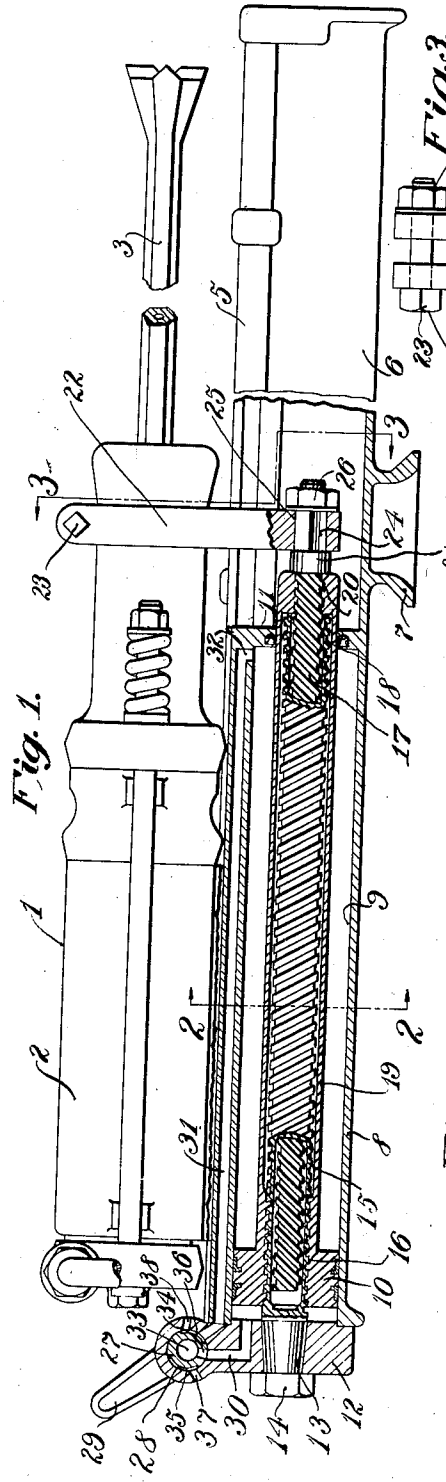


Fig. 1.

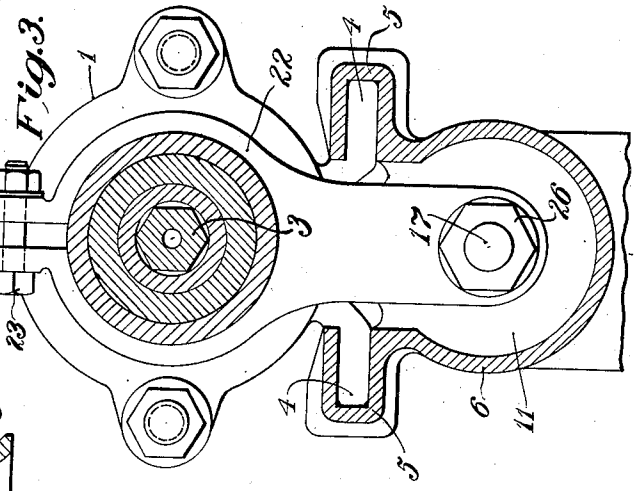


Fig. 3.

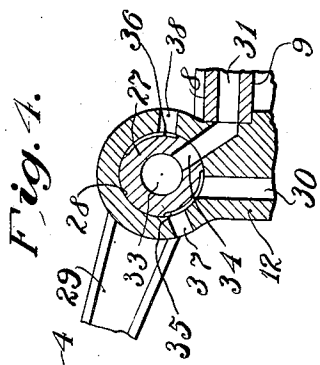


Fig. 4.

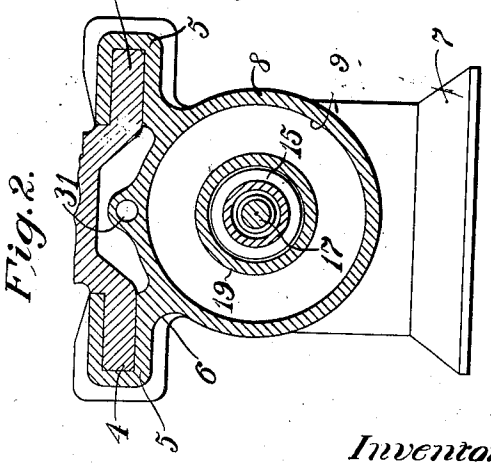


Fig. 2.

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ROCK DRILL

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14 Claims. (Cl. 121—9)

This invention relates to rock drills, and more particularly to improved feeding mechanism for a rock drill of the mounted drifter type.

An object of this invention is to provide an improved rock drill feeding mechanism. Another object is to provide an improved pressure fluid actuated feeding mechanism for a rock drill of the mounted drifter type. A further object is to provide an improved pressure fluid actuated feeding mechanism for a drifter type rock drill wherein a relatively long feed is obtained without materially increasing the over-all length of the drill. Yet another object is to provide an improved feeding mechanism for such a drill wherein a pressure fluid actuated feeding motor of the cylinder and piston type is employed and improved connections between the feeding motor and the drilling tool whereby relatively long feed is obtained. Still another object is to provide improved pressure fluid actuated feeding mechanism of the cylinder and piston type having improved differential screw mechanism between the feeding motor and the drilling tool whereby the rate of feeding movement of the feeding element is multiplied. These and other objects and advantages of this invention will, however, subsequently more fully appear.

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

In this drawing,—

Fig. 1 is a side elevational view of the illustrative form of the improved rock drill, the feeding mechanism being shown in section to illustrate details of construction.

Fig. 2 is a transverse vertical sectional view taken substantially on line 2—2 of Fig. 1.

Fig. 3 is a transverse vertical sectional view taken substantially on line 3—3 of Fig. 1.

Fig. 4 is a detail view of the feed controlling valve mechanism.

In this illustrative embodiment of the invention there is shown a rock drill of the mounted drifter type comprising a drilling tool 1 having a hammer motor 2 adapted to percussively actuate a drill steel 3. The cylinder of the hammer motor as shown in Fig. 2 is provided with laterally projecting guide members or gibs 4 which are slidably mounted in guideways 5 formed on a guide shell 6. The guide shell is provided with a swivel plate 7 which is adapted to be supported within a trunnion mounting of a usual tripod or column. In this instance a feed cylinder 8 is formed integral with the guide shell and is provided with a longitudinally extending bore 9 in which a feed piston 10 is reciprocably mounted. This feed cylinder is provided with a front head 11 formed integral with the guide shell 6 and a detachable rear head 12 suitably secured to the shell. The rear head 12 is provided with a conical bore 13 within which is secured by a nut 14 the conical end of a hollow feed screw 15, this feed screw herein being provided with right hand threads. This feed screw is threadedly connected at 16 within the feed piston 10 and has telescopically arranged therein a feed screw 17, this feed screw herein being provided with left hand threads. The feed screw 15 is provided at its forward end with a reduced central opening 18 through which the feed screw 17 extends as shown in Fig. 1.

Secured to the feed piston 10 is a forwardly extending hollow piston rod 19 within which the feed screws 15 and 17 are telescopically arranged, and this piston rod is threadedly connected at 20 at its front end with the feed screw 17. The feed screw 17 is provided with a collar 21 having its forward surface abutting against a clamp member 22 secured by a transverse clamping bolt 23 to the front end of the drilling tool 1, the feed screw 17 being held against rotation relative to the member 22 by means of a square portion 24 fitting a squared opening 25 in the member 22 and being held in position by means of a nut 26.

The improved means for controlling the fluid distribution means for the feed cylinder 8 herein comprises a rotary throttle valve 27 mounted within a bore 28 formed within the rear feed cylinder head 12. This valve is provided with a usual operating handle 29. Communicating with the bore 28 are passages 30 and 31, the latter communicating with the forward end of the cylinder bore at the front side of the feed piston through a lateral port 32. The passage 30 communicates with the feed cylinder bore at the rear side of the piston. Formed centrally within the throttle valve is a fluid supply chamber 33 which is connectible through a radial port 34 formed in the valve with either the passage 31 or the passage 30. Also formed on the external periphery of the throttle valve are grooves 35 and 36 which are adapted to connect the passages 30 and 31 to exhaust ports 37 and 38 respectively.

The operation of the improved rock drill will now be described. The rock drill is set up adjacent the working face with the swivel plate 7 of the guide shell mounted in the usual trunnion mounting of a tripod or column. When the parts are in the position shown in Fig. 1, the operator first starts the hammer motor 2 causing the drill steel to be percussively actuated. The feed control valve 27 is then rotated into the position

shown in Fig. 1, thereby admitting pressure fluid from the supply chamber 33 through the port 34 and passage 30 to the rear end of the feed cylinder bore at the rear side of the feed piston 10. At the same time the cylinder bore at the front side of the piston is connected to exhaust through port 32, passage 31, groove 36 in the valve, and exhaust port 38. When the feed control valve is in the position shown, the pressure fluid acts on the rear surface of the feed piston 10, moving the latter forwardly relative to the feed cylinder. Upon forward movement of the feed piston the latter, due to its threaded connection with the stationary feed screw 15, is rotated. This rotation of the feed piston is transmitted through the piston rod 19 and the threaded connection 18 to the nonrotatable feed screw 17. As a result the feed screw 17, due to the difference of the tooth ratio between the screws 15 and 17, is fed axially at a speed substantially twice that of the rate of movement of the feed piston 10, the feed screws 15 and 17 forming a differential screw mechanism between the feed piston and the drilling tool whereby the rate of feeding movement of said piston is substantially multiplied. By the provision of this differential screw mechanism it is possible to obtain a feeding range substantially twice that of the length of the feed cylinder. When the hole is completed, or if it is desired to change steels, the feed control valve 27 is shifted into the position shown in Fig. 4, thereby connecting the feed cylinder bore at the rear side of the piston to exhaust through passage 30, groove 35 in the valve, and exhaust port 37, and at the same time connecting the cylinder bore at the front side of the feed piston to the source of fluid supply through port 34, passage 31 and lateral port 32. As a result the feed piston 10 is moved rearward relative to the feed cylinder, thereby effecting feeding movement of the drilling tool 1 rearward relative to the guide shell to the position shown in Fig. 1.

As a result of this invention an improved pressure fluid actuated feeding mechanism is provided for a rock drill of the mounted drifter type wherein, by the provision of a differential screw mechanism between the feeding mechanism and the drilling tool, it is possible to obtain a relatively long feed with a relatively short feeding motor. It will further be evident that by the provision of the differential screw mechanism between the feed piston and the drilling tool it is possible to obtain a feed of the drilling tool substantially twice that of the travel of the feed piston, the differential screw mechanism causing the drilling tool to be fed at a speed substantially twice as fast as the rate of movement of the feed piston. These and other uses and advantages of the improved rock drill feeding mechanism will be clearly apparent to those skilled in this art.

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

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

1. In a rock drill, a guide shell, a drilling tool guided thereon, pressure fluid operated mechanism for feeding the tool relative to said shell including relatively reciprocable pressure fluid actuated feeding elements having relative rectilinear movement, and speed multiplying connections between said feeding elements and the tool for feeding the latter at a speed faster than the rate of relative reciprocation between said feeding elements including means for effecting rotation of one of said reciprocable feeding elements upon reciprocation thereof, and means for transforming the rotary motion of said feeding element to a feeding motion and for transmitting said feeding motion to the tool.

2. In a rock drill, a guide shell, a drilling tool guided thereon, pressure fluid operated mechanism for feeding the tool relative to said shell including relatively reciprocable cylinder and piston elements, and speed multiplying connections between said cylinder and piston elements and the tool for feeding the latter at a speed faster than the rate of relative reciprocation between said cylinder and piston elements including means for effecting rotation of one of said cylinder and piston elements upon reciprocation thereof, and means for transforming the rotary motion of said rotatable element to a feeding motion and for transmitting said feeding motion to the tool.

3. In a rock drill, the combination with a drilling tool, of feeding means for the drilling tool including relatively reciprocable cylinder and piston elements and actuated by pressure fluid, and connections between one of said feeding elements and the tool for feeding the tool at a speed substantially twice the rate of relative reciprocation between said feeding elements and including mechanically interlocking feeding elements having relative movement to effect feed, one of said interlocking elements telescoping within said relatively reciprocable feeding elements when the feeding means is collapsed.

4. In a rock drill, the combination with a drilling tool, of feeding means for the drilling tool including relatively reciprocable cylinder and piston elements and actuated by pressure fluid, and connections between one of said feeding elements and the tool for feeding the tool at a speed substantially twice the rate of relative reciprocation between said feeding elements and including feed screw and nut devices extensible upon relative movement between said feeding elements to effect feed and certain elements thereof arranged to telescope within said feeding elements when the feeding means is collapsed.

5. In combination with a drilling motor, a feeding means therefor including a reciprocable member rotatable on the axis of its reciprocation and associated with a stationary member, a reciprocable piston operatively connected to said member, a cylinder containing said piston, means for effecting the reciprocation of said piston and the consequential reciprocatory and rotary motion of said member, and means for transforming said rotary motion to a feeding motion and transmitting said feeding motion to said motor.

6. In combination with a drilling motor, a feeding means therefor including a reciprocable member rotatable on the axis of its reciprocation, means for effecting the reciprocatory motion of said member comprising a piston associated with said member and reciprocably mounted within a cylinder, means for transforming said reciprocatory motion to a rotatable motion, and means for converting said rotary motion to a feeding motion and transmitting said feeding motion to said motor.

7. In a rock drill, a drilling tool, pressure fluid operated feeding mechanism for said tool including relatively reciprocable feed cylinder and feed

piston elements, and speed multiplying connections between the reciprocable feeding element and the tool for feeding the latter at a rate faster than the rate of relative reciprocation between said cylinder and piston element comprising a differential screw and nut speed multiplying means operatively connected between said reciprocable feeding element and the drilling tool, said differential screw and nut means including a reciprocable screw connected to said tool and arranged in coaxial relation with said reciprocable feeding element, a rotatable nut threadedly engaging said screw, and means for effecting relative rotation between said screw and nut, said nut carried by and reciprocably movable with said reciprocable feeding element.

8. In a rock drill, a drilling tool, pressure fluid operated mechanism for feeding the tool including a stationary feed cylinder and a feed piston reciprocably mounted in said cylinder, and speed multiplying connections between the reciprocable feed piston and the drilling tool for feeding the latter at a rate faster than the rate of reciprocation of said feed piston comprising a differential screw and nut speed multiplying means operatively connected between said feed piston and the drilling tool, said differential screw and nut means including a reciprocable screw actuated axially by said feed piston and arranged coaxially with the latter, a cooperating coaxial stationary screw, nuts threadedly engaging said screws respectively, and means for effecting relative rotation between said screws and nuts.

9. In a rock drill, a drilling tool, pressure fluid operated mechanism for feeding the tool including relatively reciprocable feed cylinder and piston elements, and speed multiplying connections between the reciprocable feeding element and the tool for feeding the latter at a rate faster than the rate of relative reciprocation between said cylinder and piston elements comprising a differential screw and nut speed multiplying means operatively connected between the reciprocable feeding element and the drilling tool, said speed multiplying connections embodying means for transforming the reciprocatory motion of the reciprocable feeding element to a rotary motion, and means for transforming the rotary motion to a rectilinear feeding motion and transmitting said feeding motion to the drilling tool, said means for transforming the reciprocatory motion of the feeding element to a rotary motion including a member rotatable by one of said feeding elements upon relative reciprocation between said elements and said means for transforming the rotary motion to a feeding motion including a reciprocable screw arranged coaxially with the reciprocable feeding element.

10. In a rock drill, a tool actuator, and pressure fluid actuated means for feeding said tool actuator including relatively reciprocable feed cylinder and piston elements, and speed multiplying connections operatively connected to the reciprocable feeding element and operated by the reciprocable movement of said feeding element relative to said other feeding element for feeding the tool actuator at a speed substantially faster than the rate of reciprocable movement of said reciprocable feeding element, said speed multiplying connections comprising a differential screw and nut speed multiplying device operatively connected between the reciprocable feeding element and the tool actuator, said differential screw and nut device including a reciprocable screw actuated axially upon relative reciprocable movement between said cylinder and piston elements and arranged coaxially with the latter, a nut cooperating with said screw, and means for effecting relative rotation between said screw and nut.

11. In a rock drill, a tool actuator, and pressure fluid actuated means for feeding said tool actuator including relatively reciprocable feed cylinder and piston elements, and speed multiplying connections operatively connected to the reciprocable feeding element and operated by the reciprocable movement of said feeding element relative to said other feeding element for feeding the tool actuator at a speed substantially faster than the rate of reciprocable movement of said reciprocable feeding element, said speed multiplying connections comprising a differential screw and nut speed multiplying device operatively connected between the reciprocable feeding element and the tool actuator, said differential screw and nut device including a nut element operatively connected with one of said feeding elements and arranged coaxially therewith, a cooperating axially movable screw element connected to the tool actuator, said nut element threadedly engaging said screw element, and means for effecting relative rotation between said screw and nut elements.

12. In a rock drill, a tool actuator, and pressure fluid actuated means for feeding said tool actuator including relatively reciprocable feed cylinder and piston elements, and speed multiplying connections operatively connected to the reciprocable feeding element and operated by the reciprocable movement of said feeding element relative to said other feeding element for feeding the tool actuator at a speed substantially faster than the rate of reciprocable movement of said reciprocable feeding element, said speed multiplying connections comprising a differential screw and nut speed multiplying device operatively connected between the reciprocable feeding element and the tool actuator, said differential screw and nut device arranged wholly coaxially with said feeding elements and including a screw element extending centrally through said feed cylinder element, a nut element threadedly engaging said screw element, and means for effecting relative rotation between said screw and nut elements.

13. In a rock drilling mechanism, a guide shell providing a longitudinal guideway, a rock drill guided for movement longitudinally along said shell guideway, a feed cylinder stationary with respect to and extending longitudinally of said guide shell and containing a reciprocable feed piston actuated by pressure fluid, and speed multiplying connections between said feed piston and the rock drill for feeding the latter at a rate greater than the rate of movement of said feed piston including a screw coaxial with and fixed in a stationary position with respect to said feed cylinder, a nut fixed to said feed piston and threadedly engaging said screw, a second axially movable screw coaxial with said first screw and secured to the rock drill, and a nut fixed to said feed piston and threadedly engaging said said last mentioned screw.

14. In a rock drilling mechanism, a guide shell providing a longitudinal guideway, a rock drill guided for movement longitudinally along said shell guideway, a feed cylinder stationary with respect to and extending longitudinally of said guide shell, a feed piston reciprocable in said feed cylinder and actuated by pressure fluid, said

feed piston having a tubular piston rod, and speed multiplying connections between said feed piston and said rock drill including a tubular screw coaxial with and fixed in a stationary position with respect to said feed cylinder, said screw extending centrally within said tubular piston rod, a nut fixed to said feed piston and threadedly engaging said screw, a second axially movable screw extending centrally within said tubular screw and secured to the rock drill, and a nut fixed to said piston rod and threadedly engaging said second screw.

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