Nov. 22, 1938. L. L. RICHARDSON 2,137,900

FEEDING MECHANISM FOR ROCK DRILLS

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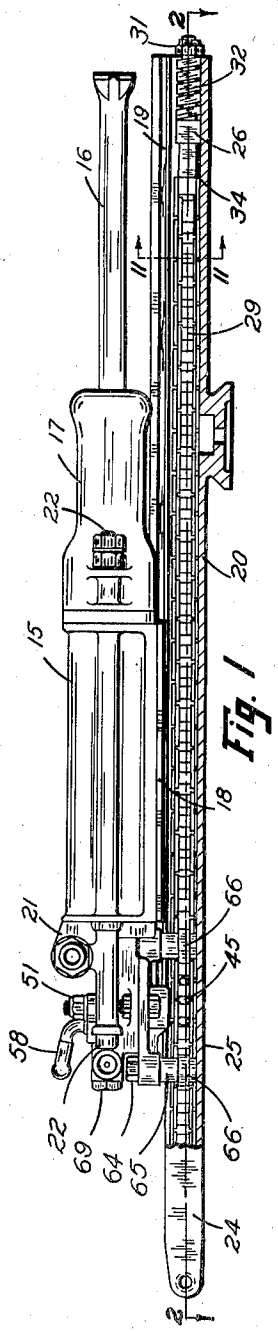


Fig. 1

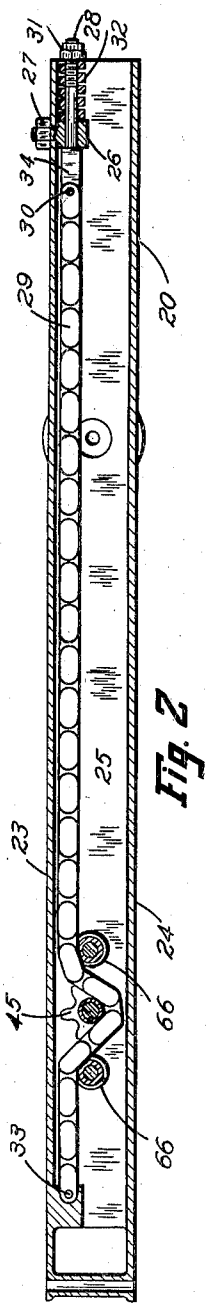


Fig. 2

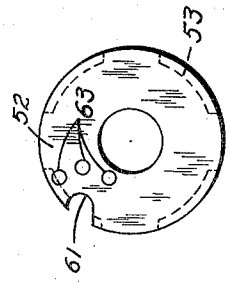


Fig. 6

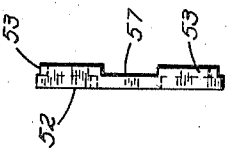


Fig. 5

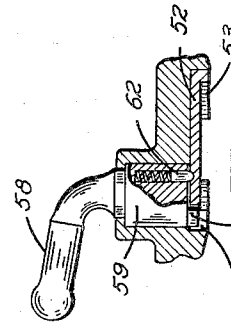


Fig. 4

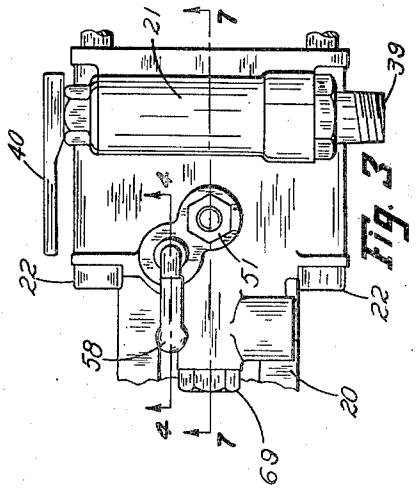


Fig. 3

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FEEDING MECHANISM FOR ROCK DRILLS

Filed July 19, 1937 2 Sheets-Sheet 2

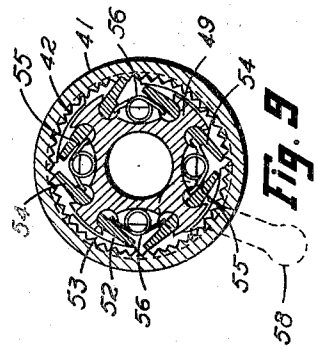


Fig. 9

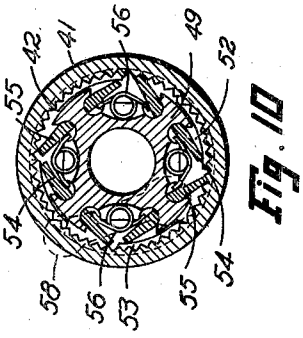


Fig. 10

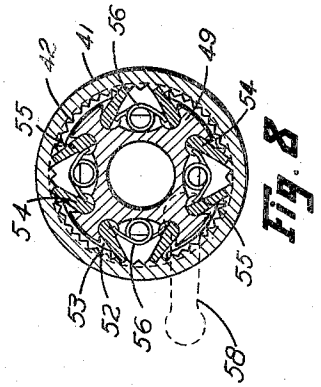


Fig. 8

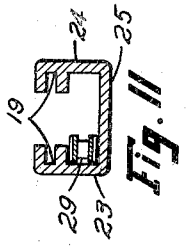


Fig. 11

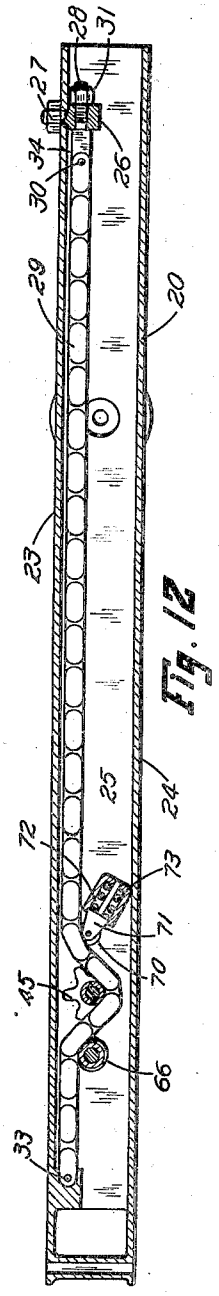


Fig. 12

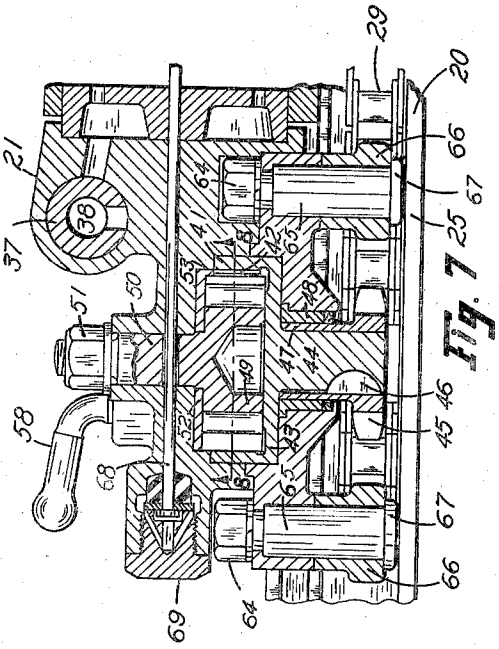


Fig. 7

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UNITED STATES PATENT OFFICE

2,137,900

FEEDING MECHANISM FOR ROCK DRILLS

Led L. Richardson, Garfield Heights, Ohio, assignor to The Cleveland Rock Drill Company, Cleveland, Ohio, a corporation of Ohio

Application July 19, 1937, Serial No. 154,409

6 Claims. (Cl. 255—45)

This invention relates broadly to rock drills, but more particularly to a feeding mechanism for rock drills of the percussive type.

One object of this invention is to utilize the force of the jars imparted to a rock drill due to the reversal of the piston strokes therein, for feeding the drill toward or away from the work.

Another object of this invention is to produce a rock drill feeding mechanism known in the art as "jump feed", with means for storing energy during the recoil of the machine, and subsequently utilizing such energy for feeding the drill in at least one direction.

Another object of this invention is to produce a rock drill feeding mechanism which is relatively inexpensive to manufacture and affording a compact assembly which is strong, durable and efficient.

Other objects and advantages more or less ancillary to the foregoing and the manner in which the various objects are attained, 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, in the claims of which they are assembled certain specific combinations of parts and specific construction indicative of the scope and spirit of the invention.

In the drawings:

Fig. 1 is a longitudinal view partly in section illustrating a rock drill having the improved feeding mechanism applied thereto.

Fig. 2 is a longitudinal sectional view taken in a plane indicated by line 2—2 in Fig. 1.

Fig. 3 is an enlarged top view of the rock drill rear end shown toward the left in Fig. 1.

Fig. 4 is an enlarged longitudinal sectional view taken in a plane indicated by line 4—4 in Fig. 3.

Fig. 5 is an enlarged side view of a movable plate shown in Fig. 4, while Fig. 6 is a top view of the plate.

Fig. 7 is an enlarged longitudinal sectional view taken in a plane indicated by line 7—7 in Fig. 3.

Figs. 8, 9 and 10 are cross sectional views taken in a plane indicated by line 8—8 in Fig. 7, showing movable parts in different positions.

Fig. 11 is a cross sectional view taken in a plane indicated by line 11—11 in Fig. 1.

Fig. 12 is a view similar to Fig. 2, illustrating a modification of the invention.

Referring to the drawings in which like symbols designate corresponding parts throughout the several views, 15 represents the usual fluid actuated percussive rock drill having a piston (not shown) reciprocable therein for delivering impacts to a drill steel 16 operatively mounted within a front housing 17. This drill is also provided with the usual guides 18 slidable within corresponding guideways 19 formed within a stationary support 20. Toward the left in Figures 1 and 2, hereinafter denoted as the rear end of the machine, there is provided a rear housing 21, which housing together with the front housing 17, is rigidly secured to the drill 15 by two side bolts 22.

The support 20 is formed of a substantially U-shaped cross section including two side walls 23 and 24, and a bottom wall 25. Toward the right in Figures 1 and 2, hereinafter denoted as the front end of the support, the side wall 23 is provided with an eye-bolt 26 located in the interior of the shell and secured thereto by a nut 27. Slidable through the eye-bolt head, there is a bolt or stem 28 having an enlarged head 34 normally engaging the eye-bolt 26 and detachably secured to one end of a chain 29 by a pin 30, while the other end of the stem is threaded to receive a nut 31. Interposed between the eye-bolt head 26 and the nut 31, there is a compression spring 32, the purpose of which will be explained later. The chain 29 extends longitudinally of the support 20, and has its other end attached to the rear end of the side wall 23 by a pin 33.

Referring now more particularly to Fig. 7, the rear housing 21 has rotatably therein a throttle valve 37 formed with a central chamber 38 into which pressure fluid may be admitted through an inlet connection 39. Secured to the throttle valve 37, there is a handle 40 through which the valve may be rotated for controlling the admission of the pressure fluid into the drilling motor 15.

Back of the throttle valve 37, the housing 21 is adequately machined to rotatably receive a ratchet ring 41 having teeth 42 formed internally thereof and provided with an integral bottom plate 43, from which depends a shaft or stem 44 protruding from the housing to receive a sprocket wheel 45 secured thereon by a key 46. The axis of rotation of the stem 44 is located in a vertical plane passing through the longitudinal center axis of the rock drill 15, thus bringing the sprocket wheel 45 in a plane perpendicular to the side walls of the support 20 on which is mounted the chain 29. The sprocket wheel 45 has a sleeve 47 extending upwardly therefrom and journaled within a harden bushing 48.

Located within the ratchet ring 41 and extend-

ing somewhat higher than the ring, there is the head 49 of a stem 50, which extends upwardly therefrom and protrudes from the housing 21 to receive a nut 51 by which the head 49 is held in position. On the head 49, there is rotatably mounted a plate or disk 52 having a partly annular bead 53 depending from the marginal edge thereof and resting on the ratchet ring 41.

The head 49 is properly machined to pivotally carry two sets of pawls 54 and 55, each set comprising four pawls grouped in pairs and each pair having a compression spring 56 mounted between the pawls and constantly acting thereon for urging the pawls in engagement with the teeth 42 of the ratchet ring 41. These pawls extend the full height of the head 49 and are supported against axial movement in one direction by the bottom plate 43 of the ratchet ring 41, and in the other direction by the plate 52. To control the engagement of the pawls with the teeth of the ratchet ring 41, the annular bead 53 of the disk 52 is formed with four cut away portions or notches 57 positionable relative to the pawls for permitting or preventing the engagement of the pawls with the teeth 42. The disk 52 may be rotated through a handle 58 extending above the housing 21 and having a cylindrical body portion 59 rotatably mounted in the housing beside the stem 50. From this body portion depends a tail 60 disposed eccentrically relative to the center axis of the body 59 and engageable with the side wall of a notch 61 provided in the disk 52 near the marginal edge thereof. For locking the disk in position, there is provided a spring pressed plunger 62 slidable within the body of the handle 58 and engageable within small depressions 63 formed on the disk.

Secured within the housing 21 by nuts 64, there are two stems 65 disposed one on each side of the sprocket wheel 45 within the same vertical plane as and parallelly to the axis of rotation of the shaft 44. Each stem protrudes below the housing to rotatably receive a roller 66 supported by an annular shoulder 67 formed on the stem.

Extending through the housing 21, there is a cleansing fluid conveying tube 68, which tube is removably secured in position by a plug 69. This tube is usually included in fluid actuated rock drill for admitting cleansing fluid through the drill steel for clearing the bottom of the drilled hole.

The chain 29 extending longitudinally of the shell 20, passes over one of the roller 66, then over the sprocket wheel 45, and again over the other roller 66 as clearly shown in Figs. 2 and 12, thereby maintaining the chain 29 in constant operative engagement with the sprocket wheel 45 and assuring the maximum possible engagement of the chain with the sprocket wheel.

In the modification of the invention shown in Fig. 12, the roller 66 located in Fig. 2 between the sprocket wheel 45 and the front end of the shell 20, has been replaced by a roller 70 rotatably carried by a fork like bracket 71 which is slidably mounted within a bore 72 formed within the rear housing 21. Interposed between the bracket 71 and the bottom of the bore 72, there is a compression spring 73 acting on the bracket to urge the roller 70 in forcible engagement with the chain 29.

In the operation of the mechanism, pressure fluid, through the throttle valve 37, is admitted into the rock drill 15 for causing the reciprocation of the piston. Due to the reversal of the piston strokes within the motor 15, forward and rearward movement or feed and recoil jars are alternatively imparted to the drilling motor 15 relative to its support or shell 20.

Referring now more particularly to the operation of the feeding mechanism, it will be understood that when it is desired to feed the drilling motor 15 toward the work, the disk 52, through the rotation of the handle 58, may be positioned as shown in Fig. 10. In this instance, the rib 53 is engaging the upper end of the four pawls 54 to maintain them out of engagement with the teeth 42, while the four pawls 55 are positioned within the notches 57 of the disk 52 and therefore are in engagement with the teeth 42. During the rearward jars or recoils imparted to the drilling motor, the rotation of the ratchet ring 41 in a clockwise direction, which would normally result due to the operative engagement of the sprocket wheel 45 with the chain 29, is prevented by the engagement of the pawls 55 with the teeth 42, thereby preventing relative movement between the chain 29 and the drilling motor, and causing the rearward jars imparted to the motor to be transmitted to the chain 29. In this instance, the compression spring 32 will be subjected to compression by the jars imparted to the chain, thereby building up and storing energy in the spring 32. During the forward jars imparted to the drilling motor, the ratchet ring 41, due to the operative engagement of the sprocket wheel 45 with the chain 29, will rotate in a counterclockwise direction in Fig. 10, while the pawls 55 simply ride the teeth 42 without interference, causing thereby the forward movement of the drilling motor relative to its support. In this instance, the energy previously stored within the spring 32 due to the compression of the spring by the backward jars transmitted to the chain, is released to carry the chain forwardly until the bolt head 34 again reengages the eye bolt 26. This forward movement of the chain will tend to rotate the sprocket wheel 45 in a counterclockwise direction in Fig. 2 and the ratchet ring 41 in a clockwise direction in Fig. 9, which rotation is prevented by the pawls 55. Since the sprocket wheel 45 is prevented to rotate in the direction resulting from the forward movement of the chain, this movement is transmitted to the drilling motor until the forward movement of the chain is checked by the reengagement of the bolt head 34 with the eye bolt 26. Thereafter, the drilling motor 15 previously carried forwardly with the chain 29 will move, by its own momentum, ahead of or relative to the chain, thereby imparting to the motor 15 a feeding power additional to that normally resulting from its forward jars. From the foregoing, it will be understood that the additional forward feeding power imparted to the drilling motor is actually resulting from the recoils or rearward jars to which the drilling motor is subjected during normal operation.

This additional feeding power may be regulated at will by subjecting the spring 32 to a more or less complete initial compression through the adjusting nut 31. The maximum additional feeding power may be obtained when the release of the energy stored within the spring and the forward movement of the drilling motor by its own momentum can be completed before the piston reciprocable within the drilling motor terminates its rearward stroke. Should this dissipation of energy as well as the consequential forward movement of the drilling require more time than that used by the piston for its rearward stroke, it will be understood that the rearward jars imparted to the drilling motor when the piston reaches its

rearward stroke would partly or completely overcome the additional feeding power above mentioned. Consequently, when maximum additional feeding power is required, it is necessary that the initial compression of the spring **32** be comparatively great, allowing thereby the complete dissipation of the stored energy before the piston reaches the end of its rearward stroke, or in other words, keeping the action of the feeding mechanism in time relation with the reciprocation of the piston. When it is desired to reduce the feeding power of the mechanism, the initial compression of the spring **32** may be reduced by unscrewing the nut **31**, requiring thereby more time for the dissipation of the energy absorbed by the spring and causing the forward feeding movement of the drilling motor by its momentum, to be partly overcome by the rearward stroke of the working piston.

In the modification shown in Fig. 12, the compression spring instead of being mounted at the front end of the chain, is mounted behind the bracket carrying roller **71**. In this instance, during the rearward jars imparted to the drilling motor, the chain **29** is allowed to stretch by compressing the spring **73**. The energy thus stored in the spring will, during the forward jars of the drilling motor, be released to act on the chain and cause a forward feeding movement of the drilling motor additional to that resulting from the forward jars imparted to the drilling motor.

When it is desired to feed the drilling motor away from the work, the disk **52** through the handle **58**, may be positioned as shown in Fig. 9. In this instance, the pawls **55** are moved out of engagement with the teeth **42**, while the pawls **54**, now located within the notches **57**, are capable of engagement with the teeth of the ratchet ring **41**, permitting thereby a step by step rearward feeding motion of the drilling motor.

With the disk **52** positioned as shown in Fig. 8, the pawls **54** and **56** are located within the notches **57**, that is in engagement with the teeth **42** of the ratchet ring **41**, thereby preventing any movement of the drilling motor **15** relative to the support **20**.

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 intended to be restrictive or confining and it is to be further understood that various rearrangements of parts and modifications 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 drilling apparatus, the combination with a support, of a motor slidable on the support having forward and rearward jars imparted thereto, of a feeding mechanism for said motor including a sprocket wheel carried by the motor and a chain carried by the support, said chain passing partly around said sprocket wheel in operative engagement therewith, stop means associated with said sprocket wheel to prevent relative movement between said motor and chain during the rearward jars of the motor and capable of release during the forward jars of the motor to allow its forward feeding motion resulting from said forward jars, and means associated with said chain having energy stored therein during the rearward jars of the motor, said energy being automatically released during the forward jars of the motor for imparting feeding motion thereto additional to that normally resulting from its forward jars.

2. In a drilling apparatus, the combination with a support, of a motor slidable on the support having feed and recoil jars alternatively imparted thereto, of a feeding mechanism for said motor whereby said feed jars effect a step by step feeding motion of the motor, said mechanism including a sprocket wheel and a chain in operative engagement one carried by the motor the other one by the support, stop means associated with said sprocket wheel to prevent relative movement between said motor and chain during the recoil jars of the motor and capable of release during its feed jars, and means associated with said chain having energy stored therein due to the recoil jars of the motor, said energy being automatically released during the feed jars of the motor for imparting feeding motion to the latter additional to that normally resulting from its feed jars.

3. In a drilling apparatus, the combination with a support, of a motor slidable on the support having feed jars and recoil jars alternatively imparted thereto, of a feeding mechanism for said motor whereby said feed jars effect a step by step feeding motion of the motor, said mechanism including a wheel carried by the motor and a flexible element carried by the support in operative engagement with said wheel, traction means on said wheel and element preventing slippage therebetween, means for automatically locking said wheel to said flexible element during the recoil jars of the motor and capable of release during its feed jars, and resilient means associated with said element having energy stored therein due to the recoil jars of the motor, said energy being automatically released during the feed jars of the motor for imparting feeding motion to the latter additional to that normally resulting from its feed jars.

4. In a drilling apparatus, the combination with a support, of a motor slidable on the support having feed and recoil jars alternatively imparted thereto, of a feeding mechanism for said motor whereby said feed jars effect a step by step feeding motion of the motor, said mechanism including a chain extending longitulinally of the support and carried thereby, means carried by the motor automatically operable for locking the motor to said chain during the recoil jars of the motor and capable of release during the feed jars of the motor, and means operatively associated with said chain having energy stored therein during the recoil jars of the motor, said energy being automatically released during the feed jars of the motor for imparting feeding motion to the latter additional to that normally resulting from its feed jars.

5. In a drilling apparatus, the combination with a support, of a motor slidable on the support having feed jars and recoil jars alternatively imparted thereto, of a feeding mechanism for said motor whereby said feed jars effect a step by step feeding motion of the motor, said mechanism including a chain extending longitudinally of the support and carried thereby, means carried by the motor automatically operable for transmitting the recoil jars of the motor to said element, and means associated with said chain having energy stored therein due to the recoil jars of said chain, said energy being automatically released during the feed jars of the motor for imparting feeding motion to the lat-

ter additional to that normally resulting from its feed jars.

6. In a drilling apparatus, the combination with a support, of a motor slidable on the support having feed and recoil jars alternatively imparted thereto, of a feeding mechanism for said motor whereby said feed jars effect a step by step feding motion of the motor, said mechanism including a sprocket wheel carried by the motor and a chain carried by the support in operative engagement with the sprocket wheel, a connection between one end of said chain and the support including a spring, means automatically operable for transmitting the recoil jars of the motor to said chain including said sprocket wheel, said spring being compressible due to the recoil jars transmitted to said chain and capable of expansion during the feed jars of the motor for imparting feeding power to the motor additional to that normally resulting from its feed jars.

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