April 1, 1941. F. M. SLATER 2,236,700

FEEDING DEVICE

Filed Nov. 23, 1940

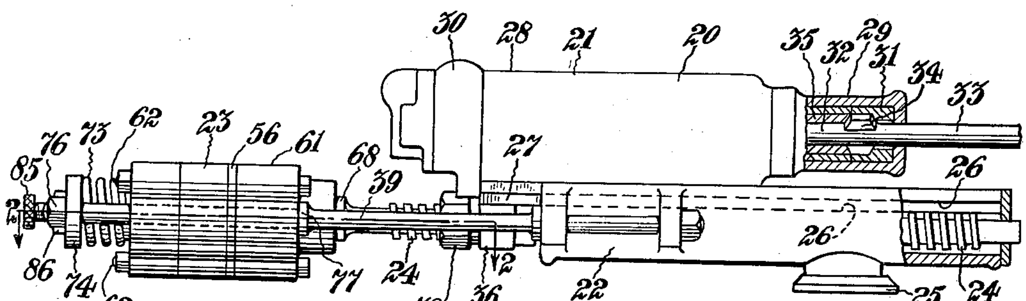

FIG.-1.

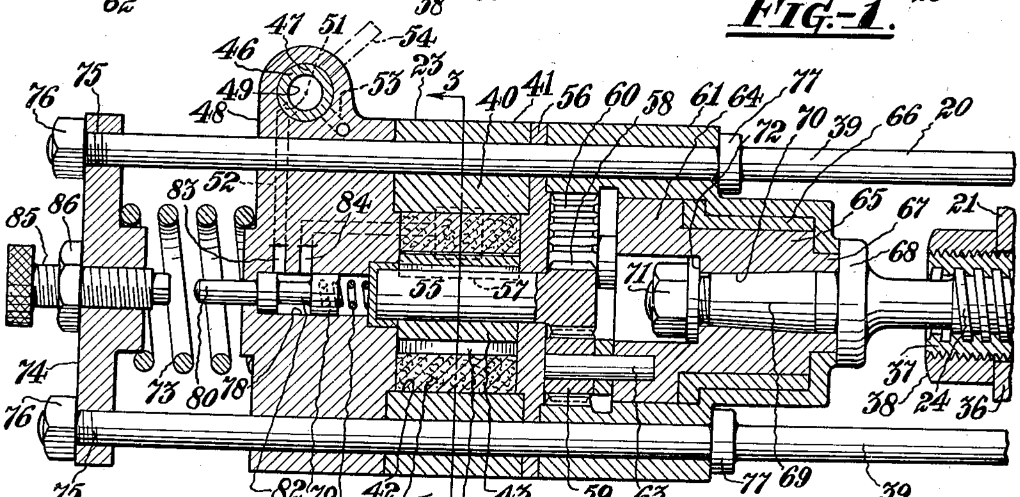

FIG.-2.

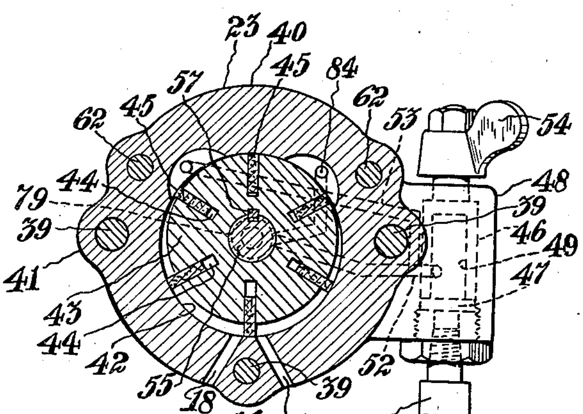

FIG.-3.

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FEEDING DEVICE

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7 Claims. (Cl. 121—9)

This invention relates to rock drilling mechanism, and more particularly to a pressure fluid actuated feeding device for advancing a rock drill toward and retracting it from the work.

One object of the invention is to apply a feeding force to the rock drill best suited for efficient drilling in the particular type of rock being drilled.

Another object is to avoid undue wear on the rotative parts of the rock drill.

Another object is to automatically cut-off the power to the feeding device whenever the pressure against the rotative parts of the rock drill becomes excessive, and

Still another object is to cause the pressure fluid actuated feeding device to automatically resume operation after the pressure on the rotative parts of the rock drill has been relieved.

Other objects will be in part obvious and in part pointed out hereinafter.

In the drawing accompanying this specification and in which similar reference numerals refer to similar parts,

Figure 1 is a longitudinal side view, partly broken away, of a rock drill, its guide member and a feeding device for actuating the rock drill along the guide member,

Figure 2 is a plan view, partly in section, taken through Figure 1 on the line 2—2, and

Figure 3 is a transverse view taken through Figure 2 on the line 3—3.

Referring more particularly to the drawing and at first to Figure 1, the drilling mechanism, designated in its entirety by **20**, comprises a rock drill **21** mounted upon a guide member in the form of a shell **22**, and at the rear end of the shell is a feeding motor **23** for actuating the rock drill **21** longitudinally of the shell through the instrumentality of a feed screw **24**.

The shell **22** may be of a well known type having a cone **25** for cooperation with a suitable clamping device (not shown) whereby the drilling mechanism may be secured to a stationary mounting. In the opposed inner surfaces of the shell are longitudinally extending grooves **26** to receive, slidably, ribs **27** extending along the opposite sides of the rock drill **21**.

The rock drill **21** likewise may be of a conventional type comprising a cylinder **28** and front and back heads **29** and **30**, respectively, which may be secured to the cylinder in any suitable manner. The cylinder and the heads **29** and **30** constitute the casing parts of the rock drill, and within the front head **29** is a chuck **31** to receive the shank end **32** of a drill steel **33** having lugs **34** to slidably interlock with the chuck.

The chuck **31** is of the rotatable type to which rotary movement may be transmitted by suitable mechanism (not shown) incorporated in the rock drill in a well known manner, and in the chuck **31** is a chuck bushing **35**, the front end of which acts as an abutment for the lugs **34** to limit the distance which the working implement may extend into the rock drill.

At the rearward end of the cylinder **28** is a lug **36** extending into the shell **22** and containing a feed nut **37** that is in threaded engagement with the feed screw **24** and locked securely in position by a nut **38** seating against the end of the lug **36**.

The motor **23** which is attached to the rear end of the shell **22** by standards **39** is of the fluid actuated rotary vane type. It comprises a cylinder **40** having lugs **41** to receive the standards **39** and is bored to provide a chamber **42** for the accommodation of a piston or rotor **43**. The rotor **43** is disposed eccentrically within the chamber **42** and has a plurality of radial slots **44** containing vanes **45** against which pressure fluid acts for rotating the rotor.

The motor **23** is of the reversible type and the direction of rotation thereof is controlled by a valve **46** rotatable in a chamber **47** in a plate **48** disposed upon the standards **39** and forming a closure for the rearward end of the chamber **42**. The valve **46** has a bore **49** which is in constant communication with a source of pressure fluid supply through a conduit **50**, attached to the plate **48**, and in the wall of the valve is a port **51** that opens into the bore **49** and is adapted to register with passages **52** and **53** leading from the valve chamber **47** to opposite sides of the point of minimum clearance between the wall of the chamber **42** and the periphery of the rotor **43**.

The chamber **42** is also provided with free exhaust ports **18** and **19** arranged on the opposite sides of the plane of maximum clearance between the wall of the chamber **42** and the periphery of the rotor **43**. A lever **54** is attached to the valve **46** for rotating it to admit pressure fluid selectively into the passage **52** or the passage **53** for rotating the rotor in one direction or the other.

The rotor **43** is mounted upon a shaft **55** journaled in the plate **48** and a plate **56** at the front end of the chamer **42** and is secured to the rotor by a key **57**. The shaft **55** extends forwardly of the plate **56** and carries a sun pinion **58** that meshes with planet pinions **59** meshing with an internal gear, or, as illustrated, with teeth **60** on the inner surface of a casing **61** seating against the plate 56. The casing 61 and the plate 56 are also arranged upon the standards 39 and, with the cylinder 41 and the plate 48, constitute the casing of the motor assembly and are clamped securely together by bolts 62 extending lengthwise of the motor.

The planet pinions are mounted upon spindles 63 seated in a carrier 64 rotatable in the casing 61. The carrier 64 has a skirt 65 at its front end journaled in a bushing 66 in the casing 61, and on the front end of the skirt is a reduced extension 67 that projects through the front end of the casing 61 and abuts a collar 68 on the feed screw 24.

In the structure shown the feed screw is provided with a tapered shank 69 that extends into a tapered bore 70 in the skirt 65 and is drawn into firm frictional engagement with the carrier by a nut 71 threaded on the shank 69 and seating against a shoulder 72 in the carrier.

In order to avoid the forcing of the chuck parts of the rock drill heavily against the lugs 34 of the working implement by the motor 23 when drilling rock of such hardness that the working implement may penetrate it only slowly, the motor 23 is capable of sliding rearwardly along the standards 39 to relieve the pressure upon the chuck parts. To the end that such retrograde movement of the motor may be yieldingly resisted the rearward end of the plate 47 is seated against a spring 73 of which the opposite end seats against a crosshead 74 disposed upon the rearward ends 75 of the standards 39. The ends 75 of the standards are threaded to receive nuts 76 that retain the cross head 74 on the standards. The nuts 76 may also serve to move the crosshead along the standards 39 for regulating the force of the spring 73 which is placed initially under compression to hold the motor 23 in a forwardly position and normally seated against collars 77 on intermediate portions of the standards 39.

Thus, as will be readily appreciated, the motor 23 may normally apply its full torque to the rock drill for feeding it towards the work in accordance with the progress of the working implement 33. The motor will be held firmly against the collar 77 of the standards by the spring 73 but when the working implement penetrates the work slowly, as when drilling hard rock, the rotative force of the motor will cause the motor to be moved gradually rearwardly along the standards and against the pressure of the spring 73, it being understood of course that the feed screw 24 is also capable of endwise movement relatively to the shell 22.

In order to avoid a condition in which the spring 73 may become compressed to a degree approaching rigidity and again create a condition under which the full torque of the motor 23 is applied to the rock drill, it is contemplated to cut-off the power supply to the motor automatically whenever the spring 73 has been compressed to a degree in which its force alone is sufficient to advance the rock drill 21 at a rate suitable for maintaining the percussive element of the rock drill in the correct striking relationship with the working implement. To this end the plate 48 is provided with a valve chamber 78 for the accommodation of a reciprocatory valve 79 having a stem 80 that projects from the rear end of the plate 48.

The valve 79 is normally pressed against the rearward end of the valve chamber 78 by a spring 81 arranged in the valve chamber 78, forwardly of the valve, and in the intermediate portion of the valve is an annular groove 82 to effect communication between the branches 83 and 84 of the passage 52. In the normal position of the valve 79 the branches 83 and 84 of the passage 52 are in communication with each other through the annular groove 82 to admit pressure fluid to the chamber 42 for imparting feeding movement to the rotor 43.

If desired, the valve 79 may be actuated manually to cover the branch 83 of the passage 52 for cutting off the supply of pressure fluid to the motor, as by applying pressure to the stem 80. Preferably, however, an abutment is provided for the stem 80, as for example by threading a screw 85 into the crosshead 74 and locking said screw fixedly to the crosshead by a lock nut 86. Being threaded to the crosshead, the screw 85 may be readily adjusted to any desired position to cause the valve to assume a position in which it overlies the branch passage 83, either early or late in the rearward movement of the motor 23 along the standards 39.

The operation of the device, briefly summarized, is as follows: Normally, when drilling rock of a nature that offers no more than the usual resistance to the penetration of the working implement thereinto the full force of the motor is applied to the rock drill for advancing it toward the work. The motor is then held in a forwardly position against the collar 77 by the spring 73 and the valve 79 will occupy a position in which the branches of the passage 52 are in full communication with each other through the groove 82 to supply pressure fluid to the chamber 42 for driving the rotor.

In the event, however, that hard rock is encountered by the working implement and in which case penetration necessarily takes place slowly the motor 23 will be forced gradually rearwardly along the standards 39 and will further compress the spring 73. If the abnormality in the rock is of only slight extent it may be reduced by the working implement before the motor 23 has reached a position in which the position of the valve 79 will be disturbed. But if resistance to the forward movement of the rock drill continues the motor will move rearwardly along the standards and when the stem 80 abuts the screw 85 further movement of the motor in a rearwardly direction will cause the branch 83 to move out of communication with the groove 82 and in this way the supply of pressure fluid to the motor will be cut-off.

Thereafter, only the spring 73 will act to drive the motor and the rock drill forwardly to maintain the rock drill in the correct relationship with the drill steel. After the rock drill and the motor have advanced toward the work a sufficient distance to again move the stem 80 out of contact with the screw 85 the passage 52 will be uncovered by the valve 79 and the motor will again resume operation to exert feeding pressure on the rock drill.

The described retrograde movement of the motor on the standards and the cutting off of pressure fluid to the motor by the valve 79 may occur repeatedly throughout the drilling operation but it will be readily understood that the rotative parts of the rock drill and of the motor will be subjected at all times only to such pressure as may be exerted by the spring 73. Inasmuch as this pressure may be conveniently controlled the rotative parts will always be protected against undue wear, such as is caused in devices in which the feeding pressure is of a value that tends to tilt the rotative parts into binding engagement with the elements serving as bearings therefor.

It will, moreover, be apparent that the device above described is particularly suited for pressures of different values. For example, if a pressure of comparatively low value is used for driving the motor no excessive feeding force may, in any event, be applied to the rock drill. On the other hand, if a considerably greater pressure value is employed for driving the motor the force against the rotative parts of the rock drill and the motor will be adequately relieved. In either case the feeding pressure will not exceed that exerted by the spring **73**.

I claim:

1. In a feeding device, the combination of a support and a rock drill slidable thereon, a pressure fluid actuated feeding motor for the rock drill slidable on the support, and cushioning means to yieldingly resist sliding movement of the motor relatively to the support.

2. In a feeding device, the combination of a support and a rock drill slidable thereon, a pressure fluid actuated feeding motor for the rock drill slidable on the support, and a spring interposed between the motor and the support to yieldingly resist sliding movement of the motor with respect to the support.

3. In a feeding device, the combination of a support and a rock drill slidable thereon, a pressure fluid actuated feeding motor for the rock drill slidable on the support, a spring to yieldingly resist sliding movement of the motor with respect to the support, and adjustable means for varying the resistance of the spring.

4. In a feeding device, the combination of a support and a rock drill slidable thereon, a pressure fluid actuated feeding motor for the rock drill slidable on the support, cushioning means to yieldingly resist sliding movement of the motor with respect to the support, a valve for controlling the admission of pressure fluid to the motor, and means for effecting the automatic shifting of the valve from one controlling position to another during movement of the motor relatively to the support.

5. In a feeding device, the combination of a support and a rock drill slidable thereon, a pressure fluid actuated feeding motor slidable on the support, cushioning means to yieldingly resist sliding movement of the motor with respect to the support, a valve for controlling the admission of pressure fluid to the motor, and an adjustable abutment for effecting the automatic shifting of the valve from one controlling position to another during movement of the motor relatively to the support.

6. In a feeding device, the combination of a support and a rock drill slidable thereon, a pressure fluid actuated motor for the rock drill slidable on the support, a spring to yieldingly resist sliding movement of the motor relatively to the support, a seat on the support for the spring and being adjustable to vary the force of the spring, a valve to control the flow of pressure fluid to the motor and being normally in a position to admit pressure fluid to the motor, and an adjustable abutment in the seat to effect the shifting of the valve to a position for cutting off the admission of pressure fluid to the motor during the movement of the motor in one direction along the support.

7. In a feeding device, the combination of a support and a rock drill slidable thereon, a pressure fluid actuated motor for the rock drill slidable on the support, means for yieldingly resisting movement of the motor relatively to the support, and means for automatically cutting off the supply of pressure fluid to the motor during movement of the motor with respect to the support.

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