Jan. 27, 1942. W. NOBLE 2,271,025

ROCK DRILL FEEDING MECHANISM

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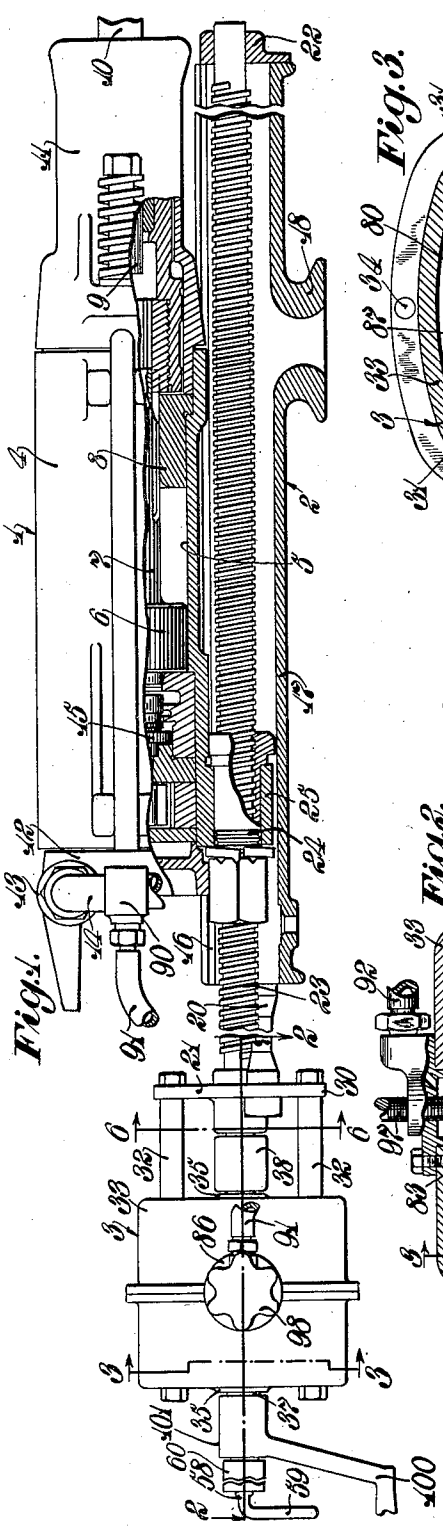


Fig. 1.

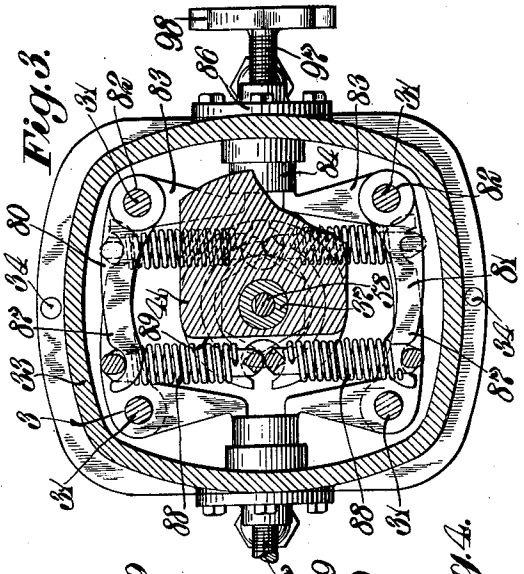


Fig. 3.

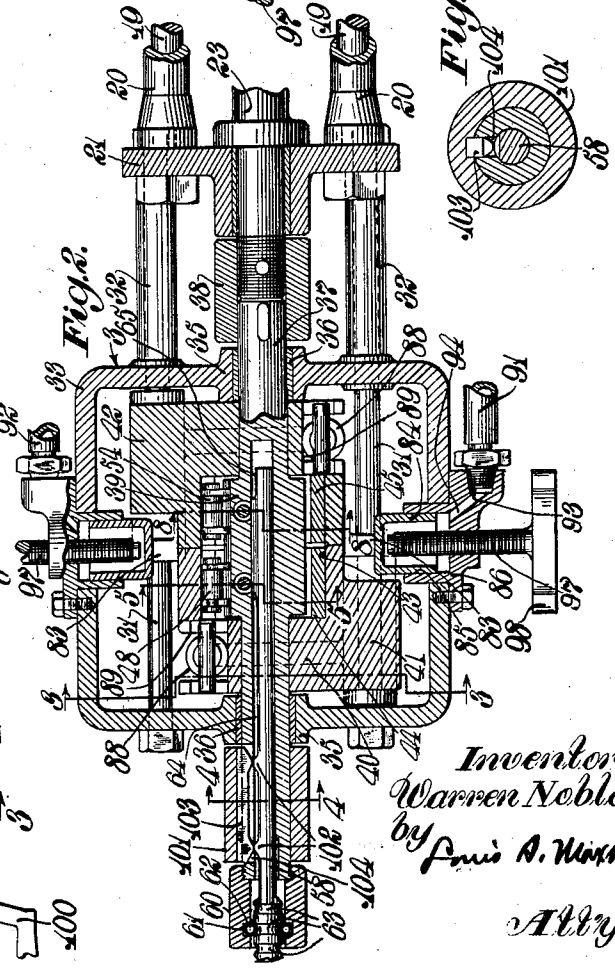


Fig. 2.

Fig. 4.

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ROCK DRILL FEEDING MECHANISM

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Fig. 5.

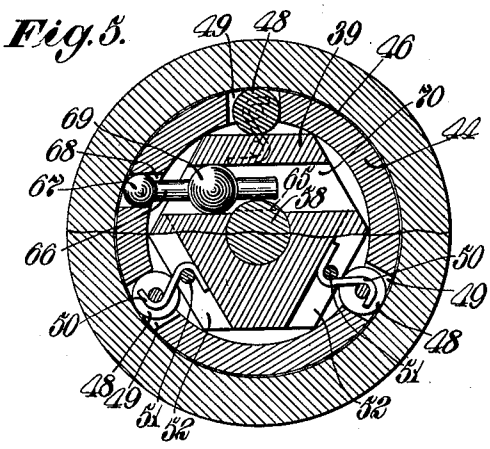


Fig. 6.

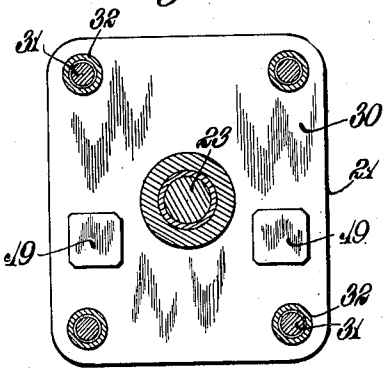


Fig. 7.

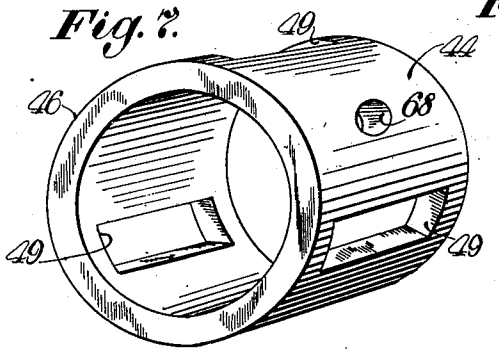


Fig. 8.

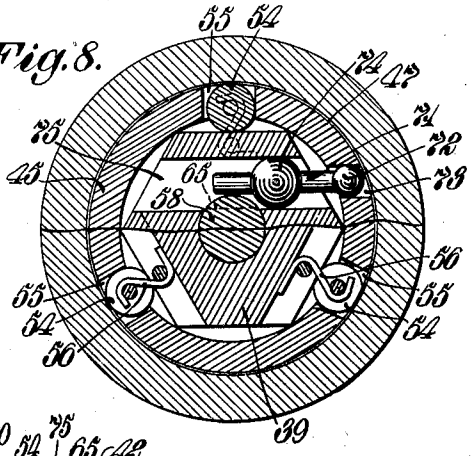


Fig. 9.

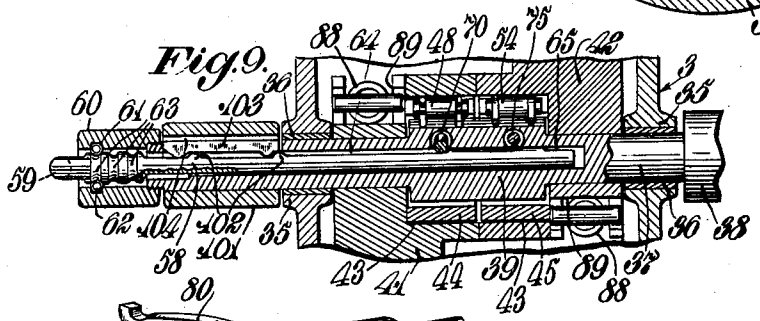
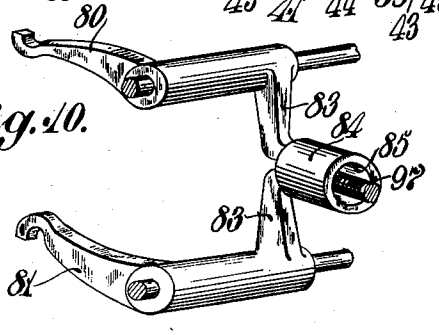


Fig. 10.



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UNITED STATES PATENT OFFICE

2,271,025

ROCK DRILL FEEDING MECHANISM

Warren Noble, Michigan City, Ind., assignor to Sullivan Machinery Company, a corporation of Massachusetts

Application April 27, 1935, Serial No. 18,633

32 Claims. (Cl. 255—45)

This invention relates to feeding mechanisms, and more particularly has reference to improvements in self-feeding mechanisms for hammer rock drills of the mounted drifter type.

An object of this invention is to provide an improved self-feeding mechanism for a rock drill. Another object is to provide an improved automatic feeding mechanism for a hammer rock drill of the mounted drifter type whereby the drill is fed automatically in accordance with a vibratory action set up within the drill by the drill hammer motor during the drilling operation. A further object is to provide an improved automatic feeding means for a hammer rock drill of the mounted drifter type wherein the feeding means is controlled automatically by a vibratory action transmitted to the drill mounting by the drill hammer motor, the reciprocatory movement of the hammer piston causing, due to the effect of the piston recoil caused by sudden change in direction of the piston at the ends of its strokes, a slight vertical vibratory effect which is transmitted in increasing intensity to the drill mounting, the automatic feeding means including inertia controlled means mounted on an extremity of the drill mounting and operated by said vertical vibratory effect. Still another object is to provide an improved automatic drill feed embodying inertia controlled feeding means operated by the vibratory effect of the drill. A still further object is to provide an improved inertia controlled automatic drill feed for a hammer rock drill of the mounted drifter type and having associated therewith manual feeding means whereby the drill may be manually fed independently of any automatic action. These and other objects and advantages of the invention will, however, hereinafter more fully appear.

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

In these drawings—

Fig. 1 is a side elevational view, with parts shown in longitudinal section to illustrate structural details, of a hammer rock drill of the mounted drifter type with which the illustrative form of the improved feeding means is associated.

Fig. 2 is an enlarged horizontal sectional view taken substantially on line 2—2 of Fig. 1.

Fig. 3 is a cross sectional view taken substantially on line 3—3 of Figs. 1 and 2.

Fig. 4 is an enlarged detail sectional view taken on line 4—4 of Fig. 2.

Fig. 5 is an enlarged sectional view taken substantially on the planes of line 5—5 of Fig. 2.

Fig. 6 is an enlarged cross sectional view taken on line 6—6 of Fig. 1.

Fig. 7 is a perspective view of one of the sleeves of the intermittent gripping means.

Fig. 8 is an enlarged sectional view taken substantially on the planes of line 8—8 of Fig. 2.

Fig. 9 is a fragmentary sectional view taken on the plane of Fig. 2 showing the control parts in a different position.

Fig. 10 is a perspective view showing a portion of the inertia weight damping means.

In this illustrative embodiment of the invention there is shown a hammer rock drill of the mounted drifter type comprising a hammer motor generally designated 1 slidably guided on mounting means generally designated 2 and with which the improved feeding means generally designated 3 is associated. The hammer motor 1 is of a standard commercial design and comprises a cylinder 4 having a bore 5 containing a reciprocatory hammer piston 6. The hammer piston has a forwardly projecting striking bar 7, guided in a bore in a front motor head 8, for delivering impact blows to the shank 9 of a usual rock drill steel 10 suitably supported within the forward end of the hammer motor chuck housing 11. Arranged in the back head 12 of the hammer motor is a usual throttle valve mechanism 13 for controlling the flow of pressure fluid from a supply connection 14 through suitable ports and passages controlled by a usual automatic valve mechanism 15, to the motor cylinder to effect reciprocatory motion of the hammer piston 6. As is usual in rock drills of the type disclosed, the cylinder 4 of the hammer motor has usual longitudinal guides slidably mounted in longitudinal guideways 16 formed on the drill mounting 2, which is herein shown as a standard commercial form of guide shell 17 provided with a usual supporting trunnion 18 adapted to be clamped in a suitable saddle of a column or tripod mounting. The feeding means 3 embodies automatic means adapted automatically to effect feed of the drill along the shell guideways in either of opposite directions under the control of a vibratory action set up within the drill by the hammer motor during the drilling operation, the hammer piston 6 as it reciprocates within its cylinder transmitting a vertical "teetering" effect to the hammer motor which is transmitted with increasing intensity to the rearward portion of the guide shell 17, this vertical "teetering" action being caused, as

above mentioned, by the piston recoil due to the sudden change in direction of the hammer piston during its reciprocation.

As is usual in rock drills of the mounted drifter type, secured to the rear end of the guide shell by parallel side rods 19, 19 and spacing sleeves 20, 20 is a transverse yoke 21, while secured by these same side rods 19 to the forward end of the guide shell is a second transverse yoke 22, and journaled at its ends within these yokes 21 and 22 is a standard form of feed screw 23 threadedly engaged by a nut 24 non-rotatably secured in a usual manner within a depending boss 25 integral with the bottom of the motor cylinder 4 as clearly shown in Fig. 1. The feed screw and nut and the mounting means therefor are, except for modifications in shape of yoke 21 as later described, of a design standard in mounted drifter type rock drills of the manually fed, screw and nut type.

In addition to the manual feeding means, the feeding means 3 embodies automatic means controlled by the vibratory action of the hammer motor, as above described, for rotating the feed screw automatically in either of opposite directions for effecting feeding of the hammer motor along the shell guideways in the direction desired.

Now referring to the improved automatic feeding means, it will be noted that, in this instance, the yoke 21 is in the form of a vertical rectangular plate 30 preferably secured by the side bolts 19, 19 to the rear end of the guide shell, and this rectangular plate in turn has secured thereto by bolts 31 and spacing sleeves 32, at the rear side thereof, a casing 33 in which the improved automatic means is housed. This casing is preferably composed of two parts held in a predetermined relation by dowel pins 34 and secured together by the bolts 31. This casing has formed thereon at its opposite ends alined boss portions 35, 35 supporting bearing sleeves 36 in which is journaled a longitudinal feed drive shaft 37 herein keyed at its forward end to a coupling 38 rigidly secured to the rear end of the feed screw 23 so that when the feed drive shaft 37 rotates the feed screw rotates therewith. Integral with or otherwise secured to the feed drive shaft 37 substantially midway between the ends of the latter is an enlarged polygonal portion 39, herein preferably hexagonal in cross section, as shown in Figs. 5 and 8, while swingably mounted on the feed drive shaft 37 and having arm portions 40 straddling the enlarged hexagonal portions 39 of the shaft is a pair of oscillatory inertia weights 41 and 42. These weights are arranged in opposite relation to the shaft and have enlarged bores 43 in which are respectively mounted, in end to end relation, coaxial sleeves 44 and 45. Interposed between the inertia weights 41 and 42 respectively and the shaft 37 are reversible intermittent gripping devices 46 and 47, one operated by one weight for effecting feed in one direction and the other operated by the other weight for effecting feed in the reverse direction. The intermittent gripping device 46 operated by the weight 41 constitutes the reverse feed gripping device and comprises, as shown in Fig. 5, three gripping rollers 48 arranged in slots 49 cut through the rear sleeve, 44, and engaging flats on the hexagonal portion 39 of the feed drive shaft 37. Bent wire springs 50 secured by pins 51 within slots 52 formed on the shaft portion 39 engage the reduced ends of the rollers for urging the latter towards their foremost wedging or griping position. These rollers engage the walls of the weight bores 43, the flats of the hexagonal portion of the shaft constituting wedge surfaces whereby the rollers are brought into gripping engagement with walls of the weight bores as the weights 41 oscillate about their pivots, the rollers gripping upon weight-swing in one direction and releasing automatically upon weight-swing in the opposite direction so that the feed drive shaft 37 may be turned intermittently in one direction. The forward feed intermittent gripping device 47 operated by the weight 42, as shown in Fig. 8, comprises gripping rollers 54, which are arranged in slots 55 cut through the sleeve 45, and are provided with bent wire springs 56 similar to the springs 50 and similarly connected to the shaft but acting in the opposite direction so that the rollers are urged in the opposite direction into wedging contact with the walls of the respective weight bores 43, and upon oscillation of the weight 42 these rollers effect intermittent rotation of the feed drive shaft 37 in the forward direction.

The means for selectively throwing the intermittent gripping devices into operation consists of a pull rod 58 arranged axially within the shaft 37, which is made hollow to receive the rod; and the rod projects rearwardly through the outer end of this shaft and has formed thereon an operating handle 59. Secured to the outer end of the shaft 37 is a collar 60 having arranged in a recess 61 therein a locking spring 62 engageable with annular recesses 63 on the rod for holding the latter in its several positions. This rod is cut away or recessed at 64 and 65 at its upper side. As shown in Fig. 5, a lever 66 has a spherical head 67 fitted in an opening 68 formed in the sleeve 44 and a spherical fulcrum portion 69 fitted in a transverse bore 70 formed in the enlarged portion 39 of the shaft. As shown in Fig. 8, a lever 71, similar to the lever 66 but oppositely disposed, has a spherical head 72 fitted in a bore 73 in the sleeve 45 and a spherical fulcrum portion 74 fitted in a transverse bore 75 parallel with the bore 70 and likewise formed in the enlarged portion 39 on the shaft. If necessary or desired, the spherical heads 67 and 72 may be held in their respective bores by pins extending longitudinally through the sleeves 44 and 45. As shown in Figs. 5 and 8, the control rod 58 is in its neutral position with the shaft engaging the inner extremities of the levers 66 and 71 holding the wedge sleeves 44 and 45 in their released position. When the rod 58 is slid inwardly the inner extremity of the lever 66 can move inwardly within the recess 64 on the rod, allowing the gripping roller springs 50 to rotate slightly the sleeve 44, thereby bringing the gripping rollers into wedging engagement with the walls of the weight bore 43. When the rod 58 is pulled outwardly from the position shown in Fig. 2, the inner extremity of the lever 66 is held out by the rod, while the inner extremity of the lever 71 can move inwardly within the recess 65, thereby permitting the springs 56 to rotate slightly the sleeve 45 to bring the gripping rollers into wedging engagement with the weight bore. When the rod 58 is in its neutral position shown in Fig. 2, the rod periphery maintains the inner extremities of both the levers 66 and 71 in a position to hold the gripping rollers released from gripping engagement with the weight bore.

It will now be seen that when the gripping

roller device 46 is connected and the gripping roller device 47 released and the drill is operating, the inertia weight 41 oscillates to effect rotation of the feed drive shaft 37, rotating therewith the feed screw in a direction to effect reverse feed of the drill. When the gripping roller device 46 is released and the gripping roller device 47 is connected, forward feed is, of course, effected by the weight 42.

Means are provided for damping the action of the inertia weights, thereby to afford a regulation for the feed. These damping means are identical and each comprises bell crank levers 80 and 81 pivotally connected at 82 on a pair of the bolts 31 and having their inner arms 83 engaging the inner face of a plunger 84. This plunger is guided in a bore 85 formed in a cylinder member 86 bolted to the side of the casing 33. The outer arms 87 of the bell crank levers are provided with hook portions for engaging the outer ends of coiled, tension, damping springs 88, the inner ends of these springs being hooked within a recess 89 formed on the weight in the manner shown. Connected by a pipe connection 90 to the fluid supply pipe 14 for the hammer motor are flexible hoses 91 and 92 connected at their other ends at 93 to the cylinder members 86, pressure fluid being adapted to flow through this hose connection and through passages 94 to the cylinder bores wherein it acts on the plungers 84 to force the latter inwardly. These plungers act on the inner arms of the bell crank levers to swing the outer arms thereof apart, thereby to maintain the damping springs 88 of both weights under tension. By varying the pressure of the plungers 84 on the lever arms, the tension of the damping springs 88 may of course be varied, thereby to modify the action of the weights, it being desirable to dampen the action of the forward feed weight to a greater degree than the reverse feed weight, so as to attain a relatively rapid reverse feed. Of course, any desired ratio between forward and reverse feeds may be attained. Manual means is also provided for limiting outward movement of each of the plungers 84 comprising a follower screw 97 threaded within the cylinder member 86 and having an operating handle 98. By screwing this follower screw in and out the outer position of the plunger 84 may be varied. It will thus be seen that by varying the damping action of the damping springs 88 the range of oscillatory movement of the inertia weights may be controlled, thereby to regulate the rate of feed irrespective of the vibratory action set up within the drill. The pressure acting on the damping spring plungers, of course, varies with the pressure in the drill supply line.

Manual means is provided for effecting feed of the drill wholly independently of any automatic action, and comprises a handle 100 having its hub 101 rotatably mounted on the projecting end of the shaft 37. The control rod 58 has cam projections 102 for engaging a key 103, and when the control rod 58 is in the position shown in Fig. 2, these cam projections force the key 103 into a keyway 104 formed within the handle hub 101, thereby positively connecting the handle to the shaft 37. When the control rod 58 is in this position both of the gripping roller devices 46, 47 are maintained in their inoperative position so that when the handle 100 is turned the feed screw 23 is manually rotated to effect feed of the drill along the shell guideways.

The operation of the improved automatic feeding means will be clearly apparent from the description given. When the drill is set up in operative drilling position with respect to the work, the operator throws in the forward feed gripping device 47 by pulling the control rod 58 outwardly, and as the hammer motor operates to actuate percussively the drill steel 10, a vibratory action is set up within the drill, and this vibratory action is transmitted to the inertia weight 42 to cause the latter to oscillate about its pivot. This oscillation of the weight causes the feed screw to be intermittently rotated, through the gripping roller device, in a direction to effect forward feed of the drill. When it is desired to reverse the direction of feed the forward feed gripping device 47 is thrown out while the reverse feed gripping device is thrown in; and, while the hammer motor continues to operate, the feed screw is rotated by the oscillation of the inertia weight 41 to effect reverse feed. It is accordingly evident that the recoil of the hammer piston, due to its sudden change in direction during its reciprocation, causes, through the feed nut and feed screw, the rearward portion of the guide shell to be vibrated in a vertical direction, and this vibratory movement is transmitted to the inertia weights, effecting oscillation of the latter. As a result, the feed screw is rotated through the gripping roller mechanism to effect feed of the drill in either of opposite directions along the guide shell. By varying the tension of the damping springs acting on the weight the action of the latter may be modified, thereby to vary the rate of feed. By increasing the damping action on one weight more than on the other, the forward and reverse feeds may be effected at relatively different rates. These and other uses and advantages of the improved feeding mechanism will be clearly apparent to those skilled in the 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 drilling mechanism, the combination with a hammer rock drilling device of the reciprocating piston, hammer-motor type and a guide device on which said rock drilling device is slidably guided for feeding movement, of automatic feeding means controlled by a vibratory action set up within the drilling mechanism by said rock drilling device for feeding the latter along the guide device, said automatic feeding means comprising relatively rotatable, coacting feeding elements, one stationary as regards longitudinal movement relative to the guide device and the other stationary as regards longitudinal movement relative to the rock drilling device, a movable inertia weight carried by that one of said devices relative to which the rotatable one of said coacting feeding elements is stationary as regards longitudinal movement, said inertia weight actuated by said vibratory action, and means operated by said inertia weight as the latter moves for driving said rotatable feeding element.

2. In a rock drilling mechansm, the combina-

tion with a hammer motor of the reciprocating piston type and a guide shell on which said motor is slidably guided, said guide shell having a support and an overhanging guide portion extending rearwardly from said support whereby the operation of said hammer motor sets up a vibratory action of said rearward portion of the shell in a direction substantially at right angles to the direction in which said guide shell extends, of feeding means operated by said vibratory action for automatically feeding the hammer motor along the guide shell, said feeding means including a pivotally mounted oscillatory inertia weight carried by the rearward portion of said guide shell and oscillated by said vibratory action, relatively movable feeding devices connecting the hammer motor with the shell and upon relative movement effecting movement of the hammer motor along said shell, and means for transmitting the kinetic energy of said inertia weight for actuating said feeding devices.

3. In a rock drilling mechanism, the combination with a hammer rock drill having a hammer motor of the reciprocating hammer piston type and a guide shell on which the drill is slidably guided, said guide shell having a support and an overhanging guide portion extending rearwardly from said support, the operation of said hammer motor setting up a vibratory action of said rearward portion of the shell in a direction substantially at right angles to the direction in which said guide shell extends, of reversible feeding means operated by said vibratory action for automatically feeding the rock drill in either of opposite directions along the guide shell, said feeding means including relatively movable, pivotally mounted, oscillatory inertia weights carried, in a relatively stationary position as regards bodily movement along the shell, by the rearward portion of said guide shell and oscillated by said vibratory action, feeding devices operatively connected to the rock drill, and selectively effective, reversely acting intermittent gripping means operated by the kinetic energy of said weights respectively and selectively operative to actuate said feeding devices in either of opposite directions.

4. In a rock drilling mechanism, the combination with a hammer rock drill of the reciprocating hammer piston type and a guide shell on which the drill is slidably guided, of feeding means operated automatically by a vibratory action set up within the drilling mechanism and embodying means selectively operative for positively feeding the rock drill relative to the guide shell at a relatively slow forward drilling speed and at a relatively high reverse speed, and associated means for varying the forward and rearward feeding speeds independently of each other and also of the vibratory action of the drilling mechanism.

5. In a rock drilling mechanism, the combination with a hammer rock drill having a hammer motor of the reciprocating hammer piston type and a guide shell on which the drill is slidably guided, of feeding means operated by a vibratory action set up within the drilling mechanism by the hammer piston for automaticalily effecting feed of the rock drill along the guide shell, said feeding means including an oscillatory inertia weight actuated by said vibratory action, feeding devices operatively connected to the drill and means for transmitting the kinetic energy of said inertia weight for actuating said feeding devices, and means for varying the rate of feed comprising adjustable damping means acting on said inertia weight for modifying the action of the latter.

6. In a rock drilling mechanism, the combination with a hammer rock drill having a hammer motor of the reciprocating piston type and a guide shell on which the drill is slidably guided, of feeding means operated by a vibratory action set up within the drilling mechanism by the hammer piston for effecting feed of the rock drill along the guide shell including a pair of relatively movable inertia weights, one for effecting feed in one direction and the other for effecting feed in the opposite direction, feeding devices operative upon power transmission thereto to effect feed, means for selectively connecting said weights in driving relation with said feeding devices to transmit to the latter the kinetic energy of said weights and thereby cause said feeding devices to effect feed, and means for independently modifying the action of said inertia weights so that the rates of feed in opposite directions may be varied.

7. In a rock drilling mechanism, the combination with a hammer rock drill of the reciprocating piston type and a guide shell in which the drill is sildably guided, of feeding means operated automatically by vibratory action set up within the drilling mechanism for positively feeding the drill along the guide shell, said feeding means including relatively rotatable feeding elements operatively connected to the shell and drill, means deriving its operating energy from the vibration for effecting relative rotation between said feeding elements, and means controlled by variations in pressure of the operating medium supplied to said rock drill for automatically altering the responsiveness of said last mentioned means to the vibration to compensate for alterations, upon changes in motive fluid pressure, in the vibratory action set up within the drilling mechanism by the operation of the hammer motor.

8. In a rock drilling mechanism, the combination with a hammer rock drill having a hammer motor of the reciprocating hammer piston type and a guide shell on which the rock drill is slidably guided, of automatic feeding means controlled by a vibratory action set up within the drilling mechanism by the hammer motor for feeding the rock drill along the guide shell, said automatic feeding means comprising a feeding element rotatably mounted on the guide shell, a non-rotatable feeding element carried by the drill and engaging said rotatable feeding element, a movable inertia weight actuated by said vibratory action and movable relative to said rotatable feeding element, and means operated by said inertia weight for rotating said rotatable feeding element.

9. In a rock drilling mechanism, the combination with a hammer rock drill having a hammer motor of the reciprocating hammer piston type and a guide shell on which the drill is slidably guided, of feeding means operated by a vibratory action set up within the drilling mechanism by the hammer motor for automatically feeding the rock drill along the guide shell, said feeding means including relatively rotatable feed screw and nut elements operatively connected to the drill, an oscillatory inertia weight actuated by said vibratory action, and means operated by said inertia weight for effecting relative rotation of said feed screw and nut elements.

10. In a rock drilling mechanism, the combi-

nation with a hammer rock drill having a hammer motor of the reciprocating hammer piston type and a guide shell on which the rock drill is slidably guided, of automatic feeding means controlled by a vibratory action set up within the drilling mechanism by the hammer motor for feeding the rock drill along the guide shell, said automatic feeding means including a feed screw rotatably mounted on the guide shell, a non-rotatable feed nut carried by the drill and engaging said feed screw, an oscillatory inertia weight pivotally mounted on the guide shell and actuated by said vibratory action, and means actuated by said inertia weight for effecting rotation of the feed screw.

11. In a rock drilling mechanism, the combination with a hammer rock drill having a hammer motor of the reciprocating hammer piston type and a guide shell on which the rock drill is slidably guided, of automatic feeding means controlled by a vibratory action set up within the drilling mechanism by the hammer motor for feeding the rock drill along the guide shell, said automatic feeding means including a feed screw rotatably mounted on the guide shell, a non-rotatable feed nut carried by the drill and engaging said feed screw, relatively movable inertia weights actuated by said vibratory action, and reversible intermittent gripping means actuated by said weights respectively and selectively operative to effect feed screw rotation in either of opposite directions.

12. In a rock drilling mechanism, the combination with a hammer rock drill having a hammer motor of the reciprocating hammer piston type and a guide shell on which the rock drill is slidably guided, of automatic feeding means controlled by a vibratory action set up within the drilling mechanism by the hammer motor for feeding the rock drill along the guide shell and including relatively rotatable feed screw and nut elements, vibration actuated means including a weight oscillatable about the feed screw axis and actuated by said vibration and means operated by said inertia weight for effecting relative rotation of said feed screw and nut elements.

13. In a rock drilling mechanism, the combination with a hammer rock drill having a hammer motor of the reciprocating hammer piston type and a guide shell on which the rock drill is slidably guided, of automatic feeding means controlled by a vibratory action set up within the drilling mechanism by the hammer motor for feeding the rock drill along the guide shell and including relatively rotatable feed screw and nut elements, vibration actuated inertia weight means actuated by said vibration and means operated by said inertia weight means for effecting relative rotation of said feed screw and nut elements, and manual means associated with said automatic means for manually effecting relative rotation of said screw and nut elements.

14. In a drilling apparatus, the combination with a support, of a drilling motor slidable on the support and having jars imparted thereto, of a stationary nut carried by the motor in threaded engagement with a rotatable screw carried by the support, the rotation of said screw effecting the feeding motion of the motor, a duality of mechanisms connectable with said screw one for manually rotating the screw and the other for automatically rotating it due to the jars of the motor, and unitary means for selectively connecting either of said mechanisms with said screw.

15. In a drilling apparatus, the combination with a support of a drilling motor slidable on the support and having jars imparted thereto, of a feeding device for the motor including a pair of elements in threaded engagement with each other, one of said elements being rotatable relative to the other for imparting feeding motion to the motor, a duality of mechanisms connectable with said rotatable element one for manually rotating the same and the other for automatically rotating it due to the jars of the motor, and unitary means for selectively connecting either of said mechanisms with said rotatable element.

16. In a drilling apparatus, the combination with a support, of a drilling motor slidable on the support and having jars imparted thereto, a rotatable screw in threaded engagement with the motor for imparting feeding motion thereto, manually operating means for said screw, automatically operating means capable of effecting rotation of the screw due to the jars of the motor, and unitary means for selectively connecting either of said operating means with said screw.

17. In a drilling apparatus, the combination with a support, of a drilling motor slidable on the support and having jars imparted thereto, a rotatable screw in threaded engagement with the motor for imparting feeding motion thereto, manually operating means for said screw, automatically operating means capable of effecting rotation of the screw in either direction due to the jars of the motor, and unitary means for selectively connecting either of said operating means with said screw and controlling the direction of rotation of the latter when connected with said automatically operating means.

18. In a rock drilling mechanism, the combination with a hammer rock drill having a pressure fluid actuated hammer motor of the reciprocating piston type and a guide shell on which the drill is slidably guided, of reversible feeding means operated by a vibratory action set up within the drilling mechanism by the hammer piston for effecting feed of the rock drill in either of opposite directions along the guide shell including inertia weight means actuated by said vibratory action, feeding devices operatively connected to the rock drill and means actuated by said inertia weight means and selectively operative to effect actuation of said feeding devices in either of opposite directions, and pressure fluid actuated means for regulating said inertia weight means in accordance with the pressure in the fluid supply line of the drill hammer motor.

19. In a drilling apparatus, the combination with a support, of a drilling motor slidable on the support, of a feeding mechanism for said motor including a duality of operatively associated elements one capable of rotation relative to the other for effecting feeding motion of the motor, a duality of power actuated members alternatively rotated in one direction, and means for transmitting the rotation of said members to the rotatable element.

20. In a drilling apparatus, the combination with a support, of a drilling motor slidable on the support, and a feeding mechanism for the motor including a pair of operatively associated elements, one capable of rotation relative to the other for effecting feeding motion of the motor, a pair of power actuated members rotatable rela-

tive to each other and alternatively rotated in one direction, means for transmitting rotation from one of said members to the rotatable element, and means for transmitting rotation from the other of said members to the rotatable element.

21. In a drilling apparatus, the combination with a support, of a drilling motor slidable on the support, and a feeding mechanism for the motor including a pair of operatively associated elements, one capable of rotation relative to the other for effecting feeding motion of the motor, a pair of power actuated members rotatable relative to each other on alined axes and alternatively rotated in one direction, means for transmitting rotation from one of said members to the rotatable element, and means for transmitting rotation from the other of said members to the rotatable element.

22. A rock drilling mechanism comprising, in combination, a hammer motor of the reciprocating piston type, a guideway on which said hammer motor is slidably guided, and automatic feeding means controlled by motion imparted to the drilling mechanism by the hammer motor for feeding the rock drill along the guide shell, said automatic feeding means comprising relatively longitudinally movable feeding elements respectively carried by the guideway and the hammer motor and coacting upon relative movement to effect hammer motor movement along said guideway, a movably supported weight carried by said drilling mechanism in a position to be moved rapidly first in one direction and then in an opposite direction relative to both said hammer motor and said guideway by the motion imparted to the drilling mechanism by the hammer motor, and an intermittent-motion-transmitting device operated by said weight as the latter makes its movements in one direction for effecting relative movement between said elements to effect hammer motor feed.

23. A rock drilling mechanism comprising, in combination, a hammer motor of the reciprocating piston type, a guideway upon which said hammer motor is slidably guided for feeding movement, and automatic feeding means controlled by a motion imparted to the drilling mechanism by the hammer motor for feeding the rock drill along the guideway, said automatic feeding means comprising relatively longitudinally movable feeding elements respectively carried by the guideway and the hammer motor and coacting upon relative movement to effect hammer motor movement along said guideway, a movably supported weight carried by said guideway in a position to be set in motion back and forth along a path relative to said guideway by the motion imparted to the drilling mechanism by the hammer motor, said hammer motor movable towards and away from said weight as it travels along said guideway, and means operated by the kinetic energy of said weight as the latter makes its movements in one direction for effecting relative movement between said elements to effect hammer motor feed.

24. In a rock drilling mechanism, the combination with a hammer rock drill of the reciprocating hammer piston type and a guide shell on which the drill is slidably guided, of feeding means operated automatically by a vibratory action set up within the drilling mechanism, said feeding means embodying means energized by such vibratory action and constituting a source of kinetic energy for effecting forward feed and connectible for positively feeding the rock drill forwardly relative to the guide shell at a relatively slow forward drilling speed, and said feeding means embodying another and different means, constituting a separate source of kinetic energy, for effecting rearward feed and connectible for positively feeding the rock drill rearwardly relative to the guide shell at a relatively high reverse speed.

25. In a rock drilling mechanism, in combination, an elongated guide shell having a supporting device therefor between its ends, a hammer motor guided by said guide shell, the operation of said hammer motor setting up a vibratory action in said guide shell about an axis extending transversely to said shell at said supporting device for said shell whereby the opposite extremities of said shell each undergo a vibratory action transverse to the length of the shell, an inertia device energized by said vibration and moved thereby to position its center of mass alternately at opposite sides of a plane extending longitudinally of said shell in fixed relation to the latter and parallel to the path of guided movement of said hammer motor, and means for effecting feed of the motor along the shell actuated by the kinetic energy of said inertia device.

26. A rock drilling mechanism comprising, in combination, a hammer motor of the reciprocating piston type, a guideway on which said hammer motor is slidably guided, and automatic feeding means controlled by motion imparted to the drilling mechanism by the hammer motor for feeding the rock drill along the guide shell, said automatic feeding means comprising relatively longitudinally movable feeding elements respectively carried by the guideway and the hammer motor and coacting upon relative movement to effect hammer motor movement along said guideway, a movably supported weight movable relative to said elements, said hammer motor and said guideway and carried by said drilling mechanism in a position to be moved rapidly first in one direction and then in an opposite direction relative to both said hammer motor and said guideway by the motion imparted to the drilling mechanism by the hammer motor, and means operated by said weight as the latter makes its movements in one direction for effecting relative movement between said elements to effect hammer motor feed.

27. A rock drilling mechanism comprising, in combination, a hammer motor of the reciprocating piston type, a guideway on which said hammer motor is slidably guided, and automatic feeding means controlled by motion imparted to the drilling mechanism by the hammer motor for feeding the rock drill along the guide shell, said automatic feeding means comprising relatively longitudinally movable feeding elements respectively carried by the guideway and the hammer motor and coacting upon relative movement to effect hammer motor movement along said guideway, a movably supported weight carried by said drilling mechanism in a position to be moved rapidly first in one direction and then in an opposite direction, in a path laterally offset from the center line of said guideway, relative to both said hammer motor and said guideway by the motion imparted to the drilling mechanism by the hammer motor, and means operated by said weight as the latter makes its movements in one direction for effect-

ing relative movement between said elements to effect hammer motor feed.

28. A rock drilling mechanism comprising, in combination, a hammer motor of the reciprocating piston type, a guideway on which said hammer motor is slidably guided, and automatic feeding means controlled by motion imparted to the drilling mechanism by the hammer motor for feeding the rock drill along the guide shell, said automatic feeding means comprising relatively longitudinally movable feeding elements respectively carried by the guideway and the hammer motor and coacting upon relative movement to effect hammer motor movement along said guideway, a movably supported weight carried by said drilling mechanism in a position to be moved rapidly first in one direction and then in an opposite direction relative to both said hammer motor and said guideway by the motion imparted to the drilling mechanism by the hammer motor, and means operated by the kinetic energy of said weight as the latter makes its movements in one direction for effecting relative movement between said elements to effect hammer motor feed.

29. A rock drilling mechanism comprising, in combination, a hammer motor of the reciprocating piston type, a guideway upon which said hammer motor is slidably guided for feeding movement, and automatic feeding means controlled by a motion imparted to the drilling mechanism by the hammer motor for feeding the rock drill along the guideway, said automatic feeding means comprising relatively longitudinally movable feeding elements respectively carried by the guideway and the hammer motor and coacting upon relative movement to effect hammer motor movement along said guideway, a movably supported weight movable relative to said elements, said hammer motor and said guideway and carried by said guideway in a position to be set in motion back and forth along a path relative to said guideway by the motion imparted to the drilling mechanism by the hammer motor, said hammer motor movable towards and away from said weight as it travels along said guideway, and means operated by said weight as the latter makes its movements in one direction for effecting relative movement between said elements to effect hammer motor feed.

30. A rock drilling mechanism comprising, in combination, a hammer rock drill of the reciprocating piston type, a guide shell in which the drill is slidably guided, and feeding means operated automatically by vibratory action set up within the drilling mechanism for positively feeding the drill along the guide shell, said feeding means including relatively rotatable feeding elements operatively connected to the shell and drill, means deriving its operating energy from the vibration for effecting relative rotation between said feeding elements, said means having resilient means associated with it for controlling its movements, and fluid pressure responsive means controlled by variations in pressure of the operating medium supplied to said rock drill for automatically altering the force exerted by said resilient means to compensate for alterations, upon changes in motive fluid pressure, in the vibratory action set up within the drilling mechanism by the operation of the hammer motor.

31. In a drilling apparatus, the combination with a support, of a drilling motor slidable on the support having reciprocatory motion imparted thereto, of a feeding device for the motor including a duality of elements in threaded engagement with each motor, means for transmitting the reciprocatory motion of the motor to said elements, one of said elements being rotatable relative to the other for imparting feeding motion to the motor, a duality of mechanisms connectible with said rotatable element one for manually rotating the same and the other for automatically rotating it due to the reciprocatory motion thereof, and means for selectively connecting either of said mechanisms with said rotatable element.

32. In a drilling apparatus, the combination with a support, of a drilling motor slidable on the support having jars imparted thereto, and feeding devices for the motor including a duality of elements in threaded engagement with each other, one of said elements being rotatable relative to the other for imparting feeding motion to the motor, a duality of mechanisms connectible with said rotatable element one for manually rotating the same and the other for rotating it automatically due to said jars, and means for selectively connecting either of said mechanisms with said rotatable element.

WARREN NOBLE.

CERTIFICATE OF CORRECTION.

Patent No. 2,271,025. January 27, 1942.

WARREN NOBLE.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 4, second column, line 27, claim 7, for "sildably" read --slidably--; page 7, second column, line 27, claim 31, for "motor" read --other--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 28th day of April, A. D. 1942.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.