July 26, 1938. W. A. MORRISON 2,124,627

ROCK DRILL MECHANISM

Filed July 30, 1937 2 Sheets-Sheet 1

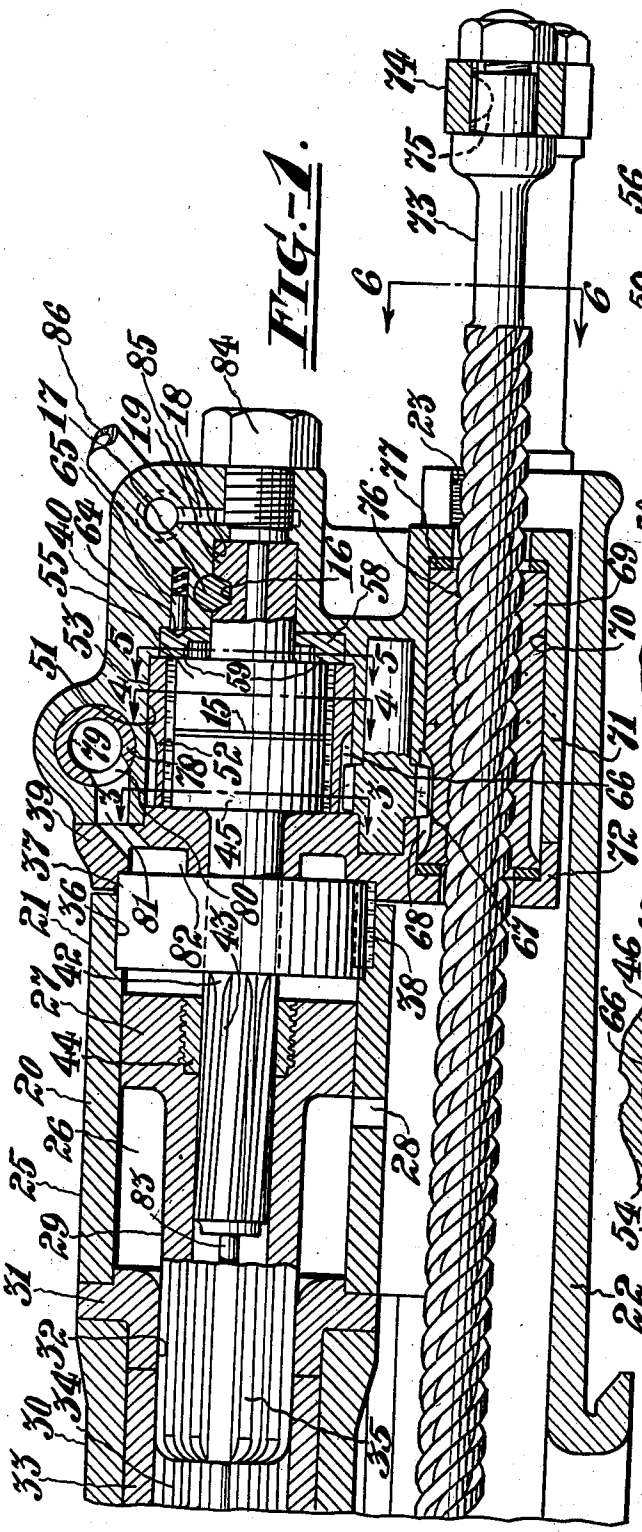

FIG.-1.

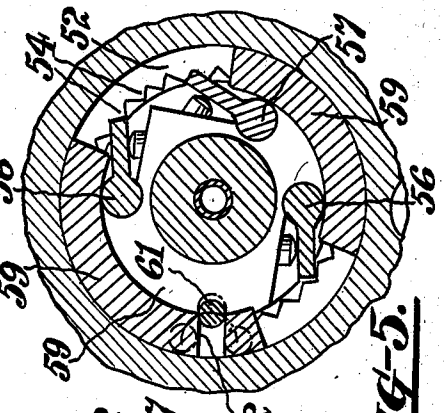

FIG.-5.

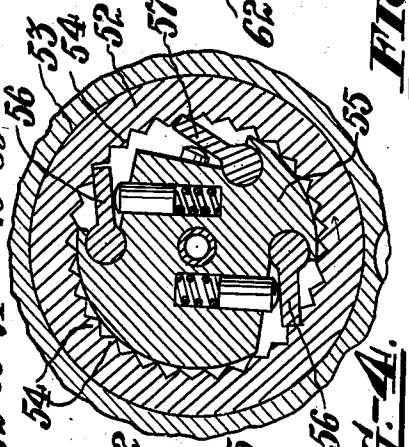

FIG.-4.

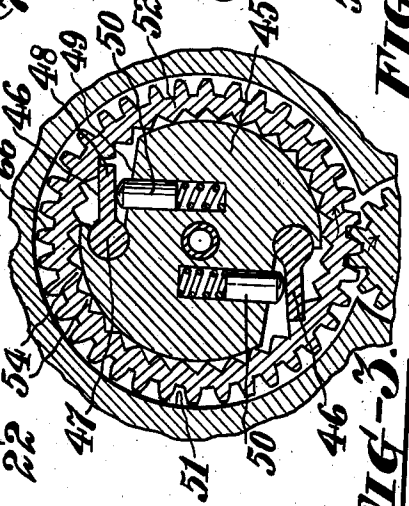

FIG.-3.

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ROCK DRILL MECHANISM

Filed July 30, 1937 2 Sheets-Sheet 2

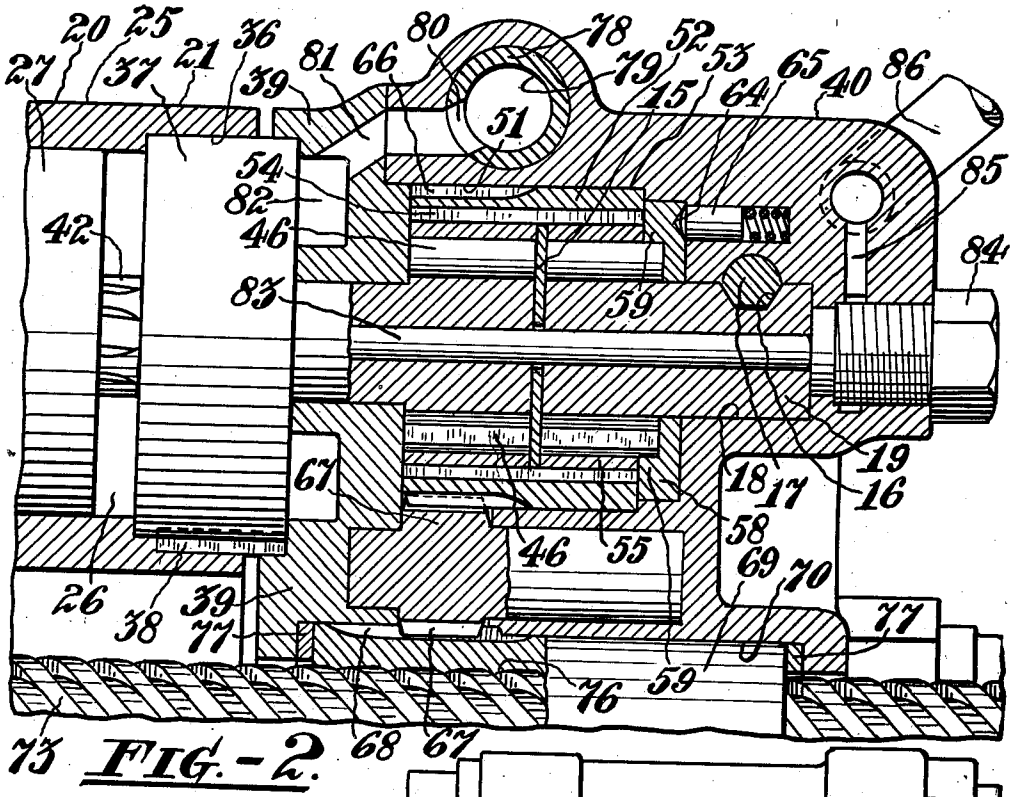

FIG.-2.

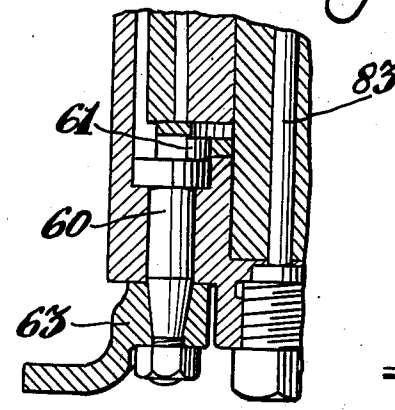

FIG.-7.

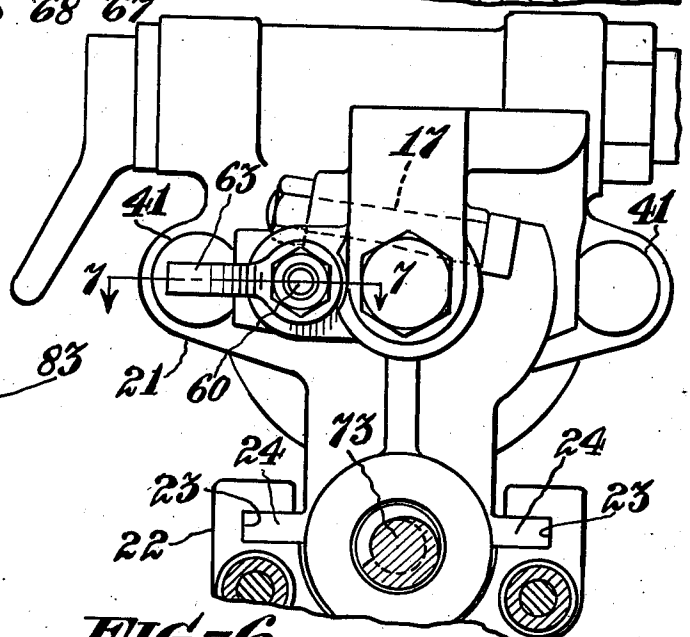

FIG.-6.

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2,124,627

ROCK DRILL MECHANISM

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Application July 30, 1937, Serial No. 156,436

6 Claims. (Cl. 121—5)

This invention relates to rock drilling mechanisms, and more particularly to rock drilling mechanism embodying rotation mechanism for rotating the working implement and feeding mechanism for actuating the rock drill relatively to its support.

One object is to assure the correct relationship of the rock drill and the hammer piston with respect to the working implement which the hammer piston actuates.

Another object of the invention is to utilize the force of the hammer piston of a rock drill for actuating both the rotation mechanism and the feeding mechanism.

Still another object is to use an element or elements of the rotation mechanism for transmitting the force of the hammer piston to the feeding mechanism.

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

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

Figure 1 is a longitudinal view, partly in section, of a rock drilling mechanism constructed in accordance with the practice of the invention,

Figure 2 is a view similar to Figure 1 showing a detailed view of the elements employed for transmitting power from the hammer piston to the feeding mechanism,

Figures 3, 4, 5 and 6 are transverse views taken through Figure 1 on the lines 3—3, 4—4, 5—5 and 6—6, respectively, and

Figure 7 is a plan view, in section, taken through Figure 6 on the line 7—7.

Referring more particularly to the drawings, 20 designates a rock drilling mechanism comprising a rock drill 21 and a shell 22 to guide the rock drill and accordingly having a pair of guideways 23 to slidably receive ribs 24 carried by the casing parts of the rock drill 21.

The rock drill 21 comprises the usual cylinder 25 having a piston chamber 26 to accommodate a reciprocatory hammer piston 27 which controls a free exhaust port 28. The hammer piston has a reduced stem 29 to deliver blows against a working implement, as for example a drill steel (not shown), but the end of which may extend into the front casing part or front head 30 arranged at the forward end of the cylinder 25.

The front head 30 and the cylinder 25 are separated by a front cylinder washer 31 having bosses on its ends extending into the adjacent ends of the front head and the cylinder and also having a bore 32 to guide the stem 29. The front head 30 houses suitable chuck mechanism 33 having ribs 34 which are slidably engaged by ribs 35 extending longitudinally of the piston stem 29 to prevent relative rotary movement between the piston 27 and the chuck 33.

The chuck mechanism 33 may be of any well known type adapted to interlockingly engage the working implement so that upon the impartation of the rotary movement to the chuck 33 the working implement will also be rotated in order to rotate its cutting end to new positions between blows of the hammer piston 27. A well known example of such chuck mechanism is that generally known as the "Leyner" type in which the chuck interlocks with lugs on the working implement to cause the two to rotate in unison and the working implement is capable of a limited degree of reciprocatory movement relatively to the chuck.

In the rearward end of the cylinder 25 is an enlarged recess 36 to accommodate valve mechanism 37 of which only the chest is shown. The valve mechanism may be of any well known type and the rock drill may be provided with the usual ports and passages (not shown) controlled by the valve mechanism to distribute pressure fluid to the ends of the piston chamber for actuating the piston 27.

The valve mechanism is held against rotary movement with respect to the cylinder 25 by a key 38 engaging these elements and is held against endwise movement by a plate 39 overlying the rear end of the cylinder 25. The plate 39, moreover, serves as a seat for a back head 40 which constitutes the rearmost casing part of the rock drill and is secured to the cylinder by the usual side rods 41 arranged on opposite sides of the rock drill.

The rock drill is provided with suitable means for imparting rotary movement to the piston 27 and thus to the chuck mechanism interlocked therewith. That illustrated and designated 42 is in the form of a bar extending through the plate 39 and the valve mechanism 37 into the piston 27, and the portion of the bar lying within the piston is provided with spiral ribs 43 to interlockingly engage similar ribs (not shown) in a nut 44 threaded into the piston 27.

On the rearward end of the bar is a head 45 which carries a series of pawls 46 of conventional type having trunnions 47 seated in the head 45 to serve as pivots for the pawls. The wing portions 48 of the pawls lie in recesses 49 in the periphery of the head 45 and are urged outwardly by spring-pressed plungers 50 slidable in the head 45.

The head 45 is arranged in a recess 51 in the back head 40 and is encircled by a ratchet ring 52 which, in accordance with the practice of the invention, is rotatable within the recess and has a smooth cylindrical bearing portion 53 that seats upon the wall of the recess 51. The teeth 54 of the ratchet ring, and which the pawls 46 are intended to engage, are located on and extend along the entire inner surface of the ratchet

ring. Their side surfaces, as is customary, serve as seats for the ends of the pawls **46** to prevent relative rotary movement in one direction between the bar **42** and the ratchet ring **52**.

Suitable means are provided to enable the direction of rotation of the ratchet ring **42** to be selectively controlled. To this end a block **55** is disposed in the ratchet ring, rearwardly of the head **45**, to provide bearings for two sets of spring-pressed pawls **56** and **57** of which the pawls designated **56** are arranged to engage one side of the ratchet teeth **54** and the pawl or pawls **57** is positioned to act as abutments for the opposite sides of the teeth **54**. Preferably a plate **15** is interposed between the head **45** and the block **55** to retain the pawls in their respective carriers.

The block **55** may be held fixedly in position in any suitable manner, as, for example, by seating a stem **19** of the block **55** in a bore **18** in the back head and firmly securing the stem **19** to the back head **40** with a key **17** extending transversely of the back head and engaging a notch **16** in the periphery of the stem **19**.

Means are provided for controlling engagement of the pawls **56** and **57** with the teeth **54**. To this end a plate **58** is arranged rotatably in the back head rearwardly of the block **55**. The plate carries a pair of wings **59** which overlie portions of the pawls **56** and **57** extending rearwardly of the block **55**. The wings **59** will, upon manipulation of the plate **58**, engage the free ends of the pawls and rock them out of the path of movement of the teeth **54**.

Any suitable means may be provided for effecting rotary movement of the plate. That illustrated comprises a shaft **60** arranged in the back head **40** and having an eccentric pin **61** which extends into a slot **62** in the rearmost end of the plate **58**, preferably near the periphery thereof. The shaft **60** extends exteriorly of the back head and carries a lever **63** whereby it may be manipulated.

In order that the plate **58** may be held fixedly in either of its limiting positions, that is, in the positions in which it holds the pawls **56**, or that designated **57**, in disengaging position, the plate **58** is provided in its rearward end with depressions **64**, of which only one is shown, to receive the end of a spring-pressed plunger **65** arranged in the back head **40**.

As has been previously stated, the ratchet ring **52** is rotatable in the recess **51**, and this movement of the ratchet ring is employed in the form of the invention illustrated for imparting feeding movement to the rock drill for actuating it along the shell **22** in order to maintain the percussive element of the rock drill in a favorable position with respect to the working implement. The ratchet ring is accordingly provided with gear teeth **66** on its periphery to mesh with an idler pinion **67** journalled in the back head **44** and the plate **39** and meshing with teeth **68** in the periphery of a feed nut **69** rotatable in a bore **70** located, in the present instance, in lugs **71** and **72** on the back head and the plate **39**.

The lugs **71** and **72** extend into the shell **22** and the bore **70** is coaxial with a feed screw **73** extending longitudinally of the shell **22**. The feed screw is supported at its ends by suitable bearings of which only one, designated **74**, is shown at the rearward end of the shell to which it may be suitably locked by a key **75**.

The threads **76** of the feed nut are of non-locking pitch and extend from one end to the other of the feed nut to assure an ample area of engagement between them and those of the feed screw upon which the feed nut **69** is threaded. Preferably plates **77** are disposed at the ends of the feed nut **69** to protect the lugs **71** and **72** against the effects of wear incident to the movement of the feed nut.

The pressure fluid employed for actuating the piston may be conveyed to the rock drill through a suitable conduit (not shown) and its admission into the rock drill is controlled by a throttle valve **78** arranged in the back head **44**. The throttle valve is shown as being of the rotary type having a central chamber **79** which may be in constant communication with the source of pressure fluid supply, and a port **80** in the wall of the throttle valve affords communication between the chamber **79** and a supply passage **81** extending through the back head **40** and the plate **39** and opening into a supply reservoir **82** in the end of the plate **39** adjacent the valve mechanism **37**.

The rock drill is, moreover, provided with a water tube **83** which extends through the back head and the percussive element to convey cleansing water to the working implement for flushing the hole being drilled. The water tube is held fixedly in position by a plug **84** threaded into the rear end of the back head and seating against the adjacent end of the water tube. A passage **85** in the back head affords communication between the water tube and a supply connection **86** attached to the back head.

The operation of the device is as follows: Let it be assumed that the rock drill **20** is in operation so that the hammer piston **27** is reciprocating within the cylinder to deliver blows to the working implement, also that the plate **58** occupies a position in which a wing **59** holds the pawl **57** out of the path of the ratchet teeth **54** and that the pawls **56** are free to engage the ratchet teeth. Under these conditions and during the forward stroke of the hammer piston the bar **42** will be rotated within the ratchet ring **52** by the piston which will then move forwardly unimpeded to strike against the working implement, it being understood, of course, that the bar **42** will then rotate freely with respect to the ratchet ring and the pawls **46** will merely pass over the crests of the teeth **54**. The pawls **47** will, however, be in constant readiness for engagement with the teeth **54**, as will also be the pawls **56**. Thus, when the piston **27** reverses in the front end of the piston chamber **26** and by its act of reversal imparts a shock or jar to the rock drill the feed nut **69** is caused to rotate in a clockwise direction as Figures 1 and 2 are viewed from the right hand ends of the drawings, and thereby enable the rock drill to be moved along the shell **22** toward the work by the force of the hammer piston. The ratchet ring, being connected to the feed nut through the pinion **67**, will also rotate in the same direction as the feed nut and its teeth **54** will merely depress the pawls **56** as they pass over the free ends of the pawls.

Upon reversal of the piston the spiral engagement between it and the bar **42** causes the bar to rotate in a direction to bring the ends of the pawls **46** into abutting relationship with the teeth **54** and, in consequence, a thrust is imparted to the ratchet ring **52** which will cause it to rotate. This movement of the ratchet ring is transmitted through the pinion **67** to the feed nut **69** which will then be rotated further in a

clockwise direction to advance it and the rock drill toward the work.

The distance which the rock drill is initially moved forwardly along the shell by the force of the hammer piston **27** at the beginning of its rearward stroke depends, of course, upon the degree of penetration of the working implement into the rock at each blow of the hammer piston but, in any case, the rock drill is moved forwardly, by the jar occasioned by the hammer piston and by the subsequent thrust against the ratchet ring, the distance required to bring the percussive element within the correct striking distance of the working implement. In practice, this final forward movement of the rock drill has been found to be fully accomplished immediately after the beginning of the rearward stroke of the hammer piston.

After the described movement of the feed nut has been effected the rock drill will be definitely restrained against further forward movement by the abutting surfaces of the working implement and the chuck mechanism. In consequence, the feed nut **69** and the parts connected thereto are incapable of further rotary movement. The ratchet ring **52** will, therefore, remain stationary, as will also the bar **42**. The piston **27** will then rotate relatively to the bar **42** during the remainder of its stroke and rotate the chuck **33** and the working implement to a new position.

When the piston reverses in the rear end of the piston chamber a jar is, of course, also imparted to the rock drill but this force will be ineffective to shift the rock drill by reason of the engagement of the pawls **56** with the teeth **54**. These elements will then prevent reverse movement of the ratchet ring **52** and thus the movement of the feed nut **69** necessary to effect or permit retrograde movement of the rock drill.

The described cycle of operations is repeated until the working implement has penetrated the rock to the limit of its extent and to accomplish which necessarily requires that the rock drill move to the forward extremity of the shell. In order, therefore, to return the rock drill to its initial position the plate **58** is rotated, by means of the lever **63**, to a position in which the wings **59** tilt the pawls **56** out of the path of the teeth **54** and release the pawl **57** to enable the latter to move into position for engaging the ratchet teeth.

During the subsequent reciprocations of the hammer piston **27** the jars applied to the rock drill upon reversal of the piston at the end of its rearward stroke cause the feed nut **69** to rotate freely on the feed screw **73** and the rock drill will be moved rearwardly towards its initial position and constitute the sole force for retracting the rock drill. The ratchet ring **52** will then also be free to rotate within the back head to permit of this movement of the feed nut but will be held against movement in the opposite direction by the pawl **57** which will be in engagement with or in position to engage a tooth **54**. Thus, when the piston **27** reverses in the front end of the piston chamber **26** the jar applied to the rock drill and tending to move it forwardly will be rendered ineffective by the pawl **57**. Upon continued operation of the hammer piston **27** the rock drill will be gradually moved rearwardly to the starting position.

I claim:

1. In a rock drilling mechanism, the combination of a rock drill and a guide therefor, a feeding mechanism for moving the rock drill relatively to the guide and comprising a pair of members in threaded engagement with each other, a hammer piston reciprocable in the rock drill applying jars thereto to move the rock drill along the guide, and rotary means actuated by the hammer piston during alternate strokes thereof for rotating one of the members to assist in moving the rock drill in one direction.

2. In a rock drilling mechanism, the combination of a rock drill and a guide therefor, a hammer piston in the rock drill, feeding mechanism for moving the rock drill relatively to the guide, and means actuated by the hammer piston and operating to actuate the feeding mechanism to move the rock drill counter to the direction of movement of the hammer piston.

3. In a rock drilling mechanism, the combination of a rock drill and a guide therefor, a feed screw on the guide, a feed nut in the rock drill in threaded engagement with the feed screw, a hammer piston reciprocable in the rock drill applying jars thereto to move the rock drill along the guide, and means actuated by the hammer piston during alternate strokes thereof for rotating the feed nut to assist in moving the rock drill relatively to the guide.

4. In a rock drilling mechanism, the combination of a rock drill and a guide therefor, feeding mechanism for the rock drill comprising a stationary member and a rotary member in threaded engagement with the stationary member, a ratchet ring rotatable in the rock drill, a driving connection between the ratchet ring and the rotary member, a hammer piston, and means interlocked with the hammer piston to impart rotary movement to the ratchet ring and thus to the rotary member during a stroke of the hammer piston.

5. In a rock drilling mechanism, the combination of a rock drill and a guide therefor, feeding mechanism for the rock drill comprising a stationary member and a rotary member in threaded engagement with the rotary member, a ratchet ring rotatable in the rock drill and being operatively connected with the rotary member to rotate said rotary member, a hammer piston, means for selectively controlling the direction of rotation of the ratchet ring, and means interlocked with the hammer piston to impart rotary movement to the ratchet ring during a portion of the rearward stroke of the hammer piston.

6. In a rock drilling mechanism, the combination of a rock drill and a guide therefor, feeding mechanism for the rock drill comprising a stationary member and a rotary member in threaded engagement with the stationary member, a hammer piston reciprocable in the rock drill and imparting jars thereto tending to move the rock drill along the support, a ratchet ring rotatable in the rock drill and being operatively connected to the rotary member to rotate said rotary member, means interlocked to said piston to cause said piston to move along a spiral path and to impart rotary movement to the ratchet ring, and means selectively engageable with the ratchet ring to render the jars of the hammer piston non-effective to move the rock drill relatively to the support.

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DISCLAIMER

2,124,627.—*William A. Morrison*, Easton, Pa. ROCK DRILL MECHANISM. Patent dated July 26, 1938. Disclaimer filed September 22, 1939, by the assignee, *Ingersoll-Rand Company*.

Hereby enters this disclaimer to claim 2 in said specification.

[*Official Gazette October 10, 1939.*]