Jan. 21, 1936. F. M. SLATER 2,028,252

ROTATION MECHANISM

Filed Dec. 19, 1934 2 Sheets-Sheet 1

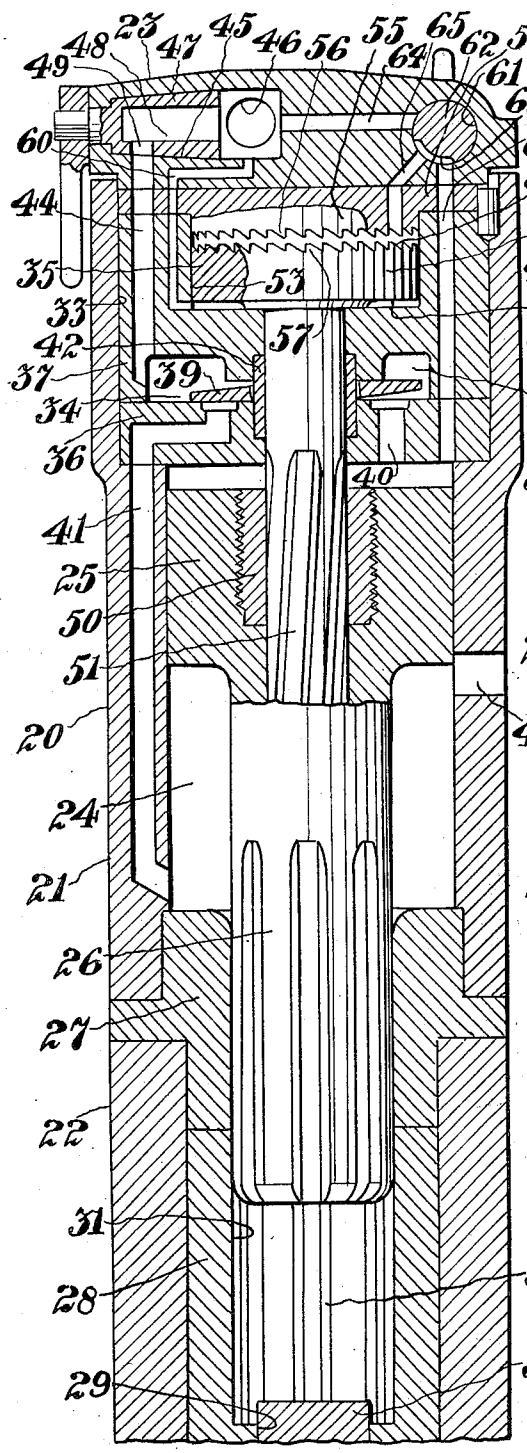



FIG.-1.

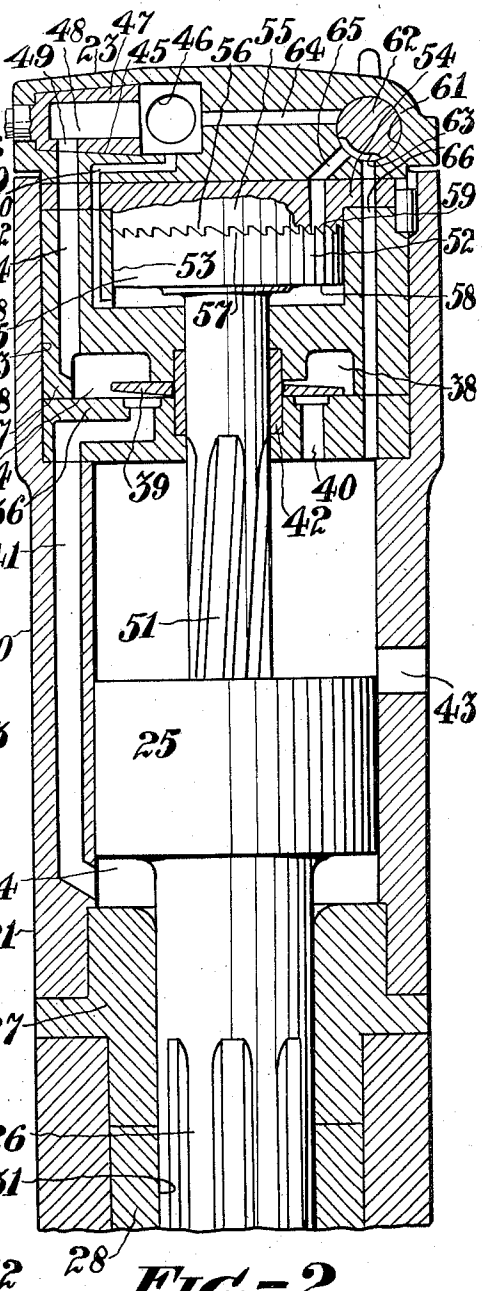



FIG.-2.

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ROTATION MECHANISM

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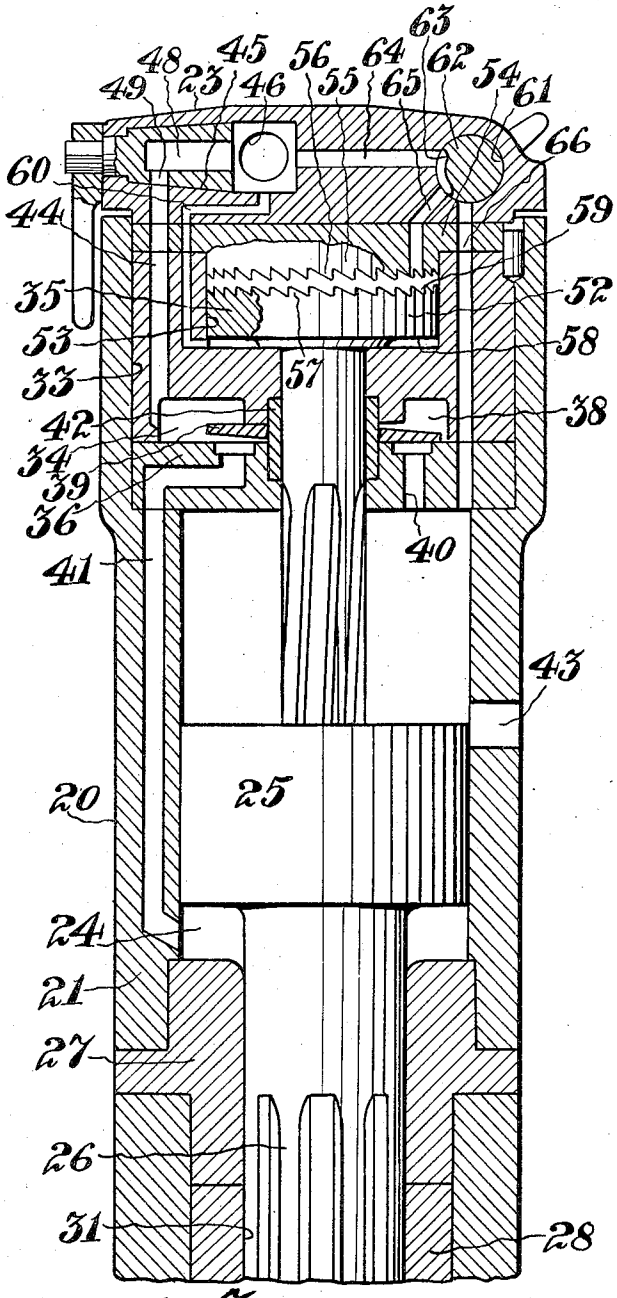



FIG. - 3.

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2,028,252

## ROTATION MECHANISM

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4 Claims. (Cl. 121—7)

This invention relates to rock drills, and more particularly to a rotation mechanism for fluid actuated rock drills of the reciprocatory hammer type.

One object of the invention is to effect rotative movement of the working implement in an improved and simplified manner.

Another object is to simplify the construction and reduce the number of parts of a rock drill embodying mechanism for rotatively shifting the drill steel between blows of the hammer piston.

Still another object is to enable the rotation mechanism to be selectively rendered effective or non-effective at the will of the operator.

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

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

Figures 1, 2 and 3 are elevations, in section, of a rock drill equipped with rotation mechanism constructed in accordance with the practice of the invention and showing the rifle bar in its limiting positions.

Referring more particularly to the drawings, 20 designates, in general, a rock drill comprising a cylinder 21 and front and back heads 22 and 23, respectively. These parts constitute the casing of the rock drill and may be secured in the correct relationship with respect to each other in any suitable manner, as for instance by side bolts (not shown) extending longitudinally along the exterior of the rock drill.

In the cylinder 21 is a piston chamber 24 containing a piston 25 having a fluted stem 26 at its front end which extends slidably through a front cylinder washer 27 interposed between the cylinder and the front head and extending into each.

The front head encases a rotary chuck 28 which is provided with a suitable bore 29 in its forward portion to receive and interlockingly engage a working implement 30, only the shank of which is shown. The rearward portion 31 of the bore 29 is suitably proportioned to receive the stem 26 of the piston and has a plurality of ribs 32 which extend into the flutes of the stem 26.

In the rear end of the cylinder 21 is an enlarged bore 33 for the accommodation of valve mechanism 34 and rotation mechanism 35. The valve mechanism is preferably arranged adjacent the rear end of the piston chamber 24 and comprises a valve seat 36 in the form of a plate which acts as a closure for the rear end of the piston chamber 24.

The plate 36 supports a block 37 having a valve chamber 38 which contains a valve 39 in the form of an oscillatory plate to control inlet passages 40 and 41 leading from the valve chamber 38 to the rear and front ends, respectively, of the piston chamber 24. The valve 39 is held against lateral movement by a bushing 42 seated in the plate 36 and the block 37. A free exhaust port 43 in the cylinder 21 provides an outlet for the exhaust fluid and is controlled by the piston.

The pressure fluid distributed by the valve 39 flows to the valve chamber 38 through a supply passage 44 in the block 37 and the back head 23 and leading to a throttle valve chamber 45 in the back head. The throttle valve chamber 45 is in constant communication with a source of pressure fluid supply through a port 46 and contains a throttle valve 47, of the rotary type, having a central chamber 48 to which pressure fluid is constantly supplied from the port 46.

In the side of the throttle valve 47 is a port 49 to register with the supply passage 44. Thus, when the throttle valve 47 occupies its open position, and in which the port 49 is in registry with the passage 44, pressure fluid flows directly from supply to the valve chamber 38. The valve 39 will then operate to distribute the pressure fluid to the ends of the piston chamber, in a well known manner, for actuating the piston 25.

The rearward portion of the piston 25 contains a nut 50 which may be fluted to interlockingly engage a rifle bar 51 whereby rotation of the piston 25, the chuck 28 and the working implement 30 is effected. The rifle bar 51 is journalled, for rotative and reciprocatory movements, in the block 37, the bushing 42 and the plate 36 and carries a head 52 which lies within the recess 53 in the rear end of the block 37. The recess 53 is of somewhat greater length than the head 52 to enable the head to reciprocate therein, and the rear end of the recess 53 is sealed by a plate 54 interposed between the back head and the block 37.

On the plate 54 is a cylindrical projection 55 which extends into the rear end of the recess 53, and on the opposing surfaces of the projection 55 and the head 52 are clutch teeth 56 and 57, respectively, which are adapted to engage each other for holding the rifle bar 51 against rotary movement during one stroke of the piston, preferably during the rearward stroke.

The front and rear ends of the head 52 of the rifle bar constitute pressure surfaces 58 and

59, respectively, against which pressure fluid acts for reciprocating the rifle bar 51 to cause engagement and disengagement between the clutch teeth 57 and 56. The pressure surface 58 is of smaller area than the pressure surface 59 and is constantly exposed to pressure fluid conveyed into the front end of the recess 53 by a supply passage 60 which is in constant communication with the port 46 so that, in the absence of an opposing pressure, the pressure fluid in the front end of the recess will shift the rifle bar to maintain the clutch teeth 57 and 56 in engagement with each other.

Means are provided for selectively subjecting the pressure surface 59 intermittently or constantly to pressure fluid, depending upon whether it be intended to permit reciprocation of the rifle bar and consequent intermittent engagement with the clutch teeth 56 or to maintain the rifle bar out of engagement with the clutch teeth 56 for prolonged periods of operation of the hammer piston 25. The back head 23 is accordingly provided with a bore 61 for the accommodation of a rotary valve 62 having a channel 63, in its periphery, to afford communication between a series of passages 64, 65 and 66.

The passages 64 and 66 are, in effect, supply passages. The former leads from the throttle valve chamber 45 to the bore 61 and the latter from the bore 61 to the rear end of the piston chamber 24, while the passage 65, which serves as a kicker passage, leads from the bore 61 to the pressure surface 59.

The operation of the device is as follows: With the throttle valve 47 occupying a position in which the port 49 registers with the supply passage 44, pressure fluid flows into the valve chamber 38 where it is distributed by the valve 39, to the ends of the piston chamber 24 to actuate the piston 25. If then the valve 62 be rotated to a position in which the channel 63 establishes communication between the kicker passage 65 and the supply passage 66 a portion of the pressure fluid admitted into the rear end of the piston chamber, for driving the piston 25 forwardly, flows to the pressure surface 59 and actuates the rifle bar forwardly to disengage the clutch teeth 57 from the teeth 56 at the beginning of each forward stroke of the piston.

The pressure fluid in the rear end of the recess 53 holds the rifle bar 51 in its foremost limiting position until the piston uncovers the free exhaust port 43, whereupon the rear end of the piston chamber and the channels and spaces communicating therewith are evacuated. The pressure fluid acting against the constant pressure area 58 will then return the rifle bar into interlocking engagement with the teeth 56. Thus, during its rearward stroke the piston is caused to describe a partial revolution and rotate the working implement to a new position in the drill hole for the succeeding blow of the piston 25.

The teeth 57 and 56 will remain interlocked until the rear ends of the piston chamber and the recess 53 are again charged with pressure fluid to disconnect the rifle bar from the teeth 56 and thereby permit of its free rotation during the forward stroke of the piston.

The cycle of operations may continue as described until the hole has been drilled, or until conditions require discontinuance of rotative movement of the drill steel. For the latter requirement the valve 62 is rotated to a position in which the channel 63 affords communication only between the kicker passage 65 and the supply passage 64. A constant supply of pressure fluid will thereby be maintained in the rear end of the recess 53. Inasmuch as the pressure surface 59 is of greater area than the surface 58 the pressure fluid acting against the former surface will maintain the rifle bar in its foremost limiting position where it will be held securely until it is again desired to rotate the working implement. The valve 62 is then returned to its former position to cause intermittent engagement of the teeth 57 with the teeth 56.

In practice, the present invention has been found to be a highly desirable device for effecting rotary movement of the working implement. The rotation mechanism comprises only a few parts of simplified construction and is positive in operation. It is, moreover, instantly responsive to changes in the direction of travel of the piston since, as will be readily understood, the rifle bar is subjected to both the force of the pressure fluid acting against its pressure surfaces and to the frictional drag of the piston.

I claim:

1. A rotation mechanism, comprising a reciprocatory rifle bar, an abutment therefor, clutch members on the rifle bar and the abutment adapted to engage each other, a pressure surface on the rifle bar constantly exposed to pressure fluid tending to actuate the rifle bar for bringing the clutch members into engagement with each other, an opposed pressure surface on the rifle bar of greater area than the first said surface, and means for selectively exposing the pressure surface of greater area to pressure fluid to actuate the rifle bar for disengaging the clutch members.

2. In a fluid actuated rock drill, the combination of a casing having a piston chamber and a reciprocatory piston in the piston chamber, a reciprocatory rifle bar interlockingly engaging the piston, clutch members on the casing and the rifle bar adapted to engage each other, opposed differential pressure surfaces on the rifle bar, the pressure surface of smaller area being constantly exposed to pressure fluid tending to actuate the rifle bar to one limiting position, and means for selectively supplying constant or intermittent charges of pressure fluid to the other pressure surface for actuating the rifle bar to another limiting position.

3. In a fluid actuated rock drill, the combination of a casing having a piston chamber and a reciprocatory piston in the piston chamber, a reciprocatory rifle bar interlockingly engaging the piston, clutch members on the casing and the rifle bar adapted to engage each other, opposed differential pressure surfaces on the rifle bar, the pressure surface of smaller area being constantly subjected to pressure fluid tending to move the rifle bar for effecting engagement between the clutch members, a kicker passage leading to the other pressure surface and having a branch passage leading to supply and another branch passage leading to the piston chamber, and a valve for selectively communicating the kicker passage with either branch passage.

4. In a fluid actuated rock drill, the combination of a casing having a piston chamber and a reciprocatory piston in the piston chamber, a reciprocatory rifle bar interlockingly engaging

the piston, clutch members on the casing and the rifle bar adapted to engage each other, opposed differential pressure surfaces on the rifle bar, the pressure surface of smaller area being constantly subjected to pressure fluid tending to move the rifle bar for effecting engagement between the clutch members, a valve chamber, a kicker passage leading from the valve chamber to the other pressure surface, a supply passage leading from the valve chamber to the rear end of the piston chamber, a second supply passage leading from the valve chamber to a source of pressure fluid supply, and a valve in the valve chamber for controlling communication between the kicker passage and the supply passages.

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