

July 17, 1956

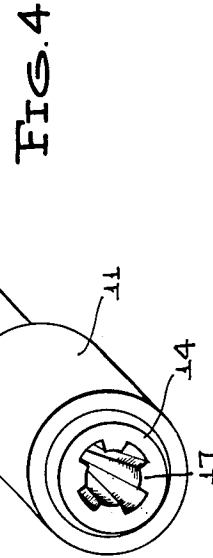
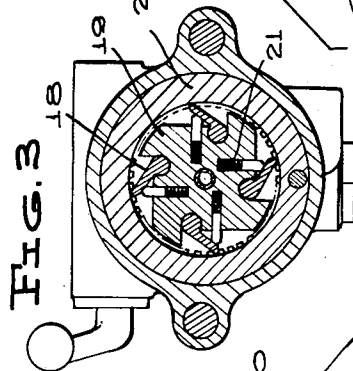
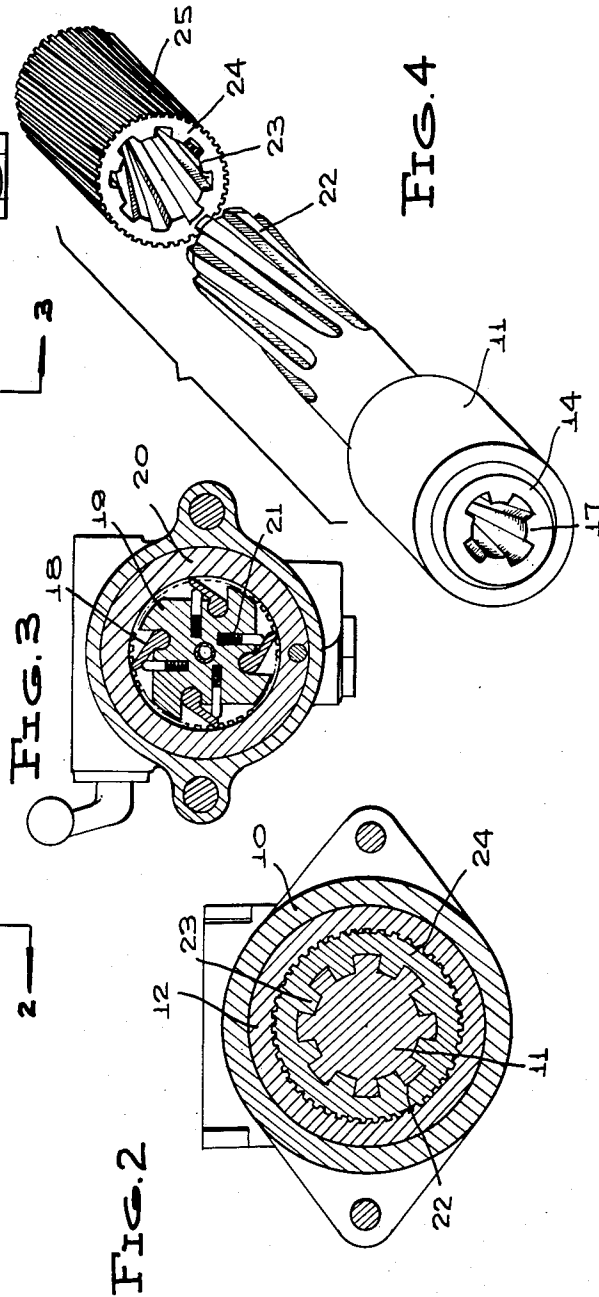
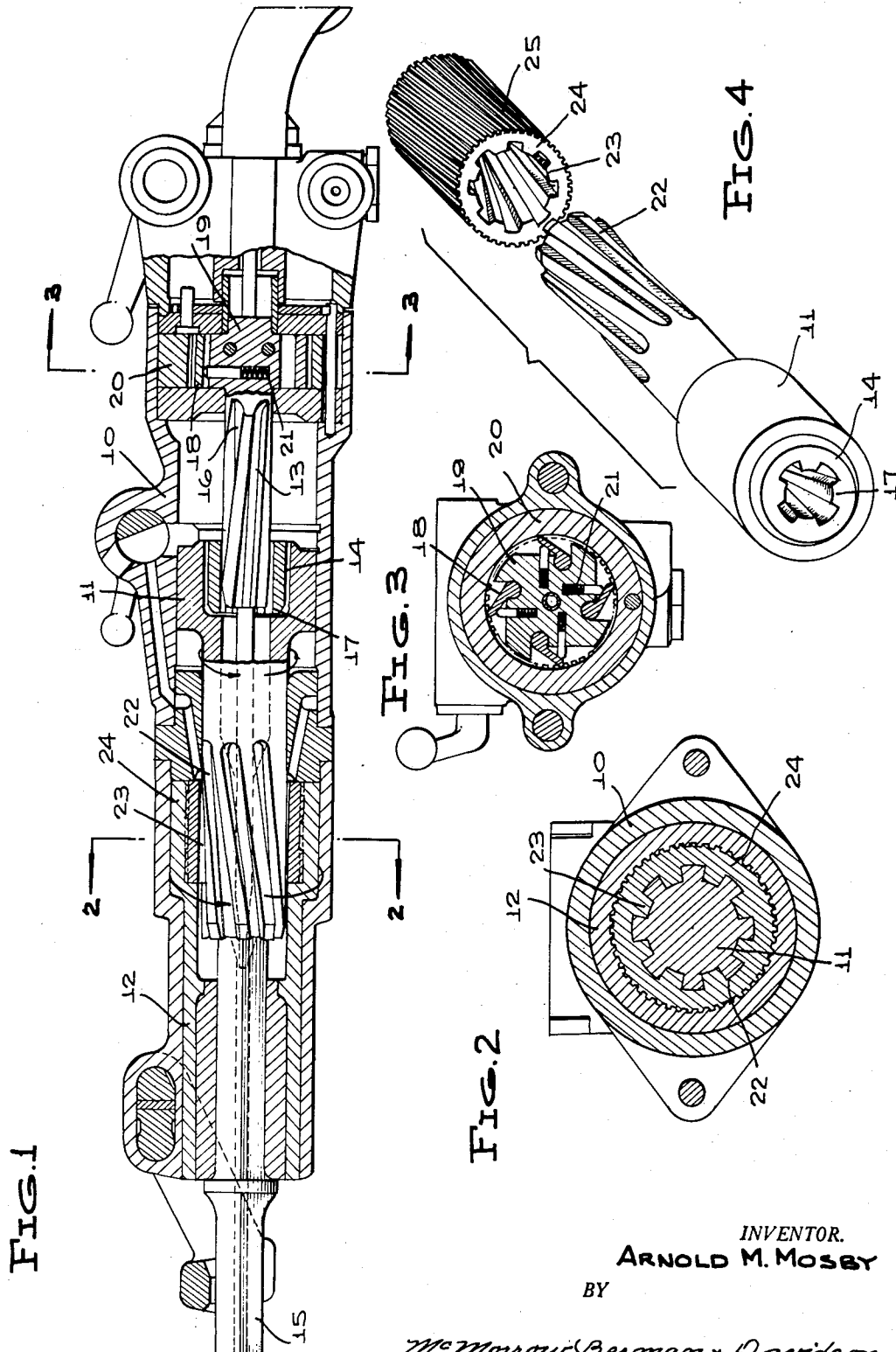
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ROTATION MECHANISM FOR ROCK DRILLS

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FIG. 5

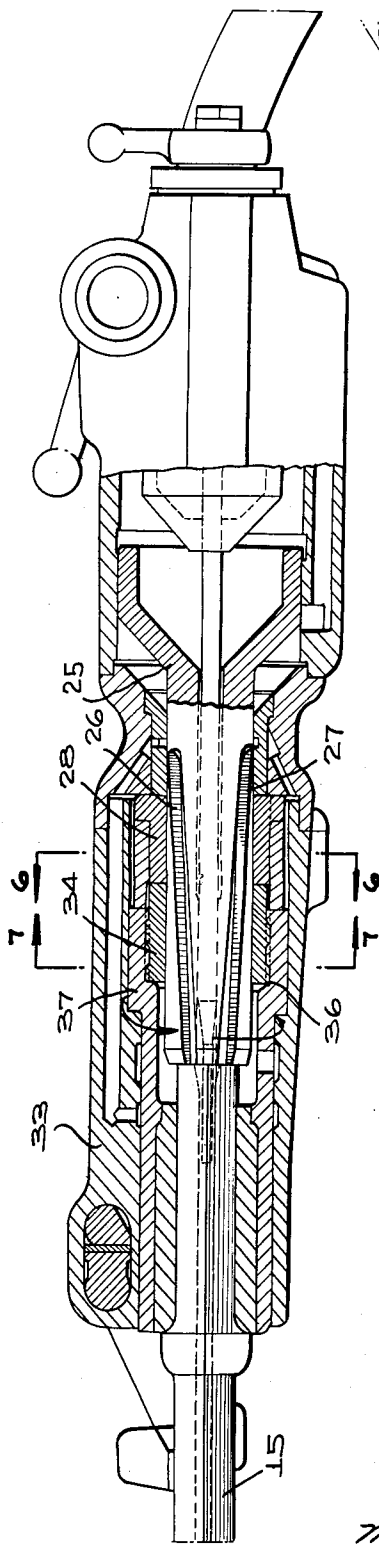


FIG. 6

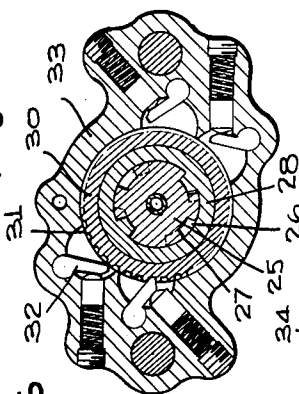


FIG. 7

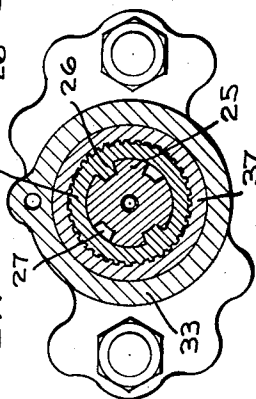
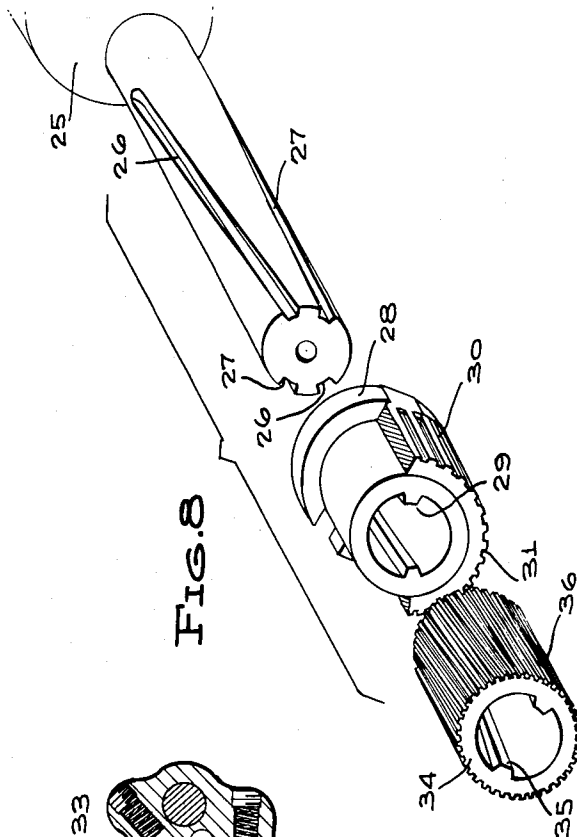


FIG. 8



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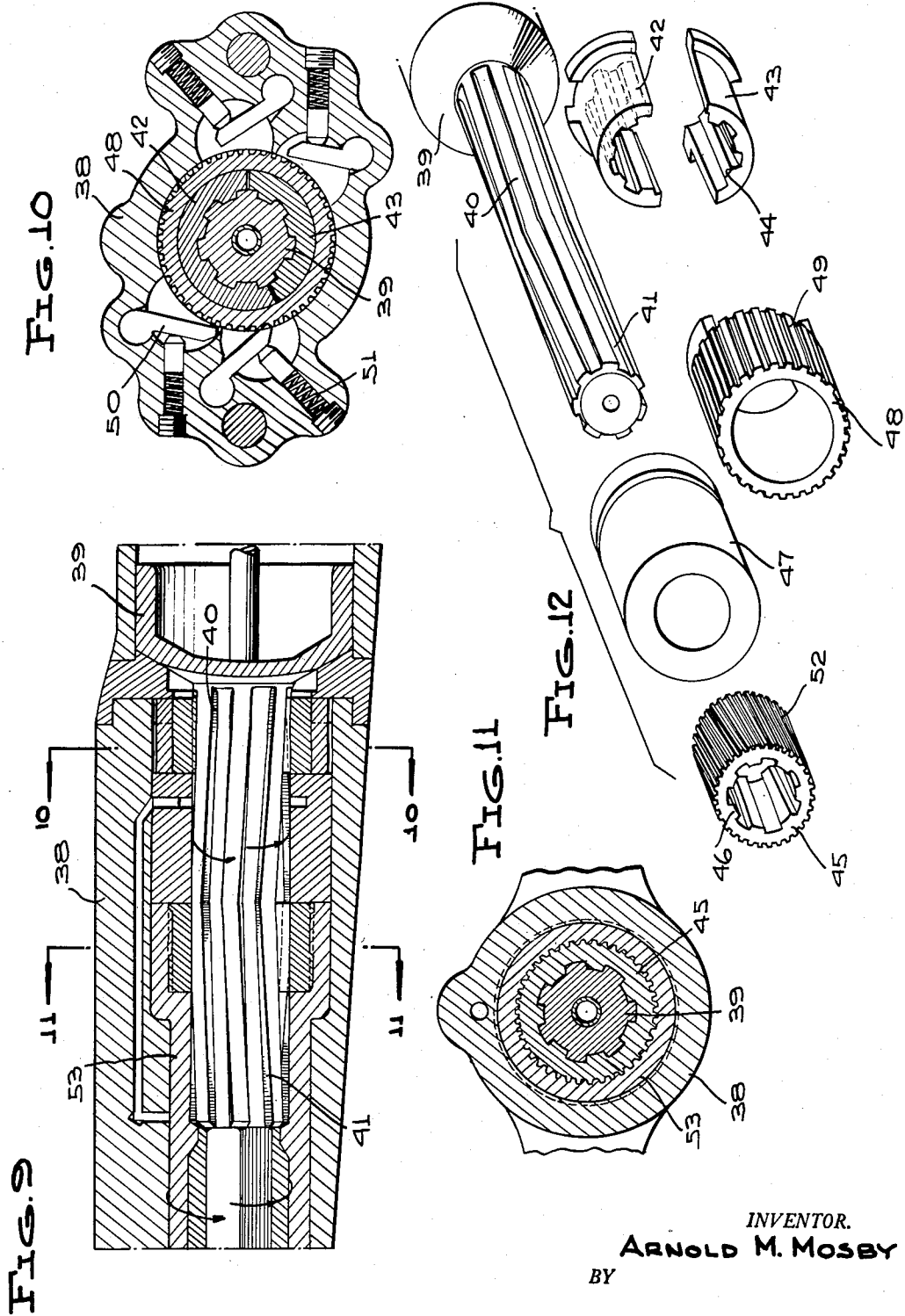
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ROTATION MECHANISM FOR ROCK DRILLS

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5 Claims. (Cl. 255—38)

The present invention relates to rock drills of the fluted actuated type and in particular to the rotation mechanism for a rock drill of that type.

The primary object of the present invention is to provide a rotation mechanism for a rock drill which rotates the drill at the conventional speed with the piston traveling half the conventional distance.

Another object of the present invention is to provide a rotation mechanism for a rock drill which is sturdy, not subject to excessive wear and one which will stand long periods of usage as well as one in which the piston travel has been shortened permitting a lighter weight piston but keeping the same speed of rotation of the drill.

These and other objects and advantages of the present invention will be more fully apparent from the following description when taken in connection with the annexed drawings, in which:

Figure 1 is a side view in cross-section of a rock drill embodying the construction of the present invention,

Figure 2 is an end view in cross-section on line 2—2 of Figure 1,

Figure 3 is an end view in cross-section on line 3—3 of Figure 1,

Figure 4 is a view in perspective of the essential components of the present invention as applied to the rock drill of the type shown in Figure 1,

Figure 5 is a side view in cross-section of a further type of rock drill, showing the employment of the construction of the present invention,

Figure 6 is an end view in cross-section on line 6—6 of Figure 5,

Figure 7 is a further end view in cross-section on line 7—7 of Figure 5,

Figure 8 is a view in perspective of the essential components of the second type of rock drill using the construction of the present invention,

Figure 9 is a view in cross-section of a rock drill constructed according to the present invention,

Figure 10 is an end view in cross-section on line 10—10 of Figure 9,

Figure 11 is a further end view in cross-section on line 11—11 of Figure 9, and

Figure 12 is a view in perspective of the components of the present invention as used in a rock drill constructed according to the present invention.

In the rock or pneumatic hammer drills, as heretofore proposed, the rifle bar and rifle nut have spiral flutes and cooperating followers, respectively, enabling the piston to rotate on one of its strokes, usually the upstroke or return stroke.

The chuck nut connects the piston to the chuck with the piston having flutes which are engaged by cooperating followers carried by the chuck nut, the flutes being either spiral and extending in the same direction as the flutes on the rifle bar, or being straight, enabling the chuck to be partially rotated by the piston as the latter executes its upstroke or return stroke and causing the cutting edge of the drill to turn within the hole being drilled.

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Referring to Figures 1 to 4, inclusive, the pneumatic hammer drill comprises a hollow cylinder 10, a reciprocal piston 11, a rotatable chuck 12, a rifle bar 13, and a rifle nut 14. A drill steel 15 is held by the chuck 12 for striking by the end of the piston 11.

The rifle bar 13 inwardly of one end thereof has spiral flutes 16 which are engaged by cooperating followers 17 carried by the rifle nut 14.

The other end of the rifle bar 13 has operatively connected thereto a ratchet mechanism comprising dogs 18 carried by the enlarged end 19 of the rifle bar, the dogs being in engagement with notches or grooves cut in the inner periphery of a ratchet box 20 secured within one end of the cylinder 10. Springs 21 bias the dogs 18 into engagement with the grooves of the ratchet box 20 preventing the rotation in one direction of the rifle bar 13.

Means is operatively connected to the piston for causing the piston in executing its reciprocatory movement in one direction to move by a rotational sliding movement and in executing its reciprocatory movement in the opposite direction to move by a rotational sliding movement. Such means embodies spiral flutes formed on a portion of the piston 11 and a nut 24 having on its inner periphery cooperating followers engageable in said flutes, the flutes being pitched in the opposite direction to that of the flutes on the rifle bar.

In the form of the invention shown in Figures 1 to 4, inclusive, such means constitutes flutes 22 on the striking end of the piston 11 and in which ride the followers 23 formed on the inner periphery of the nut 24.

The nut 24 is provided on its outer periphery with spiral splines 25 which are pitched to the same direction, and to approximately the same degree, as are the spiral flutes 22 on the piston 11. The said spiral splines 25 engage grooves cut in the inner periphery of the end of the chuck 12 for connecting the piston 11 to the chuck 12.

The pitch of the flutes 16 and 22 on the rifle bar 13 and on the piston 11 respectively may be such as to cause one revolution of the chuck in every 20, 30, or 40 reciprocatory movements of the piston.

In the operation of this pneumatic hammer drill, the rifle bar 13 is held by the ratchet mechanism for rotation in only one direction. Upon the downstroke or striking stroke of the piston 11, the flutes 16 on the rifle bar 13 and the followers 17 upon the rifle nut 14 impart a rotary motion to the rifle bar 13, the inertia and weight of the rifle bar 13 being less than that of the piston. Upon the upstroke or return stroke of the piston 11, the rifle bar is held from rotation and the followers 17 riding in the flutes 16 impart a rotary motion to the piston 11 in the direction of the arrow, as shown in Figure 1.

During the upstroke or return stroke of the piston 11, the flutes 22 on the piston and the followers 23 on the nut 24 cause the nut 24 and the connected chuck 12 to rotate in the same direction as the piston but for twice the distance of rotation of the piston.

On the down stroke or striking stroke, the piston will turn so that the flutes 22 slide between the followers 23, the weight of the piston 11 being less than the weight of the chuck 12 with the attached drill steel.

The pitch of the flutes 16 and 22 may be the same and may be at such an angle with respect to the longitudinal axis of the rifle bar 13 and the piston 11 that the impact of the respective flutes and followers be negligible and the resultant rotation of the drill steel be the same as in rock drills heretofore proposed in which only the rifle bar and the rifle nut had spiral flutes and followers, respectively. To obtain the same degree or speed of rotation in the rock drill heretofore proposed, the pitch of the flutes would be much greater than that employed in the present invention.

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In the form of the rock drill shown in Figures 5 to 8, inclusive, the rifle bar and the rifle nut are omitted and the piston 25 is provided on a portion inwardly of one end with opposed pairs of flutes 26 and 27 which are disposed in spiral arrangement upon such portion of the piston 25 with the flutes of one pair being pitched in a direction opposite to the pitch of the flutes of the other pair.

A nut 28 provided with cooperating followers 29 slides upon the striking end of the piston 25 with the followers 29 engaged in the pair of piston upstroke flutes 27.

A sleeve 30 is secured to the impeller nut 28 and is provided on its outer periphery with grooves or notches 31 which are engaged by the dogs 32 carried in the wall of the cylinder 33 and permit the rotation of the nut 28 in only one direction.

A chuck nut 34 is provided with cooperating followers 35 which engage the other pair of flutes 26 on the piston 25. The outer periphery of the nut 34 is provided with spiral splines 36 which fit within the spiral grooves formed on the inner wall of the chuck 37 and secure the chuck nut 34 to the chuck 37 for rotational movement of the latter upon reciprocal motion of the piston 25 during its upstroke when the nut is held from rotation by the dogs 32.

The operation of this form of the invention is similar to that of the form shown in Figures 1 to 4, inclusive. The pair of flutes 27 and the cooperating followers 29 on the nut 28 cause the piston to rotate counterclockwise upon its upstroke and effect the further counterclockwise rotation of the chuck 37 for twice the distance of rotation of the piston 25.

But in addition, the piston 25 can effect the same speed of standard counterclockwise rotation on its downstroke, when desired, as is more usually effected upon its upstroke. To perform downstroke rotation, the cooperating followers 29 on the nut 28 are pitched to engage the pair of flutes 26 on the piston 25, and the cooperating followers 35 of the nut 34 are pitched to engage the pair of flutes 27 on the piston 25.

On the downstroke, the lighter weight and less inertia of the nut 28 with respect to the weight and inertia of the piston 25 causes the nut 28 to rotate, the piston also rotating because it is lighter in weight and has less inertia than the chuck and the attached drill steel. This rotation on the down stroke is not positive with respect to the piston and little impact on the flutes and associated followers results. It will be seen that because of the pitch of the flutes 26 and 27 being the same, the chuck is caused to rotate twice as far as the piston.

In the third form of the invention, the rifle nut and the rifle bar are again omitted and the cylinder 38 has slidable within it a piston 39 having on a portion inwardly of one end flutes 40 and 41 disposed in end to end relation with respect to each other.

The flutes 40 and 41 have identical pitches but are arranged upon the piston 39 in opposite directions. The nut is formed from two halves 42 and 43, each half being provided with the followers 44 which engage and ride in the flutes 40 on the piston 39. A nut 45 has followers 46 which ride in the flutes 41. A transistor sleeve 47 is disposed between the nut and the nut and is dimensioned in length equal to the greatest length of stroke of the piston 39 so that the nut and the nut slide upon their respective portions of the piston 39.

The nut is provided with a ratchet sleeve 48 having its outer periphery formed with grooves or notches 49 which are engaged by the dogs 50 which prevent the ratchet sleeve 48 from rotating in one direction. Springs 51 carried in the cylinder 38 bias the dogs 50 into engagement with the notches in the ratchet sleeve 48.

The nut 45 is provided with spiral splines 52 on its outer periphery, pitched to the same direction, and the same degree, as the spiral flutes 41 on the piston 39,

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the spiral splines 52 engaging the internal spiral splines in the chuck 53 to secure the nut. The spiral splines 52 are pitched to the same left-hand direction whether the counterclockwise rotation of the chuck 53 is to be effected by the upstroke of the piston or by the special-purpose downstroke of the piston.

The operation of this form of the invention is the same as that of the forms previously described. Upon the return or upstroke of the piston 39, the dogs 50 engaging the grooves or notches 49 in the ratchet sleeve 48 prevent the nut from turning and cause the piston 39 to rotate in the direction shown by the arrow in Figure 9.

The nut with its associated followers riding in the flutes on the piston 39 cause the chuck to rotate in the direction indicated by the arrows in Figure 9 also, and for twice the distance of rotation of the piston.

In each of the three forms of the invention here described, the rotation of the chuck is twice that of the piston. In most industrial applications of the rock drill or pneumatic hammer drill, cooperating flutes of the chuck nut and the rifle bar are pitched at one of three standard degrees of pitch so that the speed of rotation of the drill is at one revolution for every 20, 30, or 40 reciprocating strokes of the piston. It is seen therefore that when the chuck rotates at twice the speed of the piston, the stroke of the piston may be cut to half or approximately half to obtain the same speed of rotation of the chuck and its attached drill steel with a shorter stroke of piston. The weight of the piston may be considerably less and higher speeds of operation are thereby permitted.

The present invention also permits the pitch of the flutes to be less on each of the components having the flutes in order to obtain the same speed of rotation of the drill steel. When the piston or the rifle bar is formed with flutes having the minimum pitch, there is less wear and damage to the flutes and their respective followers by the impact of the piston in each direction of reciprocatory motion.

By the means so described, in all three forms of this invention, the nut is so secured within the chuck that the reciprocating movement of the piston, which with upstroke rotation tends to extract the chuck nut from the chuck, is exactly countered and effectively neutralized. No adjustment of pitch to downstroke rotation is necessary. The chuck nut will not become impacted, or riveted, into the chuck and thereby be made extremely difficult to extract from the chuck when worn, as heretofore has been the problem resulting from the use of threaded chuck nuts and chucks.

In all three forms of this invention, the extractive pull of the piston against the chuck nut is reduced in proportion to the reduction in pitch of the related functioning rotation flutes and followers. By pitching the nut-securing splines equally with 20-stroke rotation splines on the striking end of the piston, or for the fastest speed of chuck rotation, the nut is secure at any other slower rotation speed.

What is claimed is:

1. In a pneumatic hammer drill, a hollow cylinder, a piston mounted in said cylinder for reciprocatory movement, means operatively connected to said piston for causing said piston in executing its reciprocatory movement in one direction to move by a rotational sliding movement and in executing its reciprocatory movement in the opposite direction to move by rotational sliding movement, said means embodying spiral flutes and a nut having on its inner periphery cooperating followers engageable with said flutes, a drill carrying chuck, and means connecting said chuck to said piston so that said chuck rotates when said piston is executing its reciprocatory movement in said opposite direction, said last named means embodying spiral flutes formed on said piston and pitched in a direction opposite to that of the pitch of said flutes of said

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first named means, a nut having on its inner periphery cooperating followers engageable with and riding back and forth in said flutes of said second named means, and interengaging means on the outer periphery of said second named nut and on said chuck.

2. In a pneumatic hammer drill, a hollow cylinder, a piston mounted in said cylinder for reciprocatory movement, means operatively connected to said piston for causing said piston in executing its reciprocatory movement in one direction to move by a rotational sliding movement and in executing its reciprocatory movement in the opposite direction to move by rotational sliding movement, said means embodying a rife bar having spiral flutes formed thereon and a nut having on its inner periphery cooperating followers engageable with said flutes, a drill carrying chuck, and means connecting said chuck to said piston so that said chuck rotates when said piston is executing its reciprocatory movement in said opposite direction, said last named means embodying spiral flutes formed on said piston and pitched in a direction opposite to that of the pitch of said flutes of said first named means, a nut having on its inner periphery cooperating followers engageable with and riding back and forth in said flutes of said second named means, and interengaging means on the outer periphery of said second named nut and on said chuck.

3. In a pneumatic drill, a hollow cylinder, a piston mounted in said cylinder for reciprocatory movement, spiral flutes extending longitudinally along a portion of said piston, a nut having on its inner periphery cooperating followers engageable with said flutes, said nut being operatively connected to said cylinder for rotational movement of said nut in one direction in response to rectilinear sliding movement of said piston in one direction and operatively connected to said piston for causing rotational movement of said piston upon execution of sliding movement of the latter in the opposite direction, other spiral flutes extending longitudinally along another portion of said piston, the first named flutes being pitched in a direction opposite to that of the pitch of said other flutes, a drill carrying chuck mounted in said cylinder for rotational movement, and another nut having on its inner periphery other cooperating followers engageable with said other flutes, said another nut being operatively connected to said chuck for rotational movement of said chuck in the same direction as said piston upon execution of sliding movement of said piston in said opposite direction.

4. In a pneumatic drill, a hollow cylinder, a piston mounted in said cylinder for reciprocatory movement, spiral flutes extending longitudinally along a portion of

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said piston, a nut having on its inner periphery cooperating followers engageable with said flutes, said nut being operatively connected to said cylinder for rotational movement of said nut in one direction in response to rectilinear sliding movement of said piston in one direction and operatively connected to said piston for causing rotational movement of said piston upon execution of said sliding movement of the latter in the opposite direction, other spiral flutes extending along said portion of said piston in the opposite direction to said first named flutes, the first named flutes being pitched in a direction opposite to that of the pitch of said other flutes, a drill carrying chuck mounted in said cylinder for rotational movement, and another nut having on its inner periphery other cooperating followers engageable with said other flutes, said another nut being operatively connected to said chuck for rotational movement of said chuck in the same direction as said piston upon execution of the sliding movement of said piston in the opposite direction.

5. In the pneumatic drill, a hollow cylinder, a piston mounted in said cylinder for reciprocatory movement, spiral flutes extending longitudinally along a portion of said piston, a nut having on its inner periphery cooperating followers engageable with said flutes, said nut being operatively connected with said cylinder for rotational movement of said nut in one direction in response to rectilinear sliding movement of said piston in one direction and operatively connected to said piston for causing rotational movement of said piston upon execution of the sliding movement of the latter in the opposite direction, other spiral flutes extending in end to end relation with respect to said first named flutes along another portion of said piston in the opposite direction and at the same angle as said first named flutes, the first named flutes being pitched in a direction opposite to that of the pitch of said other flutes, a drill carrying chuck mounted in said cylinder for rotational movement, and another nut having on its inner periphery other cooperating followers engageable with said flutes, said another nut being operatively connected to said chuck for rotational movement of said chuck in the same direction upon execution of the sliding movement of said piston in said opposite direction.

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