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3,171,501

RELEASE ROTATION MECHANISM FOR ROCK DRILLS

Filed May 15, 1962

2 Sheets-Sheet 1

FIG. 1

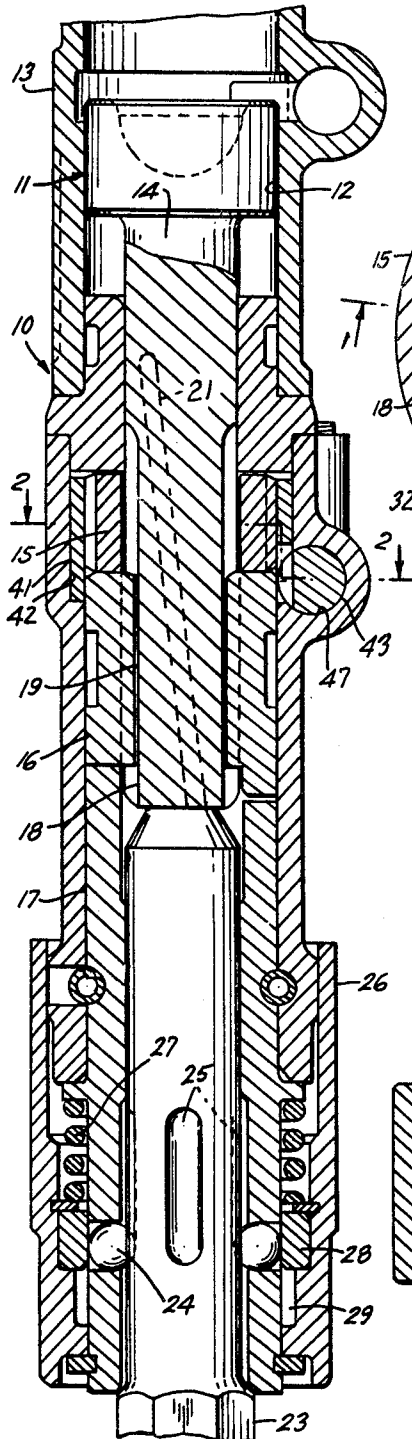


FIG. 2

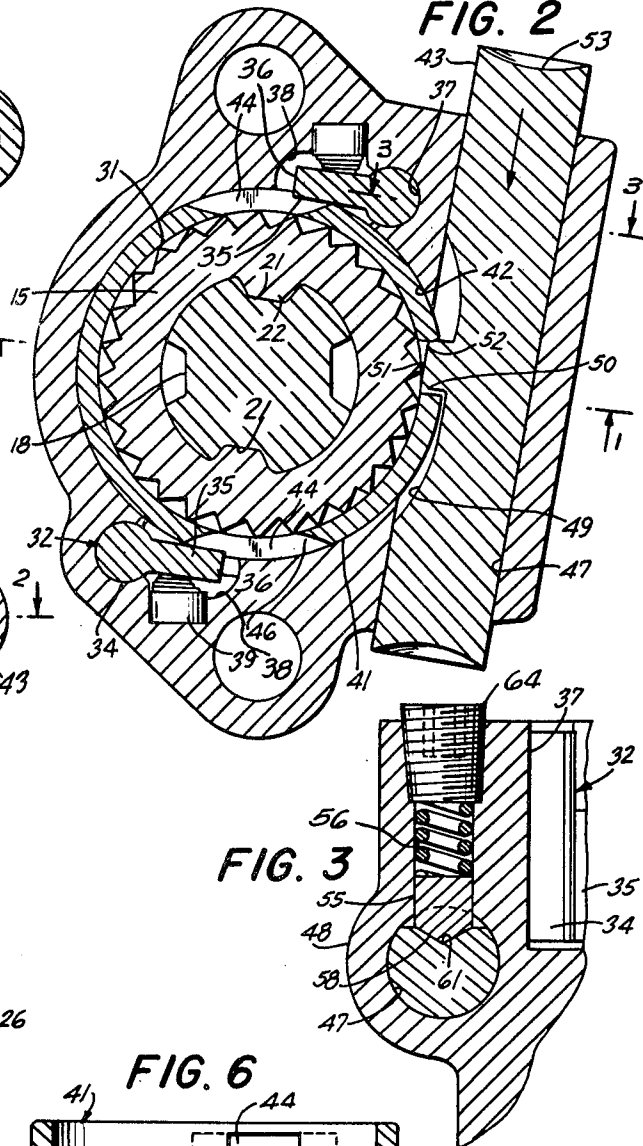


FIG. 3

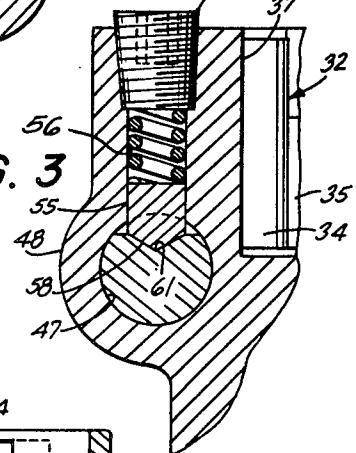
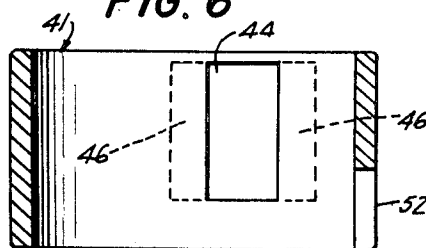


FIG. 6



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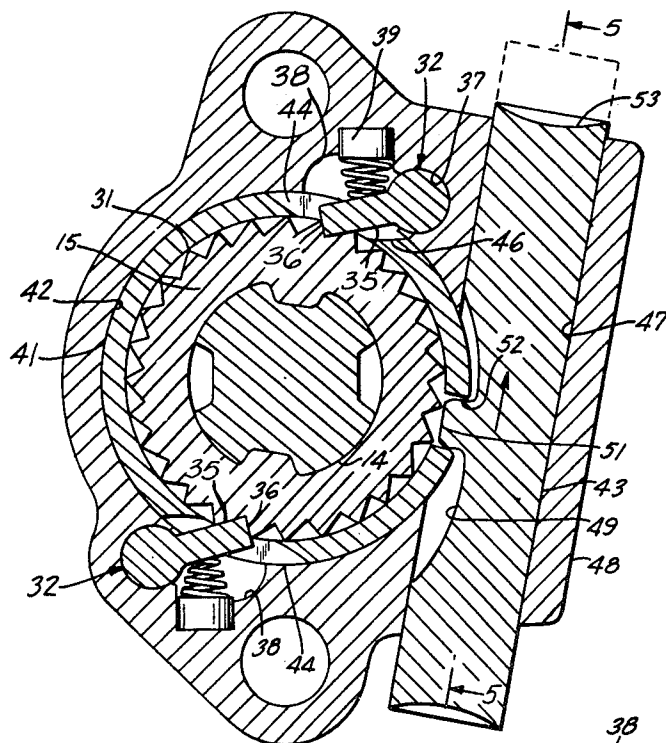


FIG. 4

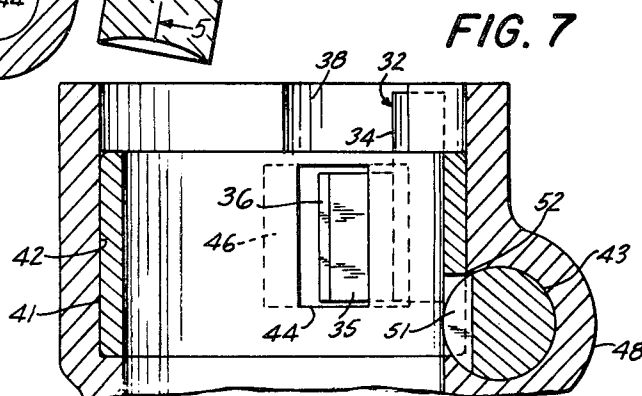


FIG. 7

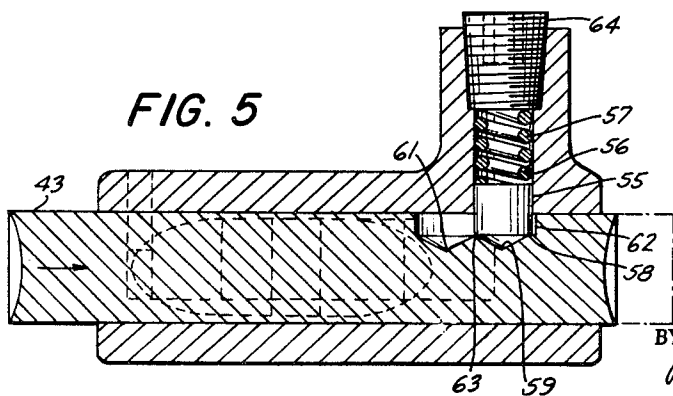


FIG. 5

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RELEASE ROTATION MECHANISM FOR
ROCK DRILLS

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This invention relates to pneumatically powered portable rock drills having a reciprocating hammer which functions in accordance with associated ratchet and pawl rotation mechanism to pound a work steel and to impart intermittent rotation to the latter. More particularly, this invention is concerned with a ratchet and pawl release rotation mechanism for such tools which enables the operator to selectively release the rotation mechanism relative to the reciprocating piston so as to enable the latter to merely pound the work steel without imparting rotation to it.

A rock drill tool in which the present invention is embodied serves the purposes of a rock drill when the reciprocating piston acts to pound the work steel and also to impart rotation to it; it serves the purposes of a concrete breaker, chipping hammer, or just a plain hammer, when the reciprocating piston acts to pound the work steel without effecting rotation thereof. An example in which the improved tool would be of special advantage is where it is desired to secure an anchor-bolt in a concrete wall. In such a case, the release rotation mechanism would be set for use of the tool as a rock drill to enable boring of a hole, in which hole a winged insert having a central bore is to be inserted. After the hole is drilled and the insert is inserted, the release rotation mechanism would be set to convert the rock drill into a hammer so as to enable a bolt to be pounded into the central bore of the insert. This advantageous dual use of the tool as a drill and as a hammer, represents a decided improvement over the steps taken to secure a bolt in a concrete wall illustrated in Patent 3,022,701 issued February 27, 1962 to Potruch. In the latter, a bore is first made in a wall for reception of an insert, and then a separate conventional claw hammer is used to pound an anchor bolt into the insert. This is only one illustration of various uses for which the dual functions of the tool, as improved by the present invention, may be employed to advantage.

The general object of this invention is to provide improved and practical manually operable release rotation mechanism for portable rock drills so as to enable such tools to be readily selectively converted from a rock drill in which a reciprocating piston pounds and imparts rotation to a work steel, to a tool in which the reciprocating piston merely pounds the work steel.

A feature of the invention is a selectively rotatable shifter sleeve which surrounds a ratchet ring associated with the reciprocating piston. This sleeve cooperates with a pair of pawls, in such manner that, when the sleeve is turned in one direction for a predetermined degree, the pawls are shifted clear of the ratchet ring; and when the sleeve is returned in the opposite direction, the pawls are enabled under the influence of a constant spring load to move into engagement with the ratchet ring.

Another feature of the invention is a manipulative shifter lever which is shiftable and cooperable with the shifter sleeve to cause selective rotation of the latter in one direction or the other.

A still further feature of the invention lies in means for releasably locking the shifter lever in its shifted position, so that it cannot be jarred or shaken loose from such position.

A still further feature of the invention lies in adjust-

able spring means which controls the degree of pressure required to effect operation of the shifter lever.

A still further feature of the invention lies in the structure of the shifter lever whereby the latter may be thumb or finger pressed in opposite directions.

A further feature of this invention is to provide a manipulative slide lever for selectively causing engagement or disengagement of ratchet pawls relative to a ratchet ring.

The invention further lies in the construction of its component parts and also in their cooperative association with each other whereby the various results intended herein are produced.

The foregoing and other objects and advantages of this invention will appear more fully hereinafter from a consideration of the detailed description which follows, taken together with the accompanying drawings wherein an embodiment of the invention is illustrated. It is to be expressly understood, however, that the drawings are for purposes of illustration and description and they are not to be construed as defining the limits of the invention.

In the drawings:

FIG. 1 is a longitudinal section taken on the line 1-1 of FIG. 2 through the front end section of a pneumatically powered rock drill in which the release rotation mechanism of the present invention is embodied.

FIGS. 2-7 are drawn to a larger scale than FIG. 1.

FIG. 2 is a sectional view taken on the line 2-2 of FIG. 1, and showing the release rotation mechanism in a condition in which the piston does not rotate;

FIG. 3 is a sectional view taken on the line 3-3 of FIG. 2, illustrating detent locking mechanism for the shifter lever;

FIG. 4 is a view similar to FIG. 2, but shows the release rotation mechanism in a condition enabling rotation of the piston;

FIG. 5 is a sectional view taken on the line 5-5 of FIG. 4 further illustrating the locking mechanism;

FIG. 6 is a detail of the shifter sleeve in longitudinal section; and

FIG. 7 is a detail in elevation showing the relation of the pawls with the shifter sleeve.

In the drawings there is shown the front end or lower portion 10 of a conventional portable pneumatically powered rock drill in which the release rotation mechanism of the present invention is embodied. The drill includes the usual hammer or piston 11 which is pneumatically reciprocal in a cylinder 12 of the housing 13 of the tool. The piston has an axially extending cylindrical stem portion 14 which reciprocates relative to a surrounding ratchet ring 15 and to a surrounding chuck sleeve or driver 16. The chuck sleeve is drivingly engaged to a chuck or work tool holder 17.

The piston stem 14 has a pair of straight or longitudinal spline grooves 18 therein with which complementary splines 19 of the chuck driver 16 are engaged; and the piston stem has a further pair of slightly helical or spiral spline grooves 21 with which complementary splines 22 of the ratchet ring 15 are engaged.

The piston is pneumatically reciprocable through the ratchet ring and chuck driver to pound a work steel 23. The latter is releasably retained in the chuck 17 by means of ball splines 24 carried by the chuck and engaged in longitudinal grooves 25 of the work steel. By means of the latter arrangement the work steel has limited axial movement relative to the chuck, and is also enabled to rotate as a unit with the chuck when rotation is imparted to the latter. The work steel may be released or removed from the chuck for replacement with another, by sliding a retainer sleeve member 26 upwardly against a spring load 27 so as to carry a blocking ring 28 away from the ball splines and thereby enable the ball splines to move

radially out of the grooves of the work steel into an annular recess 29.

The ratchet ring 15 has ratchet teeth 31 about its periphery which are engageable by a pair of diametrically arranged pawls 32 pivoted in the wall of the housing. When the pawls are engaged with the ratchet ring (FIG. 4), the latter is free to rotate in only one direction, but is restrained by the pawls from rotating in the opposite direction. When the pawls are disengaged from the ratchet ring (FIG. 2), the latter is released and free to rotate in either direction.

While the pawls are engaged, as in FIG. 4, with the ratchet ring, the tool serves the purposes of a rotation rock drill. In this respect, the reciprocating piston 11 moves on its forward or pounding stroke through the ratchet ring 15 and the chuck sleeve 16 without rotation. In this forward movement of the piston, the spiral splines of the piston cause the ratchet ring to rotate in its unrestrained or counterclockwise direction (FIG. 4). But, on the return stroke of the piston the latter is caused to rotate through a specific angle relative to the pawl restrained ratchet ring. The rotation of the piston is translated through the longitudinal grooves 18 and the splines 19 to rotate the chuck driver 16. The latter in turn acts to carry the chuck 17 about, causing rotation of the drill or work steel 23.

While the pawls are disengaged, as in FIG. 2, from the ratchet ring, only the ratchet ring rotates as the piston reciprocates. Accordingly, no rotation is imparted to the work steel on either the forward or the return stroke of the piston. In this condition the tool serves, according to the form of the work steel inserted in the chuck, as a concrete breaker, chipping hammer, plain hammer, or other tool wherein rotation is not desired.

Each pawl 32 has a cylindrical trunnion or pivot portion 34 (FIGS. 2, 3, 4, 7) from which radially extends a flat wing portion 35 having a squared end 36. The trunnion end 34 of the pawl is seated for turning movement in a complementary vertical pocket 37 of the housing. The wing portion 35 extends freely through an open area of the pocket into a recess 38 of the housing. Each pawl is pivotable under the influence of a constant spring load 39 to swing its wing portion 35 out of the recess 38 to engage the squared end 36 of the pawl with the teeth 31 of the ratchet ring. An annular shifter member or sleeve 41 arranged between the pawls and the ratchet ring is provided to selectively cause engagement with or disengagement of the pawls from the ratchet ring.

The shifter member sleeves the ratchet ring. The peripheral surface of the shifter sleeve bears against the interior wall 42 of the housing. The shifter sleeve is selectively rotatable relative to the ratchet ring by means of a shifter rod 43 to a first position as in FIG. 4, or to a second position as in FIG. 2. In its first position (FIG. 4) a pair of rectangular openings 44 in opposite wall areas of the shifter sleeve registers with the pawl recesses 38 allowing the wings of the pawls to swing under the influence of the springs 39 freely (FIG. 7) through the openings 44 into engagement with the ratchet ring. The shifter sleeve is movable counter-clockwise from this first position to the position shown in FIG. 2, in which the pawls are held pressed by the solid peripheral surface of the shifter sleeve against the load of the springs 39 and clear of the ratchet ring. The longitudinal sides of the rectangular openings in the shifter sleeve diverge outwardly to provide cam surfaces 46. As the shifter sleeve is rotated counter-clockwise from its first position (FIG. 4) to its second position (FIG. 2), one of the cam surfaces 46 of each opening 44 engages the flat wing 35 of the related pawl and shifts it radially clear of the ratchet ring. As each pawl is pivoted outwardly by this camming action of the shifter sleeve, the wing portion thereof rides over the cam surface onto the peripheral surface of the shifter sleeve, whereby the pawl is held disengaged from the ratchet ring.

The shifter rod 43 which is employed in moving the sleeve in either a clockwise or counter-clockwise direction, has an elongated cylindrical body which is slidable transversely of the housing in a bore 47 of a bossed portion 48 of the latter. The bore intersects the inner wall 42 of the housing, as appears in FIGS. 1, 2, 4, and 7. A peripheral surface portion of the shifter sleeve extends into the bore 47 and projects freely into a transverse arcuate cavity 49 of the shifter rod. A radial tongue or key 51 formed centrally of this cavity extends with a slight clearance into an undercut or slot 52 formed in the side wall of the sleeve. The opposite ends of the rod 43 project beyond the corresponding ends of the bossed portion 48; and each end of the rod has a finger well 53 whereby the rod may be thumb or finger pressed back and forth in the bossed portion.

If the rod is pressed in the direction of the arrow in FIG. 2, it will act through the key 51 to rotate the shifter sleeve 41 clockwise for a predetermined degree to bring the openings 44 into register with the corresponding recesses 38. This allows the pawls under the influence of their springs to move their wing portions through the openings 44 to engage the ratchet ring, as in FIG. 4. If the rod is pressed in the opposite direction (arrow in FIG. 4), it acts through the key to rotate the shifter sleeve counter-clockwise for a predetermined degree to cam or shift the pawls to swing the wing portion thereof into their respective recesses clear of the ratchet ring, as appears in FIG. 2. It is to be noted that the key 51 is slightly rounded at 50 on opposite sides thereof, so as to enable it to have a rolling camming action against the corresponding side walls; of the key slot 52.

Detent means is provided to limit the extent to which the rod 43 may be pressed in either direction, and thus it predetermines the degree of clockwise or counter-clockwise movement permitted to the sleeve. The detent means also serves to releasably lock the rod in each of its moved positions and as a consequence releasably locks the shifter sleeve and pawls in their shifted positions. The detent means includes a detent pin 55 which is slidable in a bore 56 of the housing and which acts under the influence of a yieldable spring 57 to move partly out of the bore to engage a coned end 58 thereof in one or the other of two coned pockets 59, 61 formed in the rod 43.

In FIG. 5, the coned end 58 of the detent is shown engaged in the pocket 59 and a cylindrical side cylinder wall area of the body of the detent is shown in abutment with a cylindrical wall area 62 of the pocket. In this position of the detent the rod 43 is blocked against any further movement to the left, thus limiting the counter-clockwise movement of the shifter sleeve to the position shown in FIG. 4. However, the shifter rod may be moved in the opposite direction, (arrow in FIG. 5). When the rod is thus moved, the detent is forced against the yieldable spring 57 out of the pocket 59 over the crest of the tooth 63, which separates one pocket from the other, and enters the pocket 61. This limits the movement of the shifter rod to the broken line position in FIG. 5, and thus limits the clockwise movement of the shifter sleeve to the position shown in FIG. 2. The force of the spring 57 acting upon the detent 55 may be adjusted by means of a screw 64.

What is claimed is:

1. In a rotation rock drill including a housing having therein a reciprocating piston, a ratchet ring surrounding the piston and having spiral splined engagement therewith, a pair of spring loaded pawls pivotable under the constant load of the springs into engagement with the ratchet ring and pivotable against the load of the springs out of such engagement; sleeve cam means surrounding the ratchet ring having rotation relative to the ratchet ring and pawls for camming the pawls out of engagement from the ratchet ring, wherein a shifter lever manually slidable in the housing transversely of the peripheral surface of the sleeve cam means has a key engagement with the latter

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for causing rotation of the sleeve accordingly as the shifter lever is selectively manually slid in one direction or the other, and spring loaded detent stop means is provided in the housing for releasably limiting the extent of movement of the shifter lever in either direction to a predetermined degree.

2. In a percussive rock drill including a rotatable ratchet ring the ratchet teeth of which are on its peripheral surface, a piston reciprocable axially of the ring having a helically splined connection with the latter, a casing block freely surrounding the ring, pawl elements mounted in the block having pivotable movement into and out of engagement with the teeth of the ring, spring means biasing the pawl elements into such engagement with the ring, a shifter sleeve disposed between the pawls and the ring in sleeved relation to the ring having rotation relative to the latter and to the pawls and including openings for allowing the pawls under the bias of the spring surface to engage the teeth of the ratchet ring therethrough as the sleeve is rotated in one direction for a predetermined degree and the openings having means for camming the pawls out of such engagement as the sleeve is rotated in the opposite direction for a predetermined degree, the improvement comprising a bore extending through the casing block transversely relative to the sleeve and intersecting a segment of the peripheral portion of the sleeve, a key slot in the segment, a shifter rod manually slidable in said bore and projecting at its ends from opposite sides of the casing block, a longitudinally extending cavity in the peripheral surface of said shifter rod in which the said segment is freely received, a radially extending key formed centrally of the cavity and engaged in the key slot, the key being cooperable with the slot to cause said rotation of the sleeve in either direction accordingly as the shifter rod is selectively slid in one direction or the other to a predetermined degree, and the radial extent of the key being limited to the periphery of the shifter rod.

3. In a percussive rock drill as in claim 2, wherein each pawl element has a winged portion movable through one of the openings of the sleeve into engagement with the teeth of the ratchet ring, and each opening in the sleeve has a beveled edge defining a cam surface engageable with the winged portion of the related pawl so as to cam the latter outwardly of the opening as the sleeve is rotated in a selected direction.

4. In a percussive rock drill as in claim 2, wherein detent stop means is provided for releasably locking the shifter rod in its selectively moved position and stopping

further movement of the shifter rod in the selected direction after it has moved a predetermined distance.

5. In a rotation rock drill including a casing, a percussive piston reciprocable in the casing, and rotation release mechanism including a ratchet ring having an internal helically splined connection with the piston for controlling rotation of the piston, pawl elements pivoted in the casing and spring biased into engagement with the ratchet ring, and a cam sleeve having rotation between the pawl elements and the ratchet ring for camming the pawl elements out of such engagement when rotated in one direction and for allowing the pawl elements to return into such engagement when rotated in the opposite direction, the improvement comprising a key slot in the periphery of the cam sleeve, a bore extending through the casing wall intersecting a segment of the periphery of the cam sleeve, a rod manually slidable in the bore having a longitudinally extending arcuate cavity in its surface between the ends of the rods, the intersected segment of the cam sleeve extending freely into the cavity, and a key extending radially from the bottom of the cavity into the key slot, the key cooperating with the slot when the rod is slid in one direction or the other to rotate the sleeve in a corresponding direction, and the key not extending beyond the peripheral surface of the rod whereby the rod may be slid free of the bore upon removal of the key from the slot.

6. In a rotation rock drill as in claim 5, wherein the slot opens through the bottom end of the sleeve, whereby the walls of the slot overlie corresponding wall areas of the key, and the bottom end of the slot being open relative to the corresponding wall area of the key.

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