Feb. 24, 1970 J. J. O'BRIEN 3,497,125

POWER-ACTUATED TOOL

Filed July 11, 1967 2 Sheets-Sheet 1

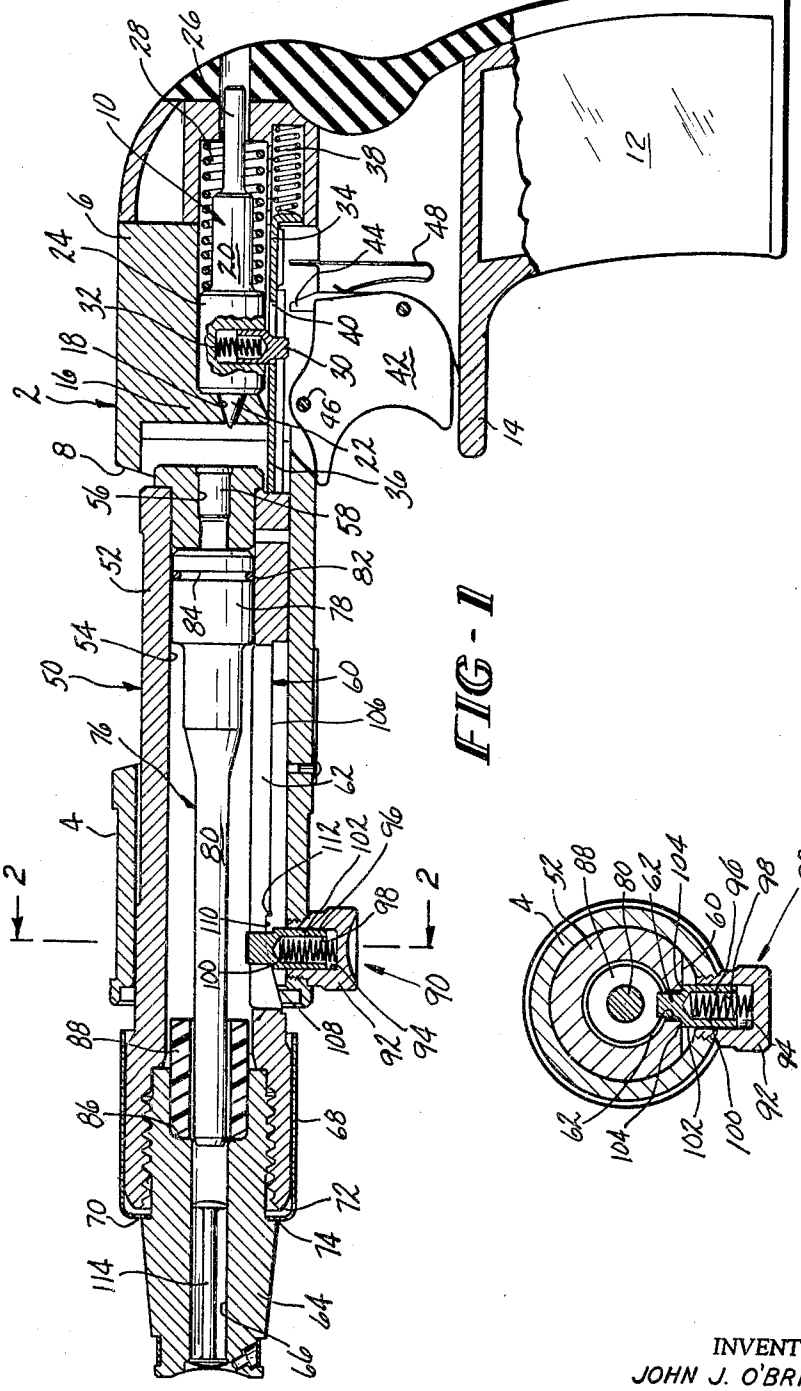

FIG - 1

FIG - 2

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Filed July 11, 1967 2 Sheets-Sheet 2

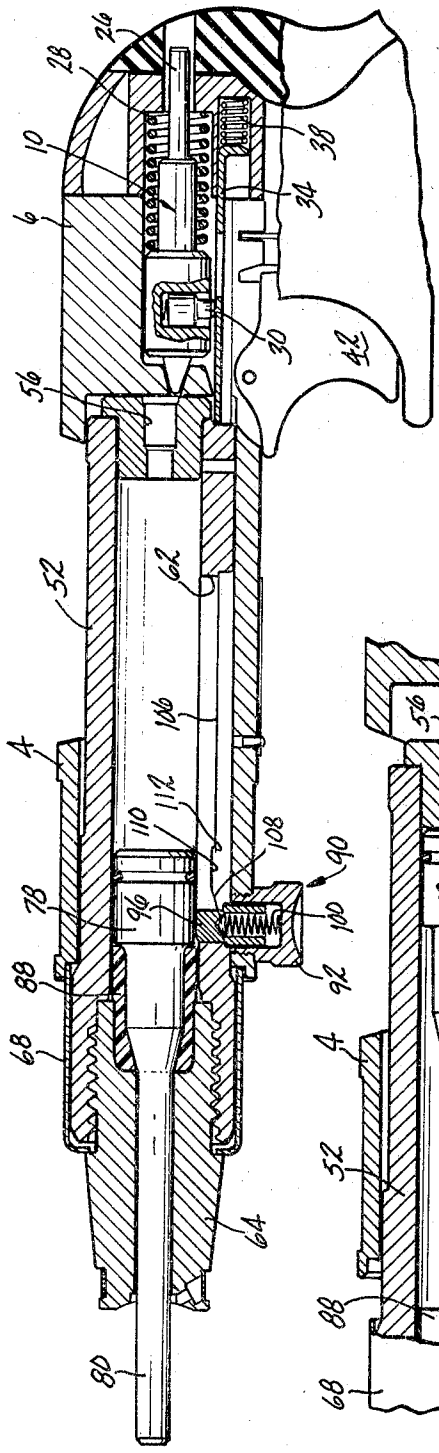

FIG - 3

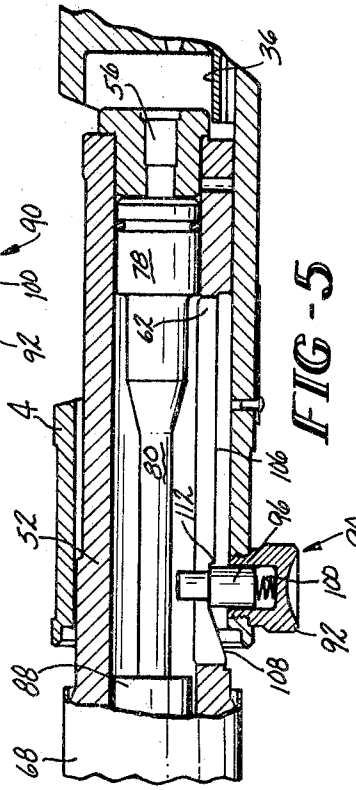

FIG - 5

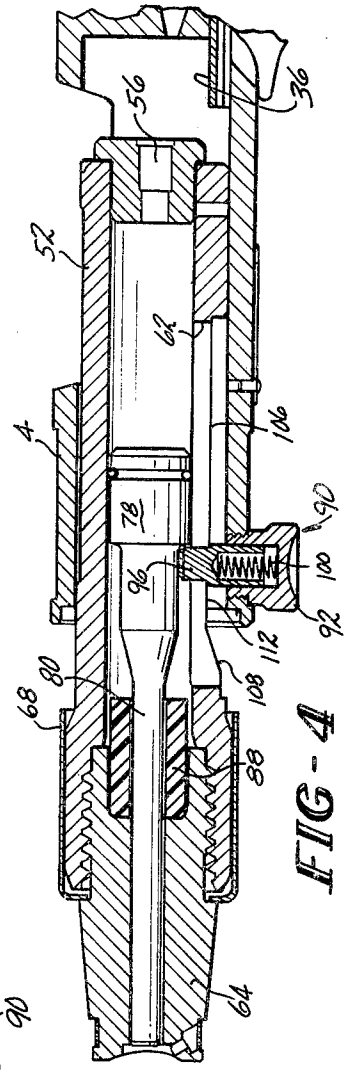

FIG - 4

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POWER-ACTUATED TOOL

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U.S. Cl. 227—10 10 Claims

ABSTRACT OF THE DISCLOSURE

A power-actuated fastening tool of the type utilizing a piston wherein the piston return member is cammed out of the path of the piston when the barrel of the tool is in the firing position.

This invention relates generally to tools for driving fasteners or the like into masonry, concrete, wood, steel or the like. More particularly, this invention relates to a power-actuated tool utilizing a piston to drive the fastener element.

In general, tools of the above type may include a barrel assembly mounted in a tubular portion of a housing for movement between a breech open position for loading and a breech closed position for firing. A piston member is slidably mounted in the barrel assembly and includes a head portion and a reduced, elongated shank portion which drives the fastener. In some instances, tools of this type are provided with a piston return member which takes the form of a projection mounted on the housing and extending into the interior of the barrel so that when the barrel is moved into its breech open position, the projection can engage the forward face of the head portion of the piston to effect the return of the piston to its firing position. This projection may also provide a means for guiding the barrel assembly during its movement.

The projection is normally positioned at a point forward enough in the housing so that when the piston is actuated and completes the driving function, the head portion thereof is spaced rearwardly from the projection. However a problem is encountered in the event that the tool is fired against a surface which is too soft to limit the penetration of the fastener. In this case, the piston member will be overdriven, contacting the piston return projection and resulting in a shearing of the projection, damage to the piston, or both. This damage can also occur when the tool is fired without being positioned against a surface wherein there is nothing to absorb the forward motion of the piston except for the buffer means provided internally of the tool.

With a view toward overcoming the above-mentioned problem, it is an object of this invention to provide a power-actuated tool in which the piston return member will not be contacted by the piston head in the event of overdrive of the piston.

More specifically, it is an object of this invention to provide a power-actuated tool wherein the piston return member is moved out of the way of the path of the piston when the tool is in the firing position, yet moves into position to contact the head portion of the piston when the tool is moved into a non-firing position.

Yet another object of this invention is to provide a power-actuated tool wherein the piston return member also holds the barrel in a semi-closed position.

These and other objects will become more apparent by reference to the following description and to the accompanying drawings in which:

FIGURE 1 is a transverse sectional view of a power-actuated tool constructed in accordance with the present invention and showing the components of the tool in a

position wherein movement of the housing member in a forward direction relative to the barrel assembly will cock the firing mechanism;

FIGURE 2 is a cross sectional view taken along the lines 2—2 of FIGURE 1;

FIGURE 3 is a transverse sectional view of the tool of FIGURE 1 showing the position of the piston return member and piston in the case where the piston is severely overdriven;

FIGURE 4 is a transverse sectional view of the tool of FIGURE 1 showing the various components of the tool in the position during movement of the barrel from the firing to the breech open position; and

FIGURE 5 is a transverse sectional view of the tool of FIGURE 1 showing the components of the tool in the position wherein the piston return member serves to hold the barrel in a semi-open position.

Referring more specifically to the drawings, FIGURE 1 shows a tool constructed in accordance with the present invention having a housing 2 including a tubular forward portion 4 and a rearward portion 6. The tubular forward portion 4 includes an elongated opening 8 to provide access for loading and unloading an explosive cartridge. The rearward portion 6 of the housing 2 houses the firing mechanism 10 and also includes a pistol grip 12 and a trigger guard 14.

The firing mechanism 10 includes a breech block 16 having a frusto-conical opening 18 therein. A firing pin 20 is mounted behind the breech block 16 for axial movement in the housing 2 and includes a frusto-conical nose portion 22, a body portion 24 and a rearwardly extending rod portion 26. The firing pin 20 is urged forwardly by a suitable spring member 28. A detent member 30 extends radially downwardly from the body portion 24 of the firing pin 20. The detent member 30 is spring biased outwardly by suitable spring means 32.

A cocking rod 34 is mounted for reciprocation in the rearward portion 6 of the housing 2 and includes a forward portion 36 extending through the breech block 16 and into the tubular forward portion 4 of the housing 2. The cocking rod 34 may be spring biased forwardly by a suitable spring member 38. The cocking rod may also include an elongated opening 40 through which the detent member 30 on the firing pin 20 may extend.

A trigger member 42 having a sear portion 44 may be pivotally mounted above the trigger guard 14 by a pivot pin 46. The trigger is resiliently urged away from the firing position by spring member 48.

A barrel assembly 50 is reciprocally mounted within the tubuar portion 4 of the housing 2 and extends from the muzzle end thereof. The barrel assembly includes a barrel member 52 having a bore 54 therein, the barrel member 52 includes a cartridge receiving chamber 56 at its breech end for the reception of an explosive cartridge 58. The bottom outside surface of the barrel member includes an axially extending bottom portion 60 which is planar in a horizontal direction. An elongated slot 62 extends through said bottom portion 60. The barrel assembly 50 also includes a muzzle bushing 64 which has a bore 66 of lesser diameter than the bore in the barrel member 52 and is threadedly received within the forward end of the barrel member 52. A sleeve member 68 surrounds the muzzle end of the barrel member 52 and includes an inturned flange 70 which is positioned between the forward edge 72 of the barrel member 52 and a shoulder 74 on the external surface of the sleeve 68.

A piston member 76 may be mounted for reciprocal movement within the barrel assembly 50. The piston member 76 includes a generally cylindrical head portion 78 and a reduced elongated cylindrical shank portion 80. A piston ring 82 may be mounted within a suitable

groove 84 about the circumference of the head portion 78 of the piston member 76.

The muzzle bushing 64 is provided with a counterbore 86 in its rearward surface. A suitable buffer member 88 is mounted in the counterbore 86 to absorb the energy of the piston member 76 in the event that the piston member 76 is overdriven. In the preferred embodiment, the buffer member 88 comprises a hollow, cylindrical member fabricated from suitable material such as polyurethane, nylon or other suitable elastomeric materials. The interior diameter of the buffer member 88 must be at least as great as the diameter of the bore 66 in the muzzle bushing 64, which in turn is of such a size as to slidably receive the shank portion 80 of the piston member 76. The buffer member 88 extends rearwardly in the tool out of the counterbore 86 into the bore 54 of the barrel member 52 for a short distance.

A piston return member 90 is attached to the housing 2 adjacent the muzzle end of the forward portion 4. The piston return member 90 comprises a screw member 92 having an internal bore 94. A piston return pawl member 96 is mounted within the bore 94 in the screw member 92 for axial movement in the direction of the axis of the screw member 92. A bore 98 in the bottom surface of the pawl member 96 provides an opening for reception of a spring member 100 which seats against the bottom of the bore 98 in the pawl member 96 and the bottom of the bore 94 in the screw member 92 to urge the pawl member 96 upwardly in the direction toward the interior of the barrel member 52. The pawl member 96 includes a generally cylindrical outer surface 102 which is provided with oppositely disposed shoulders 104 by means of machining the uppermost portion of opposite sides of a pawl member 96 into a planar configuration or by reducing the diameter of the cylinder. The spring member 100 urges the pawl member 96 upwardly in the tool so that the shoulders 104 abut against the bottom portion 60 of the barrel member 52 and the uppermost portion extends into the slot 62.

The bottom portion 60 of the barrel member 52 on opposite sides of the elongated slot 62 includes a straight portion 106 spaced from the axis of the bore 54 of the barrel member 52 such that when the shoulders 104 of the pawl member 96 abut thereagainst, the uppermost portion of the pawl member 96 extends into the interior of the barrel. The forwardmost portion of the bottom portion 60 of the barrel member 52 adjacent the forward end of the slot 62 tapers outwardly to form a cam surface 108. The portion between the cam surface 108 and 106 includes a straight portion 110 which is offset inwardly with respect to the straight portion 106 so that a shoulder or detent surface 112 is formed in the bottom portion 60.

In operation, after a fastener 114 is positioned in the muzzle bushing 64 and a cartridge 58 positioned in the cartridge receiving chamber 56, the tool may be positioned against a suitable work surface. To fire the tool, the operator must push down on the housing 2 to move the housing 2 forward relative to the barrel assembly 50. In so doing, the cocking rod 34 abuts the rearward end of the barrel member 52 so that the housing 2 moves forward relative thereto. By virtue of the detent member 30 extending into the opening 40 of the cocking rod 34, the housing 2 also moves forwardly with respect to the firing pin 20 until the forward face of the breech block 16 abuts the rear surface of the barrel assembly 50. At this point, the detent member 30 of the firing pin 20 is in operable alignment with the sear portion 44 of the trigger member, so that by pulling the trigger member 42, the sear portion 44 will release the detent member 30 from the opening 40 in the cocking rod and the firing pin 20 will move forward under the action of its spring member 28 until the nose portion 22 thereof ejects through the frusto-conical opening 18 in the breech block 16 and actuates the cartridge 58. The gases generated by the explosion of the cartridge 58 will drive the piston member 76 forwardly and drive the fastener 114 into the work surface.

As can be seen in FIGURE 3, when the tool is in the firing position with the barrel member 52 in the breech closed position against the breech block 16, the cam surface 108 on the bottom portion 60 of the barrel member 52 depresses the pawl member 96 of the piston return member 90 into the screw member 92 and out of the bore 54 of the barrel member 52. Thus, if the piston member 76 should be overdriven, as shown in FIGURE 3, the pawl member 96 will not be contacted by the piston member 76 thereby eliminating damage to either the pawl member 96 or piston member 76.

Even in the event of an overdrive of the piston member, due to the buffer member 88, the piston member 76 will rebound rearwardly in the barrel member 52 to a point wherein the forward face of the head portion 78 is positioned rearwardly in the tool relative to the pawl member 96. Thus, when the barrel assembly 50 is moved forwardly relative to the housing 2 into its breech open position as shown in FIGURE 4, and the pawl member 96 engages the straight portions 106 and 110 on the bottom of the barrel, the pawl member 96 will project into the bore 54 of the barrel member 52 into a position to be abutted by the forward surface of the head portion 78 of the piston member 76. Since the piston member 76 is then prevented from further forward movement, additional forward movement of the barrel member 52 will result in the piston member being held in place until the rearward face of the head portion 78 abuts the forward face of the cartridge receiving chamber 56. At this point, the piston member 76 is in position for the next firing and will be retained in this position by virtue of the frictional engagement.

As shown in FIGURE 5, when the barrel assembly 50 is so positioned with respect to the housing that the shoulders 104 of the pawl member 96 abut the straight portion 110 of the bottom portion of the barrel member 52, the barrel member 52 will be prevented from moving both forwardly and rearwardly under the influence of its own weight. This is due to the fact that in order for the barrel member 52 to move rearwardly relative to the housing 2, the pawl member 96 must be depressed against the force of the spring member 100 by the cam surface 108. For the barrel member 52 to move forwardly, the pawl member 96 must be depressed against the spring member 100 by engagement with the shoulder or detent surface 112. With this arrangement, after the operator has loaded the tool, if he desires to use the tool in a position wherein the axis is vertical, the barrel assembly 50 may be moved rearwardly into the position shown in FIGURE 5 and the tool positioned in a vertical direction without the barrel assembly 50 moving forward under the influence of gravity. This permits the operator to immediately begin to push down on the housing 2 to cock the tool and fire without the necessity of manually holding the barrel assembly 50 in the semi-closed position.

Although reference has been made above to a preferred embodiment of the invention, it will be appreciated that various modifications and alterations will readily suggest themselves to those skilled in the art. Accordingly, it is intended that the scope of this invention should be ascertained by reference to the following claims.

What is claimed is:

1. In a power-actuated tool, barrel means, housing means telescopically carrying said barrel means for relative movement in opposite directions, firing means in said housing, means responsive to movement of said barrel means in one direction for cocking said firing means, fastener driving means positioned in said barrel means for movement between a driving position and a driven position, return means responsive to the movement of said barrel in the opposite direction for returning said driving means from its driven position to its driving position,

and means for moving said return means out of the path of the driving means when said barrel means has moved into a position wherein said means responsive to movement of said barrel means has cocked said firing means.

2. In a power-actuated fastening tool, a housing having front and rear portions, barrel means telescopically mounted in said front portion for axial movement between a breech open and a breech closed position, piston means mounted in said barrel means for movement between a driving position and a driven position, firing means mounted in said rear portion, means responsive to movement of said barrel means into said breech closed position for cocking said firing means, return means responsive to the movement of said barrel means into the breech open position for returning said piston means to said driving position, and means responsive to movement of said barrel means into said breech closed position for moving said return means into a position where said return means will be out of the path of said piston means when said barrel is in said breech closed position.

3. The power-actuated tool of claim 2 wherein said return means includes pawl means mounted on said housing and adapted to extend into said barrel means through a slot in said barrel, and said piston means includes means to be engaged by said return means to return said piston means to its driving position during movement of said barrel means into said breech open position.

4. The power-actuated tool of claim 3 wherein said means for moving said return means out of the path of said piston means comprises a cam surface on said barrel means adapted to contact said pawl means to move said pawl means out of a position to be engaged by said means on said piston when said barrel is moved into its breech closed position.

5. The power-actuated tool of claim 4 wherein said barrel means has detent means adjacent said cam surface and rearward thereof for engagement by said pawl means to hold said barrel means in a semi-closed position.

6. The power-actuated tool of claim 4 wherein said pawl means comprises a pawl housing attached to said housing adjacent the forward end of said front portion, a pawl member mounted in said pawl housing, spring means

within said pawl housing for biasing said pawl member toward the interior of said barrel, said pawl member having shoulder means to abut the exterior surface of said barrel means adjacent said slot to limit movement of said pawl means toward the interior of said barrel means.

7. The power-actuated tool of claim 6 wherein said piston means includes a head portion and a shank portion, said pawl member adapted to move into the interior of said barrel means when said barrel means is moved into its breech open position to be engaged by the head portion of said piston means to effect return of said piston means to its driving position.

8. The power-actuated tool of claim 7 wherein the exterior surface of said barrel means adjacent said slot includes an axially straight portion and an outwardly tapering portion adjacent the front end of said barrel to be engaged by the shoulder means of said pawl member, said tapering portion serving to move the pawl member out of the path of the head portion of said piston during movement of said barrel means into said breech closed position.

9. The power-actuated tool of claim 7 wherein the exterior portion of said barrel means between said tapering portion and said straight portion includes a second straight portion offset inwardly with respect to said first straight portion to form a detent surface for engagement by said pawl member to hold said barrel means in a semi-closed position.

10. The power-actuated tool of claim 7 wherein said barrel means includes a barrel member and a muzzle bushing attached to the forward end of said barrel member, and further including a buffer member mounted in said muzzle bushing and extending rearwardly into said barrel member to a point axially forward of said slot.

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