

[54] FASTENER DRIVING TOOL

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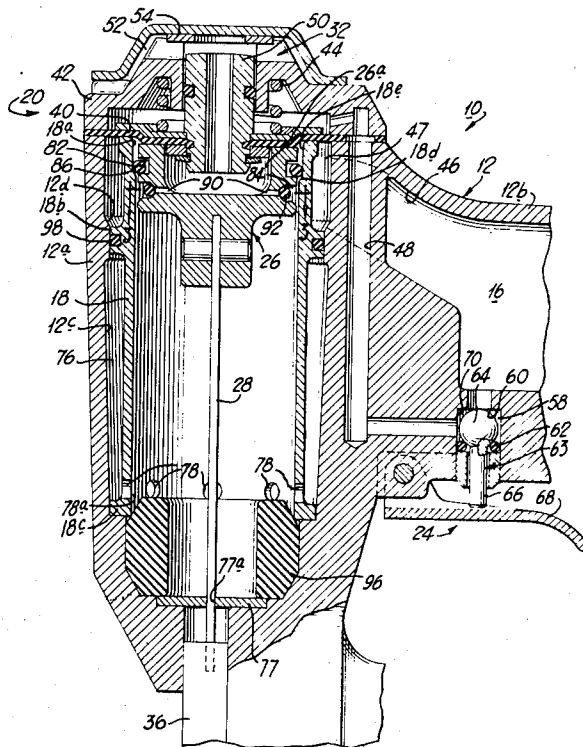
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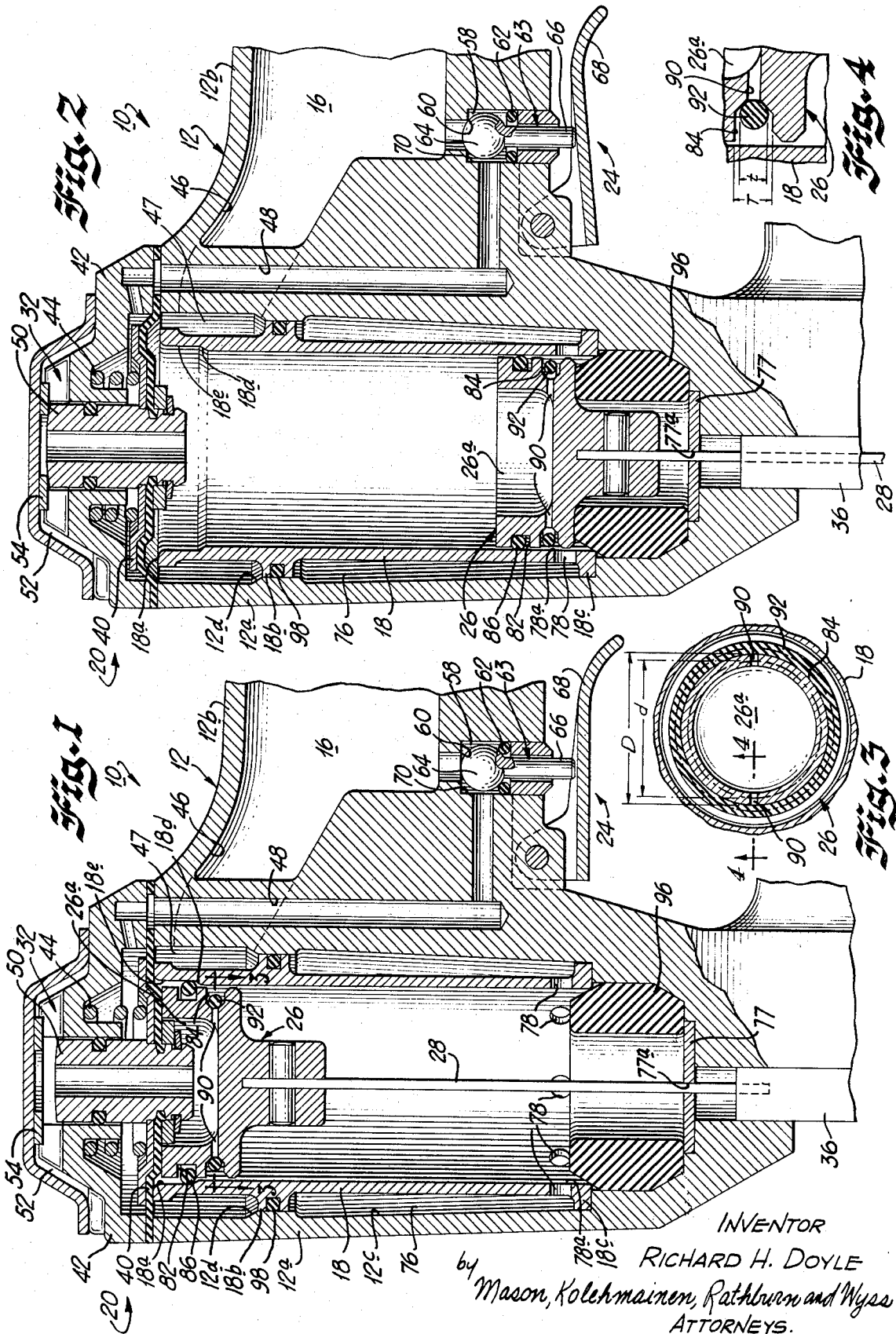
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[57] ABSTRACT

A pneumatic piston-driver blade return system for a pneumatic fastener driving tool includes an air return space continuously communicating with the lower end of a cylinder immediately adjacent a bumper. When a top valve for the cylinder is opened, compressed air drives the piston downwardly against the bumper, and a part of this air is passed through the piston into the air return space by means of an O-ring valved passage through the piston. When the cylinder top valve is closed and the top of the cylinder is vented to the atmosphere, the air in the return space enters the cylinder and acts on the lower surface of the piston to return the piston-driver blade to a normal position in which it is held by frictional engagement of another piston O-ring with the cylinder wall. Air below the piston leaks out to the atmosphere through a driver blade clearance at the lower end of the cylinder.

15 Claims, 4 Drawing Figures





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FASTENER DRIVING TOOL

This invention relates to a fastener driving tool and, more particularly, to a fastener driving tool including new and improved piston return means for returning the piston after the completion of a power or driving stroke.

Commercial pneumatic fastener driving tools on the market today are commonly of the type including pneumatic means for returning the piston after the completion of a fastener driving stroke. Such tools are frequently operated by a trigger actuated pilot valve that functions when the trigger is depressed to move the drive piston and connected fastener driving blade through a power or drive stroke of a fastener driving operation by the admission of pressurized fluid into the cylinder of the tool. The drive piston will generally remain at the end of its power stroke until the fluid pressure in the cylinder is released, as by exhausting the cylinder to atmosphere, at which time the piston return means is effective to return the piston to its normal or static position. Commercially available fastener driving tools may either return upon release of the trigger actuated pilot valve, or the drive piston and driving blade of such tools may move both down and up automatically upon a single depression of the trigger, before the trigger is released. In both types of control means are provided for supplying pneumatic fluid below the piston for returning the piston to its normal or static position after the air above the piston has been exhausted. The piston must remain in its normal or static position until it is again driven through a fastener driving stroke.

One object of the present invention is to provide a new and improved pneumatic return means for a fastener driving apparatus.

Another object of the present invention is to provide a fastener driving apparatus including new and improved pneumatic return means for returning the drive piston and associated driver blade to the normal or static position upon exhaustion of the fluid from above the piston.

Yet another object of the present invention is to provide an improved means for holding the piston of a fastener driving tool in its normal or static position during its rest between fastener driving operation.

Yet another object of the present invention is to provide a new and improved pneumatically actuated fastener driving tool.

In accordance with these and many other objects, there is provided a pneumatically operated fastener driving tool of the type including a housing having a cavity defining a fluid reservoir, and a cylinder in the housing. A drive piston is slidably mounted in the cylinder. A suitable cylinder valve may be provided for controlling the admission of fluid and for the exhaustion of fluid from the end of the cylinder above the piston. The cylinder valve may operate under the control of a pilot valve, or the fastener tool may be of the snap action or automatic signal stroke type. In accordance with the present invention, a piston return reservoir is provided in the housing and air passage means interconnect the piston return reservoir and the cylinder adjacent the lower or other end of the cylinder. The piston is provided with a pair of spaced peripheral grooves in its outer wall and a sealing member is carried in one of the grooves toward the open or control end of the cylinder effecting a pneumatic seal between the piston and the cylinder. A resilient ring sealing member, which may be of the O-ring type, is carried in the other of the grooves. Air passage means in the piston extend from the bottom of this groove to above the piston to provide a bypass around the upper one of the peripheral grooves. The sealing member functions as a check or one way valve so that upon a selected pressure differential between the upper and lower ends of the cylinder, the resilient ring sealing member will be effective to unseat from the air passage openings to provide for fluid bypass around the first sealing member.

It will be understood that during the driving stroke of the piston, the pressure above the piston does not build up sufficiently to unseat the lower O-ring of the piston and permit bypass of the pressurized fluid around the piston. However,

once the piston has reached the end of its power stroke and the pressure above the piston continues to build up, the pressure will unseat the lower O-ring to flow into the piston return reservoir. The lower O-ring will then reseat itself to close the bypass around the piston and provide the pneumatic fluid for the return stroke of the piston.

In accordance with another feature of this invention the open end of the cylinder above the piston has an enlarged diameter to define a shoulder with the remainder of the cylinder, and the upper sealing member, which may also be an O-ring, will expand above the shoulder to retain the piston in its normal or static position during its rest between fastener driving strokes.

Many other objects and advantages of the present invention will become apparent from the following detailed description, when given in connection with the accompanying drawings in which:

FIG. 1 is a fragmentary cross-sectional view of a fastener driving tool incorporating the improved pneumatic return mechanism according to the present invention and illustrated with the drive piston and driver blade in its static or at rest position;

FIG. 2 is a fragmentary cross-sectional view of the fastener driving tool of FIG. 1, illustrated with the drive piston and driver blade at the end of the drive stroke;

FIG. 3 is a fragmentary cross-sectional view of the piston in the cylinder illustrating the groove and O-ring forming the valve member and taken along line 3—3 of FIG. 1; and

FIG. 4 is an isometric fragmentary cross-sectional view of the groove and O-ring forming the valve member in the lower one of the grooves on the piston and taken along line 4—4 of FIG. 3.

Referring now to the drawings, there is fragmentarily illustrated a fastener driving tool, generally illustrated as 10, which embodies the present invention. The tool 10, as illustrated, comprises a housing 12 including a generally vertically extending head or forward portion 12a and a rearwardly extending handle portion 12b defining a fluid reservoir 16. Pressurized fluid, such as compressed air, is supplied to the fluid reservoir of the tool by suitable means, not illustrated. The drive system for the tool 10 includes a main cylinder 18 slidably mounted within a cavity 12c in the head portion 12a and having an open upper end 18a that is adapted to be selectively connected to the reservoir 16 and to the atmosphere. The open upper end of the cylinder 18 is normally in engagement with a diaphragm type main or cylinder valve assembly 20 under the control of a trigger pilot valve assembly 24. Slidably mounted within the cylinder 18 is a power or drive piston 26 having connected thereto a depending driver blade member 28. An exhaust valve assembly indicated generally as 32 is provided for controlling the selective connection of the upper end of the cylinder 18 to the atmosphere.

When the tool 10 is to be operated, the trigger pilot valve assembly 24 is actuated so that the compressed fluid from the reservoir 16 enters the upper end 18a of the cylinder 18 and drives the fastener drive piston 26 downwardly to engage a fastener or nail supplied to a drive track in a nosepiece or nosepiece structure 36. The flow of compressed fluid into the upper end of the cylinder 18 is controlled by the cylinder valve assembly 20, which includes a diaphragm 40, the periphery of which is clamped between a cap 42 and the head portion 12a of the housing 12 and which seats against the upper edge 18a of the cylinder 18. The diaphragm 40 is resiliently biased against the upper edge surface 18a by a spring 44 located between the cap 42 and the diaphragm 40. The cylinder side of the diaphragm 40 is continuously in connection with the fluid reservoir 16 through a suitable passageway 46 and annular chamber 47 so that the pressurized fluid continuously acts against the cylinder side of the diaphragm 40 tending to displace the diaphragm 40 from the edge 18a of the cylinder 18. However, pressurized fluid is also introduced to the opposite side of the diaphragm 40 through a passageway 48 when the fastener driving tool 10 is in a static or at rest position. The dif-

ferential pressure acting upon the diaphragm 40 is effective to maintain the diaphragm 40 in a closed position, as illustrated in FIG. 1. However, as the pressurized fluid above the diaphragm 40 is discharged, the pressurized fluid acting through passageway 46 is effective to unseat the diaphragm 40 from the edge 18a of the cylinder 18 to direct pressurized fluid into the top of the cylinder 18 and to drive the drive piston 26 through a drive stroke.

When the fastener driving tool is at rest, or during the return stroke of the drive piston, the upper open end of the cylinder 18 is exhausted to the atmosphere through the exhaust valve assembly 32. In the illustrated embodiment the exhaust valve assembly comprises a hollow valve stem 50 secured to the diaphragm and connecting the upper end of the cylinder 18 to the atmosphere through a suitable exhaust passageway 52. However, when the drive piston is operated through a fired or drive stroke, it is necessary for the upper end of the cylinder 18 to be closed off from the atmosphere, and to this end there is provided a valve seat 54 on the cap 42 disposed adjacent the end of the valve stem 50 remote from the cylinder 18 and adapted to be engaged by the valve stem 50 when the diaphragm 40 is raised at the initiation of a drive stroke, thereby closing off the upper end of the cylinder 18 to the atmosphere. Since a substantial impact load is transmitted to the valve seat 54, the cap 42 is preferably of hardened steel. Advantageously a hardened steel cap 42 will prevent damage occurring to the tool 10 if the operator thereof taps with the cap 42.

The trigger pilot valve assembly 24 is provided for initiating the firing of the tool 10, and may be of known design. In the illustrated embodiment the valve assembly 24 includes a valve chamber 58 having opposed valve ports 60 and 62 defining valve seats alternately engageable by a valve element 63 here shown as comprising a valve ball 64 and a downwardly extending rod actuator 66. The valve port 60 communicates with the reservoir 16, while the valve port 62 exhausts the valve chamber 58 to the atmosphere when the valve ball 64 is unseated therefrom. The rod actuator 66 is operated by a suitable trigger 68 so that when the fastener driving tool 10 is at rest the valve ball 64 is seated against the valve port 62, and when the trigger 68 is depressed, the valve ball 64 closes the valve port 60. Additionally, the pilot valve chamber 58 is provided with a control port 70 connected to the upper end of the cylinder valve assembly 20 through the passageway 48. It will be understood that in the operation of the trigger pilot valve, when the trigger 68 is released, the control port 70 is in communication with the reservoir 16 through the valve port 60; but when the trigger 68 is depressed unseating the valve ball 64 from the valve port 62 and closing the valve port 60, the control port 70 is exhausted to the atmosphere.

To provide for the return drive of the drive piston 26, there is provided an air return chamber 76 communicating with the lower end of the cylinder 18 through a plurality of air passage openings 78 including ports 78a opening in the cylinder 18. The piston 26 is of generally cup-shape with a central cavity 26a opening toward the upper end of the cylinder 18. The outer surface of the piston 26 is provided with spaced peripheral grooves 82 and 84, the upper one 82 of which serves as a sealing groove while the lower one 84 functions as a one way valve means to provide for the passage of pressurized fluid to the air return chamber 76. An O-ring 86 provided in the upper one of the grooves 82 functions as a sealing member effecting a pneumatic seal between the piston 26 and the inner wall of the cylinder 18. To bypass around the groove 82 and O-ring 86, there is provided a plurality of air passageways 90 extending from the lower one of the grooves 84 and communicating with the central cavity 26a. An O-ring 92 defining a valve element is positioned within the lower one of the grooves 84. The O-ring 92 is of resilient construction and is normally seated against the ports defined by the air passages 90. To this end, the O-ring 92 in its unstressed state has an inner diameter d, shown in phantom in FIG. 3, smaller than the inner diameter D of the groove 84 and has a diamet-

ric thickness t , FIG. 4, less than the width T of the groove 84. The O-ring 92 is expandable upon a selected pressure differential between the upper and lower ends of the cylinder through the piston 26 so as to unseat from the ports 90a of the air passages 90 to provide for fluid to bypass through the piston 26 around the O-ring 92 and to supply air to the air return chamber 76.

It is of course necessary to seal the driver blade 28 sufficiently to trap the air for the return stroke and to this end there is provided a sealing washer 77 at the lower end of the head 12a and having an opening 77a closely receiving the blade 28. It is necessary to provide sufficient air to return the piston 26, but the volume of return air should not be so great as to require an excessive air supply or to prevent rapid discharge of the return air by leakage through the opening 77a after return of the piston 26. It has been found that a ratio of return air to piston displacement of two-thirds is satisfactory.

To cushion the drive stroke of the piston 26 and to provide a further pneumatic seal around the driver blade when the drive piston 26 is in its lowermost position, there is provided a resilient annular bumper 96 at the lower end of the cylinder 18 which is engageable by the piston 26, as illustrated in FIG. 2, when the piston 26 is in its lowermost position.

Advantageously the cylinder 18 is held in position in the cavity 12c only by the fluid pressure acting upon it, thus facilitating rapid disassembly for repair or replacement. More specifically, the cylinder 18 includes an outwardly extending flanged portion 18b adjacent an inwardly extending ring portion 12d formed in the wall of the cavity 12c. The interface between the flanged portion 18b and the portion 12d is sealed by a resilient O-ring 98 so that the O-ring 98 divides the space between the wall of the head portion 12a and the cylinder 18 into the chambers 47 and 76. The lower end of the cylinder 18 is provided with an outwardly extending flange 18c engageable against the inner surface of the cavity 12c to position the lower end of the cylinder 18. The fluid pressure in the chamber 47 acts on the outwardly extending flanged portion 18b to hold the cylinder 18 in place. The spaced positioning of the work cylinder 18 from the wall of the head portion 12a further serves to protect the cylinder 18 against damage by impact or other forces on the head 12a of the tool 10.

To hold the piston 26 of the fastener driving tool 10 in its static or normal position during the rest period between fastener driving operations, the upper O-ring 86 locks against a shoulder 18d formed at the lower end of an enlarged diameter portion 18e in the cylinder 18. Preferably the shoulder 18d is chamfered to provide an incline for the O-ring 86.

From the above-detailed description, the operation of the improved pneumatic return system is believed clear. However, briefly, it will be understood that in the operation of the basic tool, the piston 26 and associated driver blade member 28 is driven downwardly through a drive stroke by the connection of the open upper end 18a of the cylinder 18 with the reservoir 16. Since there is not significant restraint to the piston 26 during its downward movement, the pressure above the piston 26 will not build up sufficiently to unseat the O-ring 92 until the piston 26 reaches the bottom of its drive stroke as illustrated in FIG. 2. At this point the pressure above the piston 26 will continue to build up until it approaches the pressure in the reservoir 16 and the O-ring 92, functioning as a valve element, will be unseated from the ports of the air passages 90 thereby providing a source of pressurized fluid to the air return chamber 76 through the air passage opening 78. There will be no significant loss of air below the piston 26 during the short time interval required for the drive and return strokes of the piston. Upon release of the trigger 68 the cylinder valve assembly 20 will close against the open upper end 18a of the cylinder 18 and the upper end of the cylinder 18 will be exhausted to the atmosphere through the exhaust valve assembly 32. At this time the pressurized fluid in the air return chamber 76 will return through the openings 78 below the piston 26 and will return the piston 26 and associated driver blade member 28 to its static or at rest position. The return air will

then exhaust around the driver blade 28 through the opening 77a to prepare the tool 10 for a subsequent driving stroke.

Although the present invention has been described by reference to a single embodiment thereof, it will be apparent that numerous other modifications and embodiments may be devised by those skilled in the art and it is intended by the appended claims to cover all modifications and embodiments which will fall within the true spirit and scope of the present invention.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. A pneumatically operated fastener driving tool comprising a housing having a cavity defining a fluid reservoir, a cylinder in said housing, a piston slidably mounted in said cylinder, a cylinder valve means for controlling the admission of fluid and for the exhaustion of fluid from one end of said cylinder, a piston return reservoir in said housing, air passage means connecting said piston return reservoir and said cylinder and including port means opening in said cylinder adjacent the other end thereof, said piston including a pair of spaced peripheral grooves in its outer wall, a ring sealing member in the one of said grooves toward said one end of said cylinder effecting a pneumatic seal between said piston and said cylinder, air passage means in said piston extending from the other of said grooves around said one of said grooves, and including means defining ports in said other of said grooves, a resilient ring sealing member in said other of said grooves normally seated against said ports and expandable upon a selected pressure differential between said one end of said cylinder and said other end thereof to unseat from said ports to provide for fluid to bypass around the first sealing member from said one end of said cylinder to said other end thereof providing for passage of air into said piston return reservoir.

2. A fastener driving tool as set forth in claim 1 wherein said last mentioned sealing member is an O-ring.

3. A fastener driving tool as set forth in claim 2 wherein the inside diameter of said O-ring in its unstressed state is less than the minimum diameter of said other of said grooves, and the diametrical thickness of said O-ring is less than the width of said other of said grooves.

4. A fastener driving tool as set forth in claim 1 wherein said piston is generally cup-shaped with a central cavity opening toward said one end of said cylinder and said air passage means comprises a plurality of passageways communicating between the inner surface of said other of said grooves and said cavity.

5. A fastener driving tool as set forth in claim 1 and including a resilient annular bumper adjacent said other end of said cylinder engageable by said piston and defining a pneumatic seal when said piston is at said other end of said cylinder.

6. A fastener driving tool as set forth in claim 1 wherein said cylinder is provided with an enlarged diameter portion at its upper end defining a shoulder, and wherein said ring sealing member sets above said shoulder when said piston is in its normal position to retain the piston in said normal position.

7. A pneumatically operated fastener driving tool comprising a housing having a cavity defining a fluid reservoir, a cylinder in said housing having an open upper end and an enlarged diameter portion forming a shoulder with the remainder of said cylinder and extending from said shoulder to the open upper end of the cylinder, a piston slidably mounted in said cylinder and provided with at least one peripheral groove in its outer wall, a ring sealing member in said groove effecting a pneumatic seal between said piston and said cylinder and setting above said shoulder when said piston is in its normal position thereby holding said piston in said normal position, a cylinder valve means for controlling the admission of fluid and the exhaustion of fluid from the open upper end of said cylinder, said cylinder valve means including structure engaging the piston to stop the piston in said normal position, the shoulder in the cylinder being spaced downwardly from the open upper end thereof a distance such that the ring sealing member rests on the shoulder when the piston engages

the structure on the cylinder valve means, and means controlling operation of said cylinder valve.

8. In combination:

- a. a single stroke fluid pressure operated motor having a cylinder with a piston operable therein between a retracted position at one end of the cylinder and an actuated position at the other and closed end of the cylinder, and with a driver extended from the piston and through a close fitting limited leakage guideway at the said other closed end of the cylinder;
- b. means operable to charge and to exhaust the cylinder at said one end thereof;
- c. restraining means normally holding the piston at rest at said retracted position;
- d. a closed fluid reservoir in open and continuous communication with the cylinder below the piston throughout its travel between said retracted and actuated positions;
- e. and air return means for movement of the piston from said actuated position to said retracted position when the first mentioned means is operated to exhaust the cylinder and comprising, a fluid restricting port through the piston and communicating with the fluid under pressure advancing the piston and open into said reservoir below the piston when the first mentioned means is operated to charge the cylinder;
- f. whereby there is a build-up of fluid pressure in the reservoir as the piston reaches the said actuated position, and whereby the built-up fluid pressure is applied to the piston and returns the same to the retracted position when the first mentioned means is operated to exhaust the cylinder followed by exhaust of said built-up pressure through said limited leakage guideway.

9. In combination:

- a. a single stroke fluid pressure operated motor having a cylinder with a piston operable therein between a retracted position at one end of the cylinder and an actuated position at the other and closed end of the cylinder, and with a driver extended from the piston and through a close fitting limited leakage guideway at the said other closed end of the cylinder;
- b. means operable to charge and to exhaust the cylinder at said one end thereof;
- c. restraining means normally holding the piston at rest at said retracted position;
- d. a closed fluid reservoir in open and continuous communication with the cylinder below the piston throughout its travel between said retracted and actuated positions;
- e. and air return means for movement of the piston from said actuated position to said retracted position when the first mentioned means is operated to exhaust the cylinder and comprising, a fluid restricting check valve means through the piston and communicating with the fluid under pressure advancing the piston and open into said reservoir below the piston when the first mentioned means is operated to charge the cylinder;
- f. whereby there is a build-up of fluid pressure in the reservoir as the piston reaches the said actuated position, and whereby the built-up fluid pressure is applied to the piston and returns the same to the retracted position when the first mentioned means is operated to exhaust the cylinder followed by exhaust of said built-up pressure through said limited leakage guideway.

10. In combination:

- a. a single stroke fluid pressure operated motor having a cylinder with a piston operable therein between a retracted position at one end of the cylinder and an actuated position at the other and closed end of the cylinder, and with a driver extended from the piston and through a close fitting limited leakage guideway at the said other closed end of the cylinder;
- b. means operable to charge and to exhaust the cylinder at said one end thereof;
- c. restraining means normally holding the piston at rest at said retracted position;

- d. a closed fluid reservoir in open and continuous communication with the cylinder below the piston throughout its travel between said retracted and actuated positions;
 - e. and air return means for movement of the piston from said actuated position to said retracted position when the first mentioned means is operated to exhaust the cylinder and comprising, a port through the piston and communicating with the fluid under pressure advancing the piston, a valve seat surrounding the piston and carrying a constricted check valve element to yieldingly open the port into the cylinder below the piston and into said reservoir when the first mentioned means is operated to charge the cylinder;
 - f. whereby there is a build-up of fluid pressure in the reservoir as the piston reaches the said actuated position, and whereby the built-up fluid pressure is applied to the piston and returns the same to the retracted position when the first mentioned means is operated to exhaust the cylinder followed by exhaust of said built-up pressure through said limited leakage guideway.
11. In combination:
- a. a single stroke fluid pressure operated motor having a cylinder with a piston operable therein between a retracted position at one end of the cylinder and an actuated position at the other and closed end of the cylinder, and with a driver extended from the piston and through a substantially close fitting limited leakage guideway at the said other closed end of the cylinder;
 - b. means operable to charge and to exhaust the cylinder at said one end thereof;
 - c. restraining means normally holding the piston at rest at said retracted position;
 - d. a snubber means comprising a body of resilient material surrounding the driver and with a seat having sealed engagement with the bottom of the piston upon arrestment of the piston at said actuated position;
 - e. a closed fluid reservoir in open and continuous communication with the cylinder above said snubber seat and below the piston throughout its travel between said retracted and actuated positions;
 - f. and air return means for movement of the piston from said actuated position to said retracted position when the first mentioned means is operated to exhaust the cylinder and comprising, a fluid restricting port through and opening above the bottom of the piston and communicating with the fluid under pressure advancing the piston and open into said reservoir when the first mentioned means is operated to charge the cylinder;
 - g. whereby there is a build-up of fluid pressure in the reservoir as the piston reaches the said actuated position, and whereby the built-up fluid pressure is applied to the piston and returns the same to the retracted position when the first mentioned means is operated to exhaust the cylinder followed by exhaust of said built-up pressure through said limited leakage guideway.
12. In combination:
- a. a single stroke fluid pressure operated motor having a cylinder with a piston operable therein between a retracted position at one end of the cylinder and an actuated position at the other and closed end of the cylinder, and with a driver extended from the piston and through a substantially close fitting limited leakage guideway at the said other closed end of the cylinder;
 - b. means operable to charge and to exhaust the cylinder at said one end thereof;
 - c. restraining means normally holding the piston at rest at said retracted position;
 - d. a snubber means comprising a body of resilient material surrounding the driver and with a seat having sealed engagement with the bottom of the piston upon arrestment of the piston at said actuated position;
 - e. a closed fluid reservoir in open and continuous communication with the cylinder above said snubber seat and below the piston throughout its travel between said retracted and actuated positions;

- f. and air return means for movement of the piston from said actuated position to said retracted position when the first mentioned means is operated to exhaust the cylinder and comprising, a fluid restricting check valve through and opening above the bottom of the piston and communicating with the fluid under pressure advancing the piston and open into said reservoir when the first mentioned means is operated to charge the cylinder;
 - g. whereby there is a build-up of fluid pressure in the reservoir as the piston reaches the said actuated position, and whereby the built-up fluid pressure is applied to the piston and returns the same to the retracted position when the first mentioned means is operated to exhaust the cylinder followed by exhaust of said built-up pressure through said limited leakage guideway.
13. In combination:
- a. a single stroke fluid pressure operated motor having a cylinder chamber with an open ended cylinder seated therein to reciprocally receive a piston operable between a retracted position at said open end of the cylinder and an actuated position at the other seated and closed end of the cylinder, and with a driver extended from the piston and out of the seated closed end of the cylinder and through a closed fitting limited leakage guideway in said cylinder chamber;
 - b. means operable to charge and to exhaust the cylinder at said open end thereof, from fluid pressure stored in said cylinder chamber;
 - c. restraining means normally holding the piston at rest at said retracted position;
 - d. a closed fluid reservoir surrounding the cylinder and in continuous communication with the cylinder through an opening therein below the piston throughout its travel between said retracted and actuated positions;
 - e. and air return means for movement of the piston from said actuated position to said retracted position when the first mentioned means is operated to exhaust the cylinder and comprising, a fluid restricting port through the piston and communicating with the fluid under pressure advancing the piston and open into said reservoir below the piston when the first mentioned means is operated to charge the cylinder;
 - f. whereby there is a build-up of fluid pressure in the reservoir as the piston reaches the said actuated position, and whereby the built-up fluid pressure is applied to the piston and returns the same to the retracted position when the first mentioned means is operated to exhaust the cylinder followed by exhaust of said built-up pressure through said limited leakage guideway.
14. In combination:
- a. a single stroke fluid pressure operated motor having a cylinder chamber with an open ended cylinder seated therein to reciprocally receive a piston operable between a retracted position at said open end of the cylinder and an actuated position at the other seated and closed end of the cylinder, and with a driver extended from the piston and out of the seated and closed end of the cylinder and through a close fitting limited leakage guideway in said cylinder chamber;
 - b. means operable to charge and to exhaust the cylinder at said open end thereof, from fluid pressure stored in said cylinder chamber;
 - c. restraining means normally holding the piston at rest at said retracted position;
 - d. a closed fluid reservoir surrounding the cylinder and in continuous communication with the cylinder through an opening therein below the piston throughout its travel between said retracted and actuated positions;
 - e. and air return means for movement of the piston from said actuated position to said retracted position when the first mentioned means is operated to exhaust the cylinder and comprising, a fluid restricting check valve means through the piston and communicating with the fluid under pressure advancing the piston and open into said

- reservoir below the piston when the first mentioned means is operated to charge the cylinder;
- f. whereby there is a build-up of fluid pressure in the reservoir as the piston reaches the said actuated position, and whereby the build-up fluid pressure is applied to the piston and returns the same to the retracted position when the first mentioned means is operated to exhaust the cylinder followed by exhaust of said built-up pressure through said limited leakage guideway.
- 15. In combination:
 - a. a single stroke fluid pressure operated motor having a cylinder chamber with an open ended and externally flanged cylinder seated therein to reciprocally receive a piston operable between a retracted position at said open and flanged end of the cylinder and an actuated position at the other seated and closed end of the cylinder, and with a driver extended from the piston and out of the seated end of the cylinder and through a substantially close fitting limited leakage guideway in said cylinder chamber;
 - b. means operable to charge and to exhaust the cylinder at said open and flanged end thereof, from fluid pressure stored in said cylinder chamber;
 - c. restraining means normally holding the piston at rest at said retracted position;
 - d. a snubber means comprising a body of resilient material

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- surrounding the driver and with a seat having sealed engagement with the bottom of the piston during its arrestment at the actuated position;
- e. a closed fluid reservoir defined by the seated end and flanged end of the cylinder engaging the cylinder chamber and in open and continuous communication with the cylinder through an opening therein above said snubber seat and below the piston throughout its travel between said retracted and actuated positions;
- f. and air return means for movement of the piston from said actuated position to said retracted position when the first mentioned means is operated to exhaust the cylinder and comprising, a fluid restricting port through and opening above the bottom of the piston and communicating with the fluid under pressure advancing the piston and open into said reservoir when the first mentioned means is operated to charge the cylinder;
- g. whereby there is a build-up of fluid pressure in the reservoir as the piston reaches the said actuated position, and whereby the built-up fluid pressure is applied to the piston and returns the same to the retracted position when the first mentioned means is operated to exhaust the cylinder followed by exhaust of said built-up pressure through said limited leakage guideway.

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