

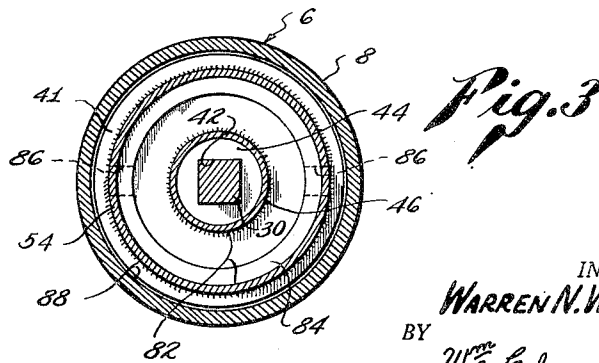
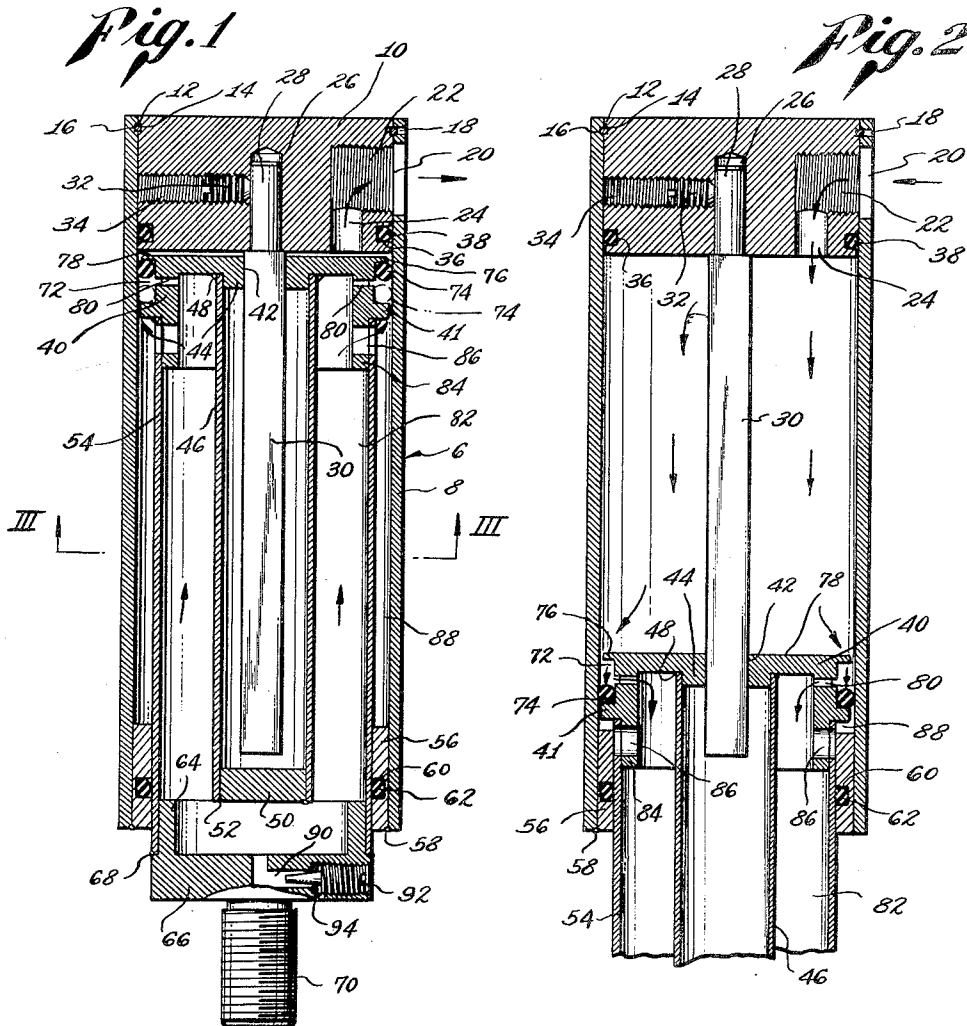
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PRESSURE RETURN CYLINDER AND PISTON UNIT

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PRESSURE RETURN CYLINDER AND PISTON UNIT

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2 Claims. (Cl. 121—38)

This invention relates to a cylinder and piston unit and more particularly to one which is commonly known as a one-way unit which is operated by air pressure to advance and/or retract a tool such as is used in a punch press.

This is a continuation of my original application Serial No. 154,503, filed April 7, 1950, entitled Cylinder and Piston Unit, now abandoned.

It has been customary to operate various mechanisms such as presses with air cylinders for advancing the tool to the work and springs to return it when the air pressure is cut off. Ordinarily, the piston is advanced against air or spring pressure which is utilized for the return stroke, and considerable work is required to thus advance the piston and build up a return stroke force.

Objects of the present invention are: to provide a cylinder and piston unit having one-way applied pressure operation in which the applied pressure for advancing the piston is utilized in reverse to return the piston; to provide a cylinder and piston unit including a valved passage between opposite sides of the piston to permit pressure flow from the working face of the piston to the rear side thereof on the working stroke and to cut off the flow connection for the return stroke, whereby pressures built up on the rear side of the piston head will be sufficient to return the piston when the applied working pressure is removed; to provide a cylinder with a reciprocating piston with means interconnecting the two which will prevent rotation of the piston so that a tool mounted on the piston will not rotate out of position; to provide back pressure or return pressure storage means which is charged by the applied working pressure and wherein the degree of stored pressure can be readily controlled; to provide a unit wherein the relative sizes of cylinder and piston shank are such that piston return pressures can be built up without producing too great a resistance in the working stroke; and to provide an improved check valve construction which can advantageously be used in a structure of this type.

The above and other objects and advantages will more fully appear from the following description made in connection with the accompanying drawing wherein:

Fig. 1 is a longitudinal sectional view through the unit with the piston at the end of its return stroke.

Fig. 2 is a similar sectional view with the piston at the end of its working stroke.

Fig. 3 is a transverse sectional view of the unit taken on the line III—III of Fig. 1.

The device includes a cylinder 6 having a side wall 8 and an end plug 10 held in place by a flexible coupling wire 12 which lies in mated grooves 14 and 16 in the plug and cylindrical walls, respectively. The wire is inserted through an opening 18 which extends through the wall 8 of the cylinder.

The cylinder wall 8 is provided with an air inlet opening 20 which registers with an internally threaded air inlet port portion 22. This port portion is in communication with a port 24 which leads to the interior of the cylinder 6.

The plug 10 is provided with a central socket 26 to receive the rounded end 28 of a squared piston head guide bar 30. A set screw 32 is threaded into a bore 34 in the plug 10 to engage and firmly hold the rounded end 28 of the guide bar 30.

The plug 10 is provided with a circumferential groove

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36 in which is an O-ring seal 38 which is in sealed contact with the inner side of the cylindrical wall 8.

A piston head 40 has a squared central aperture 42 which slidably receives the squared guide bar 30. The rear face of the piston head 40 is provided with a boss 44 over which is placed a cylindrical sealing partition 46 which is soldered at its upper end, as indicated at 48, to secure it to the piston head. The lower end of the cylindrical sealing partition 46 is provided with a sealing plug 50 which is soldered as at 52. The length of the cylindrical sealing partition is sufficient to receive the full length of the squared guide bar 30.

The piston head 40 has a sleeve 54 mounted thereon. This sleeve extends downwardly and throughout the remainder of the length of the cylinder 6 and is slidable in a band 56 which is secured in the lower end of the cylinder wall 8 by solder at 58. The band 56 has an inner circumferential groove 60 which contains an O-ring 62 which is in contact with the outer surface of the sleeve 54.

The lower end of the sleeve 54 is mounted on a flange 64 which extends upwardly from a disk 66 and said sleeve 54 is soldered to the disk at 68. The disk 66 has a threaded extension 70 to which a suitable tool can be attached.

The piston head 40 is provided with a circumferential channel 72 in which is a sealing ring 74, preferably of rubber. The upper side of the channel 72 is defined by a flange 76 which is spaced inwardly from the inner wall of the main cylinder 6 to provide air flow from the port 24 to the pressure face 78 of the piston head 40. A port 80 extends from the channel 72 to provide flow communication with a chamber 82 inside of the sleeve 54 which constitutes the shank of the piston.

A portion of the piston head 40 comprises a skirt 84. Said skirt and the sleeve 54 are provided with common ports 86 permitting air flow from the port 80 and chamber 82 to a chamber 88 which lies between the sleeve 54 and the cylindrical wall 8 of the main cylinder 6.

The disk 66 in the lower end of the piston shank sleeve 54 is provided with an air passage 90 having an adjustable valve plug 92 therein. This valve plug is threaded, as shown, and can be positioned against, or in variably spaced relation relative to a valve seat ring 94. This ring can, if desired, be formed of rubber. The valve plug 92 and ring 94 constitute a bleeder permitting restricted flow from the chamber 82.

With the device in the position shown in Fig. 1, air under pressure can be introduced through the aperture 20 in the wall 8 of cylinder 6 and thence through the port 22, 24, and thence to the interior of the cylinder 6. Air under pressure will flow around the piston head flange 76 and push the valve ring 74 from the full line to the dotted line position thereof. The ring is retained in its dotted position by a flange 41 on the piston head 40. Air flows into the channel 72 and through the port 80 into the chamber 82 and also into chamber 88.

The air under pressure will push the piston head 40 downwardly and at the same time compress air in chambers 82 and 88. The piston is shown in its downward position in Fig. 2.

When air pressure is removed from the piston pressure face 78, air which is compressed in the chambers 82 and 88 will attempt to escape through the ports 80, 86 and channel 72 to the pressure face side of the piston and thence out of passage 24, 22, 20. The flow of air through port 86 will push the valve ring 74 back to the full line position of Fig. 1, thereby closing the piston head air passage and causing the piston to be pushed from the position of Fig. 2 to that of Fig. 1.

The reciprocating action of the piston relative to the guide bar 30 prevents the piston from turning on its axis. As a result, a tool or other mechanical element can be held on the threaded extension 70 without turning. This feature is important in many types of installations. Leakage of air under pressure around the guide bar 30 is prevented by the inner cylinder 46 which is sealed over and around the bar so that no flow communication is afforded between the chamber 82 and the inside of the inner sleeve 46.

The bleeder valve unit 92, 94 is provided to compen-

sate for different working pressures exerted by the piston relative to applied air pressures.

It should be noted that the sleeve 54 defines the piston rod or shank which slides in the sealing band 66 in the lower end of cylinder 6. The diameter of the sleeve 54 is nearly as great as the inner diameter of the cylindrical portion 8 of cylinder 6. By the same token, the diameter of the end disk 66 at the bottom of sleeve 54 is nearly as great as the diameter of the piston head 40. This results in a nearly balanced condition of the piston relative to atmospheric pressure.

One of the primary features of the device is the ability to advance the piston unit outwardly from the cylinder under air pressure without creating back pressures during the advancing movement. It is not necessary to build up a back pressure for the return stroke or to advance the piston against a return spring.

When the cylinder and piston unit is expanded pressure is exerted on the inner face of the disk 66 to push the piston outwardly. When return of the piston is desired, air pressure is relieved at the cylinder air inlet 20 and the interior of the cylinder is opened to atmospheric pressure.

At this point, there is air under greater than atmospheric pressure in the chamber 82 in the hollow piston shank and in the chamber 88 between the piston sleeve 54 and the cylinder wall 8. This compressed air, tending to escape, moves the check valve O-ring 74 to the full line position of Fig. 1. The confined and compressed air acts on the inside of the piston head 40 and O-ring 74 and also against the edge of the band 66 as a pressure base, to return the piston unit to the position of Fig. 1.

Thus it will be seen that the piston moves outwardly, or downwardly as viewed in the drawing, under the influence of applied pressure introduced through the cylinder inlet 20, and this movement is not restricted by any residual back pressure. Therefore, the applied pressure is utilized only for expanding the cylinder and piston unit and moving a tool or other part secured to the threaded piston extension 70, and no additional pressure is needed for building up return pressures.

Attention is also directed to the check valve element provided by the axially shiftable O-ring 74. The O-ring is shifted to the dotted line, or open position of Fig. 1, by incoming air under pressure, and it seals the space between the piston head and the inside of the cylinder wall when air under pressure attempts to flow from the interior piston chamber 82. It is in sliding contact with the inner wall of the cylinder and therefore simultaneously serves as a piston packing.

While I have described the unit as being in a vertical position and for use on presses of various types, it will be understood that the cylinder and piston unit can be placed at any angle and that its threaded extension 70 can be connected to any type of mechanism to be reciprocated. It will be understood that changes can be made in the details and proportions of the several parts

of the device without departing from the spirit of the invention.

I claim:

1. In a cylinder and piston unit, a cylinder having an inlet port, a piston assembly slidable in said cylinder and including a head and a shank, said cylinder inlet port having flow communication with the interior of the cylinder at the pressure face side of said piston head, said piston shank including an air compression chamber therein, said piston head having an air flow passage therein providing flow from the pressure face thereof to said air compression chamber in said shank, a check valve in said passage, said valve being shiftable in said passage to permit flow only from the operating pressure face of the piston head to the opposite side of the piston head, said cylinder having a piston head guide bar supported at one end thereof and extending a substantial distance longitudinally therein, said piston head having an aperture therethrough and non-rotatably receiving said guide bar, and a partition between said air compression chamber in said shank and said guide bar, said partition comprising an elongated cylinder having one end sealed to said piston head about its guide bar opening and having its other end closed beyond the end of said guide bar.

2. In a cylinder and piston unit, a cylinder having an inlet port, a piston assembly slidable in said cylinder, said piston assembly including a head located within the cylinder and a hollow shank telescopically fitting said cylinder and extending through an end thereof, a seal between said end of said cylinder and said shank and defining, with said head, an air chamber between said shank and the inner wall of said cylinder, said piston head having a portion thereof defining an air passage between said air chamber and that portion of said cylinder lying ahead of said piston, passage means connecting the interior of the shank to said air chamber, an O-ring lying about said piston head and constituting, with said passage, a one-way valve permitting air flow from the interior of said cylinder in front of said head through said air passage and into said air chamber and the interior of said shank, and said shank having a bleeder port therein providing flow communication between the interior of the shank and the atmosphere exteriorly of said shank and cylinder.

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