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CUSHIONING STRUCTURE FOR HYDRAULIC CYLINDERS

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FIG. 1

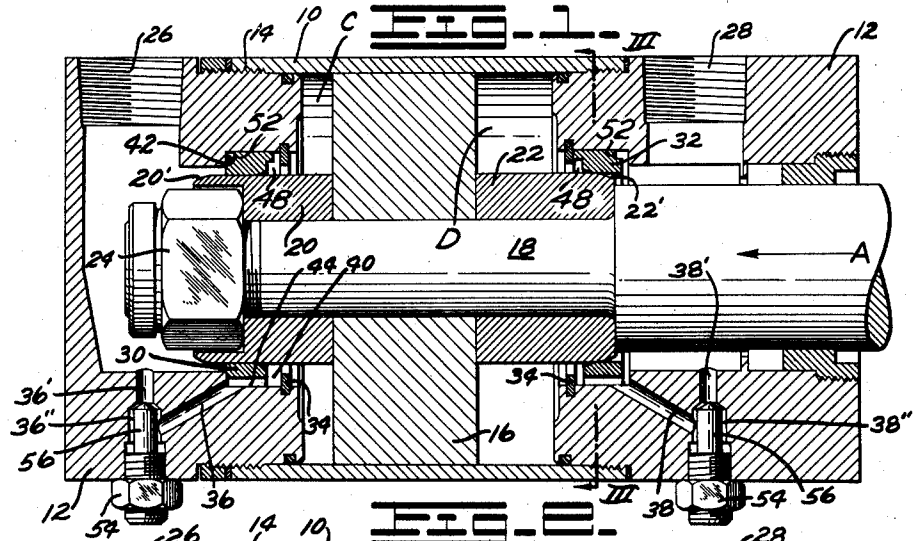


FIG. 2

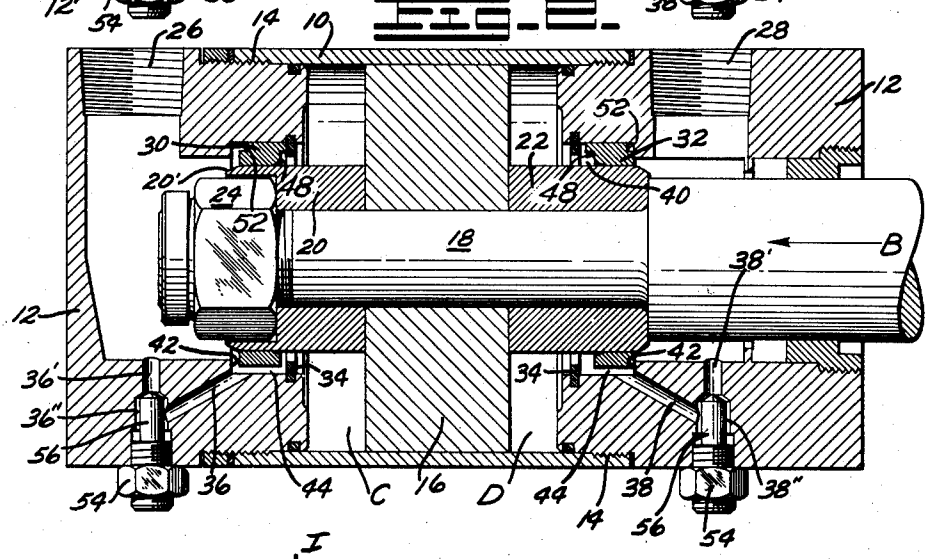
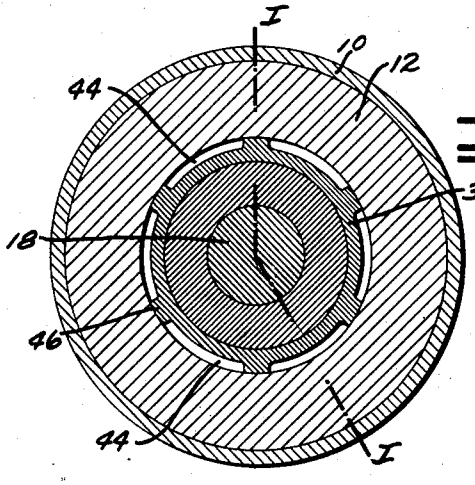


FIG. 3



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CUSHIONING STRUCTURE FOR HYDRAULIC CYLINDERS

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1 Claim. (Cl. 121—38)

This invention relates to improvements in the means employed for cushioning and regulating the movement of reciprocated pistons actuated by a fluid, such as oil, air, and the like in which structure is employed, movable with the piston, to restrict the flow of the fluid moving ahead of the piston so as to cushion and regulate the movement as the piston reaches the end of its stroke in one direction or in the opposite direction.

It is an object of the invention to provide improved means for effecting such flow restricting and cushioning action in a simple yet efficient manner with the employment of the fewest number of parts, which can be standardised and manufactured without the need for close manufacturing tolerances and are capable of being readily installed, or replaced.

The above and other objects and advantages of the invention, residing in the construction, arrangement and combination of parts will appear clear from a consideration of the following descriptions with reference to the accompanying drawings and from the appended claim.

In the drawings:

Figure 1 is a longitudinal section on the line I—I of Figure 3 of a piston and cylinder assembly incorporating fluid flow restricting and cushioning means in accordance with the invention and shown in position when the piston is moved to the left, as indicated by the arrow A,

Figure 2 is a similar view to Figure 1, but with the piston shown moved to the right, as indicated by the arrow B, and

Figure 3 is a cross section on the line III—III of Figure 1.

Referring to the drawings **10** indicates the cylinder, which has heads **12** secured thereto at its opposite ends in any suitable manner, as by the screw-threading **14**.

The piston, indicated at **16**, is supported for reciprocation in the cylinder and has its piston rod **18**, upon which sealing plugs **20** and **22** are secured so as to engage the opposite sides of the piston, with the nut **24** holding the parts in position.

To alternately direct fluid under pressure against opposite sides of the piston **16**, any suitable conduit (not shown) connects the ports **26** and **28** with a source of the pressure fluid, there being a valve provided (not shown) for alternatively connecting these parts to receive the pressure fluid for admission against one side of the piston and for alternatively connecting them for exhaust of the pressure fluid. Thus, if the port **26** is connected to admit pressure fluid against the left-hand side of the piston the port **28** will be connected to exhaust the pressure fluid from the right-hand side of the piston, and vice versa.

The means provided for restricting the fluid and cushioning the piston movement as it reaches the end of its stroke in either direction comprise a pair of similar slotted rings **30** and **32**, with associated stop rings **34**, and restricted flow passages **36**, **36'** and **38**, **38'** provided in the left-hand and the right-hand piston heads **12**, respectively.

The slotted rings **30** and **32** are mounted for axial movement within annular spaces **40** defined between the cylinder heads **12** and the piston rod plugs **20** and **22**, their movement being limited by internal radial abutment surfaces **42** on each cylinder head and by the stop rings **34**. These slotted rings also have some freedom of movement to float vertically within their confining spaces **40** and with respect to the said radial abutment surfaces **42**, whereby to provide for a self centering movement of these rings in the piston cushioning movements and eliminate the necessity of providing precision concentric surfaces. The stop rings **34** are shown secured within annular recesses on the interior surfaces of the cylinder heads **12**, and the piston plugs **20** and **22** are shown with bevelled end surfaces **20'** and **22'** which assist in leading the plugs into their respective slotted rings and effect the initial cushioning of the piston.

The slotted rings **30** and **32** are of similar construction, as will be seen from reference to the drawings. Each ring is formed on its exterior surface with a series of circumferentially spaced arcuate slots **44**, which extend the full-axial extent of the rings and define axial fluid flow passages, the slots being separated by radial integral web portions **46** of the rings, which web portions have relative axial sliding and vertical floating movement with respect to the interior cylinder head surfaces.

On each side of each of the slotted rings, as presented to the corresponding stop ring, the rings are formed with internal counterbores **48** and on their opposite sides, as presented to the cylinder head abutment surfaces **42**, the rings are formed with external counterbores **52**.

The restricted fluid flow passages **36**, **36'** and **38**, **38'** communicate with intermediate passages **36''** and **38''**, respectively, in which valve plugs **54** are located for adjustment by the nuts **56** so as to adjust the effective size of the opening between the passages **36''**, **36'** and **38''**, **38'**. Such adjustment may be an initial set adjustment made to suit a particular cylinder and piston assembly.

In operation, with pressure fluid admitted through port **28** and port **26** being connected to exhaust, and having reference to Figure 1, the pressure fluid will act against the slotted ring **32** to move it to the left against the corresponding stop ring **34**. This opens up the slots **44** to a flow of the fluid from the port **28** to the right-hand side of the piston, with attendant movement of the piston to the left, insertion of the sealing plug **20** in the slotted ring **30**, and seating of the slotted ring **30** against the abutment surface **42** on the left-hand cylinder head surface **42**. This seating of the ring **30** gives rise to the formation of a restriction within the cylinder space C formed on the left-hand side of the piston, as seen in Figure 1, due to the flow of the fluid from this cylinder space to the exhaust port **26** being constrained to take place through the restricted passageway **36**, **36''**, **36'** via the slots **44** in the ring **30**. These slots **44**, with the ring **30** floatingly seated against the said surface **42**, will be open to a flow of the fluid from the cylinder space C but will be closed to the exhaust port **26** except through the said passages **36**, **36''**, **36'**.

The reverse action takes place when the piston is moved to the right from the position seen in Figure 1 to the position seen in Figure 2, where the slotted rings **30** and **32** are shown reversed in position and the fluid cushion is formed in the cylinder space D on the right of the piston **16**.

Having thus described our invention, what we claim as novel and desire to protect by Letters Patent is as follows:

A piston and cylinder assembly having a fluid cushion for cushioning the piston travel at the ends of its stroke comprising a cylinder for cylinder heads at opposite ends thereof, a centrally located bore defined in each of said

heads for the passage of actuating and exhaust fluids in opposite directions, a cylindrical piston disposed in said cylinder for actuation by differential fluid pressure on opposite sides of said piston and having a piston rod connected thereto, cylindrical members of lesser diameter than said piston and located upon opposite sides of said piston and alternatively movable into said bores of said heads as the end of each stroke of said piston is approached to restrict the passage of fluid through said bores, ring valves supported in said bores for limited axial and radial movement, the internal diameter of said ring valves approaching the external diameter of said cylindrical members to provide a sliding seal between said ring valves and said cylindrical members and imparting limited movement to said ring valves in the direction of piston movement, port structure defined along the periphery of said ring valves for the controlled passage of fluid through said bores, and abutment structure located in said bores and providing a seat for said ring valves for regulating said port structure upon axial movement of said ring valves, said abutment structure and

said ring valves coacting in said bores and providing a seat for said ring valves for regulating said port structure upon axial movement of said ring valves, and said cylindrical members and said ring valves coacting in said bores to restrict the exhausting of fluid from said cylinder as the piston approaches from one direction the end of its stroke to provide a fluid cushion, upon piston movement in the opposite direction said ring valves being axially moved to open said port structure for the admission of actuating fluid to said cylinder.

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