Nov. 9, 1965 J. E. WHELAN 3,216,050

HYDRAULIC DOOR CLOSING MECHANISM

Filed March 29, 1962 2 Sheets-Sheet 1

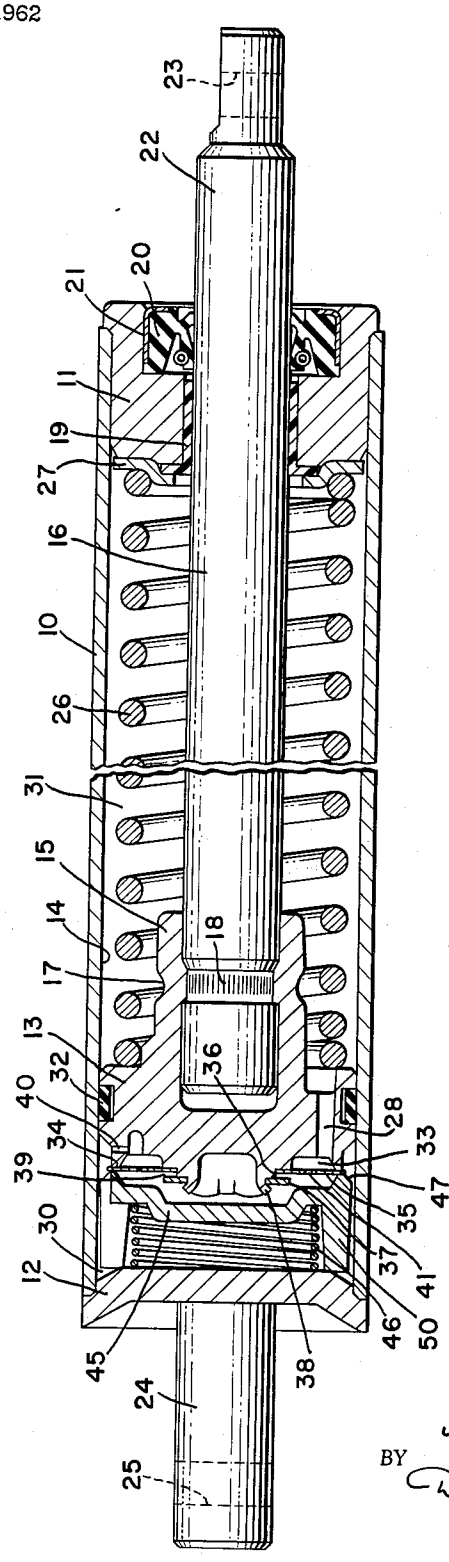


Fig. 1

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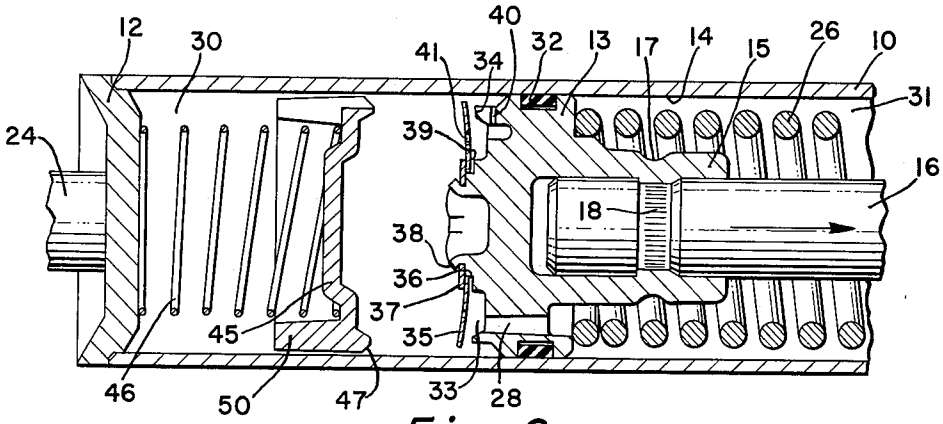


Fig. 2

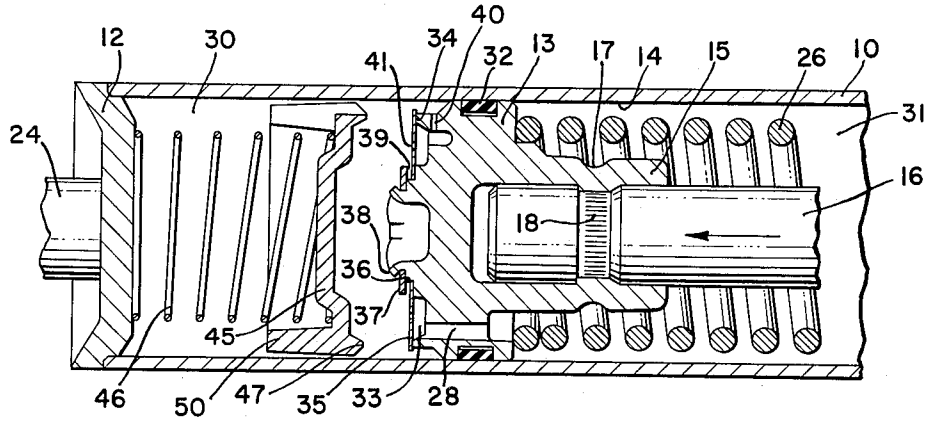


Fig. 3

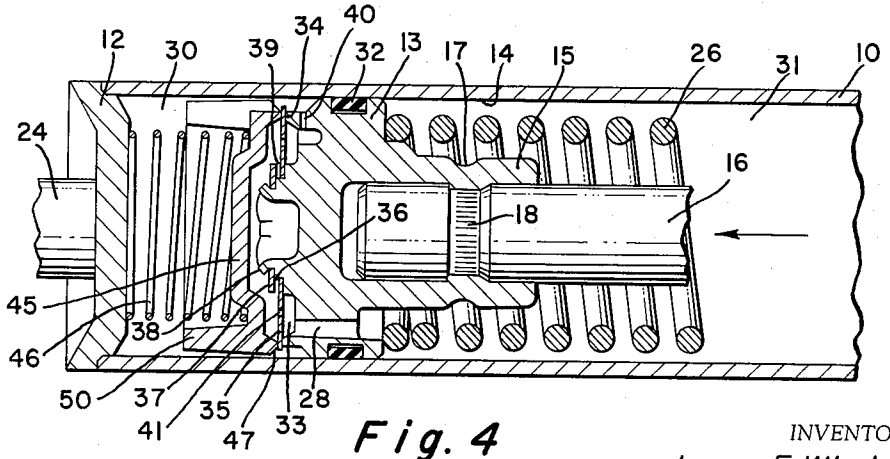


Fig. 4

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HYDRAULIC DOOR CLOSING MECHANISM

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1 Claim. (Cl. 16—52)

This invention relates to door closure controlling mechanisms.

An object of the invention is to provide an improved hydraulically controlled door closure mechanism that is constructed and arranged in a manner that a door can be opened freely but wherein the door closure control mechanism is provided with suitable passages effecting resistance flow of hydraulic fluid between opposite sides of a piston reciprocable in a cylinder so that the door will close at a slow speed of movement until it approaches a closed condition, at which time, a part of the resistance passage means is closed or blocked off so as to increase the resistance to flow of hydraulic fluid between chambers at opposite sides of the piston in the last portion of the stroke of movement of the door closing mechanism.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein preferred embodiments of the present invention are clearly shown.

In the drawings:

FIGURE 1 is a longitudinal cross-sectional view of a door closing mechanism incorporating features of this invention;

FIGURE 2 is a partial cross-sectional view of the mechanism of FIGURE 1 showing the position of the several parts during a relatively unrestricted opening of a door;

FIGURE 3 is a partial cross-sectional view similar to FIGURE 2 but wherein the several parts of the mechanism provide for restrictive movement of a door during a closing movement; and

FIGURE 4 is a cross-sectional view similar to FIGURE 2 but wherein a part of the restriction to flow of hydraulic fluid between chambers at opposite sides of the piston is partially closed to increase the resistance to movement of the piston during the last portion of stroke of movement as a door is being fully closed.

In this invention, the door closing mechanism consists of a cylinder **10** closed at one end by the closure member **11** and at the opposite end by the closure member **12**. A piston **13** is slidable in the cylinder bore **14** and has an axial extension **15** to which the rod **16** is secured by means of deforming the area **17** into the undercut or reduced diameter portion **18** of the rod **16**. The opposite end of the rod **16** extends through the closure member **11** through a nylon, or similar material, sleeved bearing **19** positioned in the closure member **11**. A lip seal **20** is supported in the recess **21** in the closure member **11** to prevent loss of hydraulic fluid from within the cylinder **10**. An extending end **22** of the rod **16** has a transverse opening **23** that is adapted to be secured to a suitable pivot on a door or door frame member. The opposite closure member **12** has an extension **24** that has a transverse opening **25** adapted to be placed on a suitable connection on a door or door frame so that the door opening mechanism will be supported suitably between a door and door frame for closing the door.

A compression spring **26** is disposed between the piston **13** and a spring retainer member **27** normally urging the piston **13** in a left-hand direction to the position shown in FIGURE 1 of the drawings.

The piston **13** has a plurality of passages **28** extending axially through the body of the piston **13** for fluid flow

between the chambers **30** and **31** provided at opposite sides of the piston **13**, piston **13** dividing the cylinder **10** into the two chambers **30** and **31**. A suitable ring seal **32** is carried by the piston **13** to prevent interchange of fluid between the chambers **30** and **31** around the outer periphery of the piston **13** in its reciprocatory movement in the cylinder **10**.

The plurality of passages **28** in the piston **13** terminate at one end in an annular recess **33** provided in the left-hand face of the piston **13**. The outer peripheral edge of this recess **33** forms an annular valve seat **34** on which a disc valve **35** seats.

The disc valve **35** is carried on a forward projection **36** on the piston **13** and is retained on the piston by a retaining washer **37** held in position on the projection by a plurality of staked portions **38**. There is a clearance space **39** provided in which the disc valve **35** can move toward and away from the plane of the annular seat **34** for the disc valve.

The piston **13** has one or more radially extending passages **40** that by-pass the valve member **35** and maintain continuous fluid connection between the chamber **30** at the left-hand side of the piston and the annular chamber **33**. The disc valve **35** has one or more ports or passages **41** therein which allow for flow of hydraulic fluid from chamber **30** into chamber **31** under the restrictive flow condition of the passages **41** when the valve is in the position shown in FIGURE 3 in a manner hereinafter described. Passages **40** in piston **13** provide for restrictive flow between the chambers **30** and **31**, and maintain this restrictive flow at all times during movement of the piston **13** in a left-hand direction.

An auxliary member or piston **45** is placed in the chamber **30** at the left-hand side of piston **13**. This member **45** is spring urged outwardly in a right-hand direction by means of a compression spring **46**, in the manner shown in FIGURES 2 and 3, when the piston **13** is moved in a right-hand direction. This piston member **45** has an annular ridge **47** that is engageable with the disc valve **35** when the piston **13** moves in a left-hand direction as viewed in FIGURE 4. This engagement of the annular ridge **47** with the disc valve **35** retains the valve on the seat **34** by means of the compression spring **46** and also prevents fluid communication between the chamber **30** and the chamber **31** through the ports **41** in the disc valve **35**.

The cylinder **10** is partially filled with hydraulic fluid when the piston **13** and rod **16** are collapsed into the cylinder in the position shown in FIGURE 1 so that there will be no compression of fluid by the displacement of the components when the door closing device is in fully collapsed condition, an air space being provided in the cylinder.

When the door closing device of this invention is suitably attatched between a door and door frame by the extensions **22** and **24** and a door is opened, the device will be extended so that piston **13** moves in a right-hand direction away from the closure member **12** and the auxiliary piston member **45**. Such a movement is illustrated in FIGURE 2 with the piston **13** moving in a right-hand direction. At this time, the compression spring **46** will move the piston member **45** in a right-hand direction until the spring **46** reaches its extended free length, which is the position of the component **45** shown in FIGURE 2.

With piston **13** moving in a right-hand direction, disc valve **35** moves away from the valve seat **34** by a distance equal to the space **39** on the piston **13** and thereby allows free flow of fluid from chamber **31** through passages **28** into chamber **30**. If the door opening is rapid, the disc valve **35** can flex so as to allow relatively completely free flow of hydraulic fluid from chamber **31** to chamber

30 during the stroke of movement of the piston 13 in a right-hand direction.

When the door is to be closed, the compression spring 26 takes over action and moves piston 13 in a left-hand direction, as viewed in FIGURE 3. Under this circumstance, the disc valve 35 is held on its seat by the body of fluid on the left-hand side of the piston with resistance passages 40 in the piston and 41 in the disc valve allowing for flow of hydraulic fluid from chamber 30 into chamber 31 to govern the rate of closing movement of the door, that is the rate of movement of the piston 13 in a left-hand direction.

As piston 13 approaches the auxiliary piston member 45 in the left-hand movement of piston 13, the ridge 47 on the piston member 45 engages the disc valve 35 to retain it on its seat 34. When this occurs, passages 41 in the disc valve 35 are rendered ineffective because fluid from chamber 30 can no longer flow through these passages. However, passages 40 in the piston 13 continuously by-pass the disc valve 35 so that now the rate of movement of the piston 13 in a left-hand direction is reduced and is under control of the resistance passages 40. This condition is illustrated in FIGURE 4 and continues until the piston member 45 has the annular extension 50 thereof bottoming on the closure wall 12. This reduction of flow of fluid from chamber 30 to chamber 31 is in the last part of the stroke of movement of piston 13 just as the door is making its final closure, and prevents door slamming.

While the embodiments of the present invention as herein disclosed constitute preferred forms, it is to be understood that other forms might be adopted.

What is claimed is as follows:

A hydraulic door closing mechanism comprising, a cylinder, a closure member at each end of said cylinder, a first piston slidable in said cylinder dividing the same into separate chambers on either side of said first piston, a rod having one end thereof connected to said first piston and the opposite end thereof extending through one of said chambers and through one of said closure members at the end of said cylinder, a first coil spring surrounding said rod and having the outer surface thereof located in close proximity to the inner surface of said cylinder, one end of said first coil spring engaging said one of said closure members and the other end of said first spring continuously engaging said first piston for urging it toward the other closure member, said first piston having an annular valve seat formed on one end thereof located within the other of said chambers, a first fluid passageway directed through said piston from one side to the other side thereof, a restricted fluid passageway directed through said annular valve seat for providing a first restricted fluid path from said other chamber through said piston passageway, valve disc means on said first piston movable with respect to said valve seat for producing substantially unrestricted fluid flow through said first piston on movement thereof produced by movement of said piston rod exteriorly of said cylinder, said valve disc means engaging said valve seat upon movement of said first piston in an opposite direction, said valve disc means having a second resistance passageway therein for producing a more restricted fluid flow through said first piston upon its movement in said opposite direction, a second piston located within said other chamber movable relative to said cylinder, said second piston having an outer peripheral portion in close spaced relationship with the inside surface of said cylinder for axially guiding said second piston upon movement thereof relative to said cylinder, a second spring urging said second piston within said other chamber toward said first piston, said second spring locating said second piston in spaced relationship with first piston when said piston rod is extended exteriorly of said cylinder a predetermined distance, said second piston member having an annular valve seat thereon engaging said valve disc means upon predetermined movement of said first piston in said opposite direction to block fluid flow through said second resistance passageway in said valve disc whereby fluid flow across the piston is solely direced through the resistance passageway in said first piston valve seat.

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