July 22, 1969 E. H. EASTIN 3,456,282

HYDRAULIC DOOR CLOSER

Filed Oct. 6, 1967

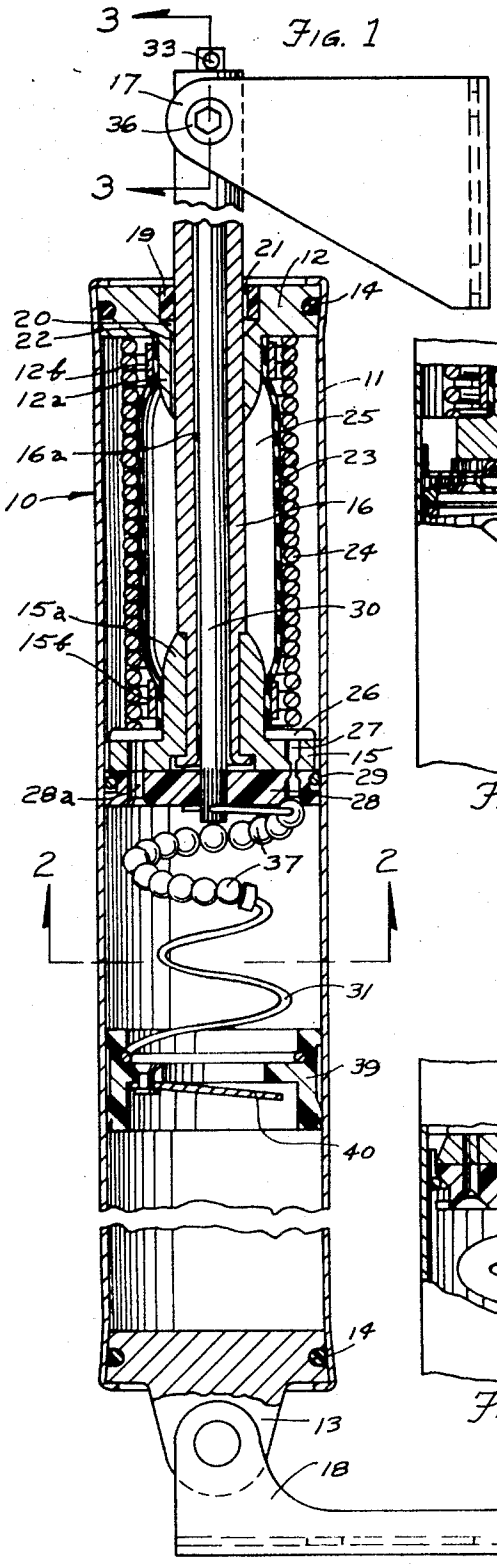


FIG. 1

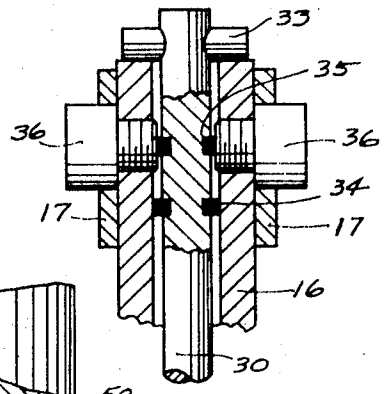


FIG. 3

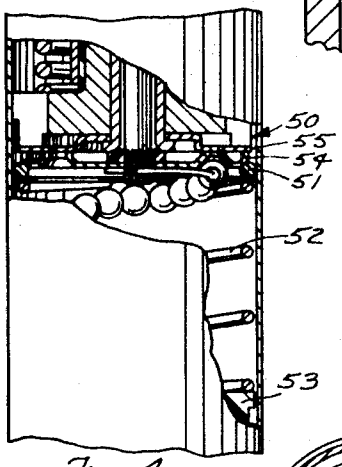


FIG. 4

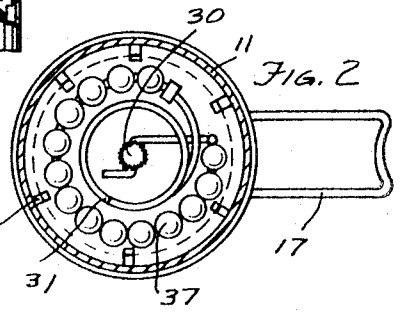


FIG. 2

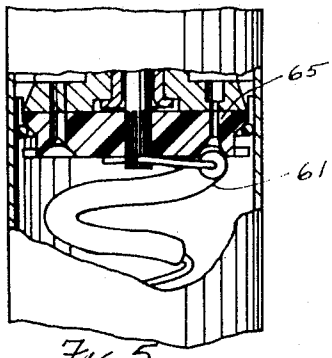


FIG. 5

INVENTOR.
EDWARD H. EASTIN

BY
Barnes, Kisselle,
Raisch & Choate

United States Patent Office 3,456,282 Patented July 22, 1969

3,456,282

HYDRAULIC DOOR CLOSER

Edward H. Eastin, 254 Reitman Court, Rochester, Mich. 48063

Filed Oct. 6, 1967, Ser. No. 673,378
Int. Cl. E05f 3/10
U.S. Cl. 16—52 22 Claims

ABSTRACT OF THE DISCLOSURE

The hydraulic door closer disclosed herein comprises a cylinder, a piston with a piston shaft extending outwardly from one end of the cylinder and a spring yieldingly urging the piston inwardly of the cylinder. The piston has a plurality of circumferentially spaced axial openings and a carrier is fixed to the piston and has closure members thereon. When the piston is moved inwardly of the cylinder under the action of the spring, the carrier with the closure members thereon is compressed to bring the closure members successively in registry with the openings and thereby restrict the flow of fluid through the openings. A one-way valve on the piston is operable to permit free flow of hydraulic fluid past the piston when the piston is moved outwardly of the cylinder. An expandable sleeve is provided around the piston shaft to provide a variable reservoir for fluid in the area surrounding the shaft. Means are provided for varying the size of the openings through the piston.

Background of the invention

This invention relates to hydraulic door closers.

Among the objects of the invention are to provide a hydraulic door closer which is relatively simple, dependable and will provide smooth closing of a door; which will also function to absorb the sudden forces on the door due to wind and the like.

Description of the drawings

FIG. 1 is a part sectional view of a hydraulic door closer embodying the invention.

FIG. 2 is a sectional view taken along the line 2—2 in FIG. 1.

FIG. 3 is a fragmentary sectional view taken along the line 3—3 in FIG. 1.

FIG. 4 is a fragmentary sectional view of a modified form of the invention.

FIG. 5 is a fragmentary sectional view of a further modified form of the invention.

Description

Referring to FIG. 1, the door closer **10** embodying the invention comprises a cylinder **11** having ends **12, 13** press fitted therein with O-rings **14** forming seals. A piston **15** is mounted for reciprocating movement within the cylinder and has a piston rod **16** that extends outwardly through an opening in the cylinder end **12**. A bracket **17** is pivoted, as presently described, to the piston rod **16** for attaching the door closer to a door frame or jamb and a bracket **18** is pivoted to the end **13** for attaching the cylinder to a door.

The end **12** includes a plastic bearing **19** for slidably supporting the piston rod **16**. The bearing **19** and the end **12** define an annular channel **20**. This channel is vented to the interior of the cylinder and to the atmosphere by diametrically opposed axial openings **21, 22** for reasons presently described.

An expendable sleeve **23** has one end thereof fixed to a hub **12***a* on the end **12** by a band **12***b* and the other end thereof fixed to a hub **15***a* on the piston by a band **15***b*.

A compression spring **24** surrounds the expandable sleeve **23** and is interposed between the piston **15** and the end **12**.

In the position shown in FIG. 1, the spring **24** is fully compressed corresponding to a position wherein the door is open. In this position, the air vented to the interior of the expandable sleeve **23** holds the wall portion **25** outwardly generally as shown in FIG. 1. When the piston moves inwardly of the cylinder under the action of the spring **24**, the flexible wall **25** is stretched reducing the air space size and increasing the size of the space about the flexible wall **25** to provide space for fluid from beneath the piston to move upwardly above the piston and thereby compensate for the volume of the piston shaft **16**. The piston **15** has radial projections **26** against which the spring **24** bears.

The piston **15** further includes a plurality of circumferentially spaced axial passages **27**. A disc **28** having a plurality of circumferentially spaced axial openings **28***a* is provided beneath the piston **15** and is rotatably adjustable relative thereto to vary the flow of fluid axially through the piston. The periphery of the disc **28** cooperates with the piston **15** to form an axially extending annular passage in which an O-ring **29** is provided. The O-ring **29** opeartes when the piston is moved inwardly of the cylinder to form a one-way check valve preventing flow of fluid around the periphery of the piston. When the piston is moved upwardly or outwardly relative to the cylinder, the O-ring moves downwardly permitting flow of fluid freely about the periphery of the piston from above the piston toward the lower end of the cylinder.

The disc **28** is held in adjusted position by a construction which includes a shaft **30** that is fixed to the disc and extends upwardly through the opening **16***a* of the piston shaft through the free upper ends of the piston shaft. A cross pin on the upper end of the adjustment shaft **30** engages the upper end of the piston shaft **16**. By grasping the cross pin **33**, the adjustment shaft **30** and, in turn, the disc **28** can be rotated. The adjustment shaft **30** is locked in adjusted position relative to the piston shaft by an arrangement which includes screws **36** that are threaded inwardly into engagement with an O-ring **35**. Another O-ring **34** in a groove in the adjustment shaft **30** provides a fluid seal beneath O-ring **35**, as viewed in FIG. 3. The heads of the screws **36** are enlarged and form the pivot to the bracket **17** as shown in FIG. 3.

A carrier **31** in the form of a spiral spring has one end thereof fixed to the adjustment shaft **30** and the other end thereof extending downwardly and fixed to a secondary piston **39**. The carrier rotatably supports a plurality of closure members or balls **37** in substantial axial alignment with openings **28***a* so that when in operation, the carrier is compressed bringing the closure members successively into contact with the openings **28***a* and progressively retarding the flow of fluid from beneath the piston to the area above the piston.

The piston **39** has a one-way check valve **40** therein so that in the cases of a sudden gust of wind or the like tending to close the door or an intentional quick closing movement of the door, the closure **40** is closed entrapping fluid between the pistons **39** and cylinder end **13** thereby providing intermediate opeartion of the carrier at that time rather than at the end of the stroke.

In normal operation, when a door is open, the spring **24** is compressed and the fluid is forced from above the piston as viewed in FIG. 1 to the area beneath the piston through the openings **27, 28***a* as well as about the periphery of the piston. When the door is released, the spring **24** tends to return the piston and piston shaft to their original position, namely, inwardly of the cylinder. As this occurs the one-way valve formed by O-ring **29** closes.

As the door closes, the piston **39** will engage the bottom of the cylinder. Upon further movement the carrier **31** will become compressed bringing the balls **37** successively into contact with their respective openings in the disc **28** to progressively restrict the flow of fluid from the area beneath the piston to the area above the piston and thereby provide a harmonic stop. As the fluid flows upwardly as viewed in FIG. 1, the fluid will displace the air from the interior of the expandable sleeve **23** filling the area surrounding the sleeve.

In the form of the invention shown in FIG. 4, the piston **50** has sheet metal parts **54**, **55** and a lightweight coil spring **52** is utilized for urging the O-ring **51** against the piston to provide the one-way control of fluid about the periphery of the piston. Spring **52** abuts against secondary piston **53**.

In the form of the invention shown in FIG. 5, the openings in the piston **65** are engaged by a single closure member **61** in the form of a resilient body on the carrier which progressively engages the openings to produce the desired restricting action. Other forms of carriers and closure members may be used as disclosed in my copending application Ser. No. 659,364, filed Aug. 9, 1967.

I claim:

1. In a hydraulic door closer, the combination comprising

a cylinder,

a piston mounted for reciprocating motion within said cylinder,

said piston having a piston rod extending through one end of the cylinder,

means on said rod and said cylinder for mounting said rod and said cylinder on a door jamb and door,

spring means for yieldingly urging said piston inwardly of said cylinder,

means operable to restrict the flow of fluid from the side of said piston to the other when the piston is moved inwardly and to permit the relatively free flow of fluid from one side of the piston to the other when the piston is moved outwardly relative to the cylinder,

said piston having a plurality of openings therethrough,

a carrier interposed between said piston and the end of said cylinder opposite said rod,

closure means supported by said carrier and operable upon inward movement of said piston under the action of said spring means to successively engage said openings in said piston to restrict the flow of fluid through said piston.

2. The combination set forth in claim **1** wherein said carrier comprises a spiral member.

3. The combination set forth in claim **2** wherein said closure means comprises a ball.

4. The combination set forth in claim **2** wherein said closure means comprises a plurality of balls.

5. The combination set forth in claim **2** wherein said closure means comprises a complementary curved member progressively engaging said opening.

6. The combination set forth in claim **1** including a tubular flexible wall surrounding said piston rod,

means for fixing one end of said wall to said cylinder and means for fixing the other end of said wall to said piston.

7. The combination set forth in claim **6** wherein said spring means comprises a spring surrounding said piston and interposed between said piston and said one end of said cylinder through which said piston rod extends.

8. The combination set forth in claim **6** wherein said end of said cylinder through which said piston rod extends includes axially spaced and circumferentially spaced generally axially extending openings with an intervening arcuate space connecting said openings whereby the interior of said flexible wall is bent to the atmosphere.

9. The combination set forth in claim **1** including

means for adjusting the size of said axial openings in said piston.

10. The combination set forth in claim **9** wherein said means comprises a disc having axial openings therethrough and means for adjusting the position of said disc circumferentially of said piston.

11. The combination set forth in claim **10** wherein said last-mentioned means comprises an adjusting shaft extending axially through said piston rod,

and means for adjusting the position of said shaft relative to said piston rod and, in turn, said piston.

12. The combination set forth in claim **11** wherein said last-mentioned means comprises means for frictionally engaging said adjusting shaft and locking in position relative to said piston shaft.

13. The combination set forth in claim **1** wherein said door closer includes an auxiliary piston in the space between said piston and the end of said cylinder opposite that through which the piston rod extends,

said auxiliary piston being connected to said carrier,

said auxiliary piston having a one-way valve therein operable upon sudden movement of the main piston inwardly of the cylinder to close and entrap fluid between the auxiliary piston and cylinder end.

14. The combination set forth in claim **1** wherein said first-mentioned restricting means comprises an O-ring,

said piston having means thereon operable upon axial movement of said O-ring to cause engagement of said O-ring with the sides of the wall of the cylinder and operable upon movement in the opposite direction to permit said O-ring to move away from the sides of the wall of said cylinder.

15. The combination set forth in claim **14** wherein said piston is made of sheet metal.

16. In a hydraulic door closer, the combination comprising

a cylinder,

a piston mounted for reciprocating motion within said cylinder,

said piston having a piston rod extending through one end of the cylinder,

means on said rod and said cylinder for mounting said rod and said cylinder on a door jamb and door,

means operable to restrict the flow of fluid from one side of said piston to the other when the piston is moved inwardly and to permit the relatively free flow of fluid from one side of the piston to the other when the piston is moved outwardly relative to the cylinder,

spring means for yieldingly urging said piston inwardly of said cylinder,

said piston having an opening therethrough,

a closure supported by said piston and operable upon inwardly movement of said piston under the action of said spring means to restrict the flow of fluid through openings in said piston,

a tubular flexible wall surrounding said piston rod,

means for fixing one end of said wall to said cylinder.

17. The combination set forth in claim **16** wherein said spring means comprises a spring surrounding said piston and interposed between said piston and said one end of said cylinder through which said piston rod extends.

18. The combination set forth in claim **17** wherein said end of said cylinder through which said piston rod extends includes axially spaced and circumferentially spaced generally axially extending openings with an intervening arcuate space connecting said opening whereby the interior of said flexible wall is bent to the atmosphere.

19. In a hydraulic door closer, the combination comprising

a cylinder,

a piston mounted for reciprocating motion within said cylinder,

said piston having a piston rod extending through one end of the cylinder,

means on said rod and said cylinder for mounting said rod and said cylinder on a door jamb and door,

spring means for yieldingly urging said piston inwardly of said cylinder,

means operable to restrict the flow of fluid from one side of said piston to the other when the piston is moved inwardly and to permit the relatively free flow of fluid from one side of the piston to the other when the piston is moved outwardly relative to the cylinder,

said piston having openings therethrough,

a closure supported by said piston and operable upon inwardly movement of said piston under the action of said spring means to restrict the flow of fluid through said piston, and means for fixing the other end of said wall to said piston,

means for adjusting the size of said axial opening in said piston comprising

a disc having an opening therethrough and means for adjusting the position of said disc circumferentially of said piston.

20. The combination set forth in claim **19** wherein said last-mentioned means comprises an adjusting shaft extending axially through said piston rod,

and means for adjusting the position of said shaft relative to said piston rod and, in turn, said piston.

21. The combination set forth in claim **20** wherein said last-mentioned means comprises means for frictionally engaging said adjusting shaft and locking in position relative to said piston shaft.

22. In a hydraulic door closer, the combination comprising

a cylinder,

a piston mounted for reciprocating motion within said cylinder,

said piston having a piston rod extending through one end of the cylinder,

means on said rod and said cylinder for mounting said rod and said cylinder on a door jamb and door,

spring means for yieldingly urging said piston inwardly of said cylinder,

means operable to restrict the flow of fluid from one side of said piston to the other when the piston is moved inwardly and to permit the relatively free flow of fluid from one side of the piston to the other when the piston is moved outwardly relative to the cylinder,

said piston having an opening therethrough,

a closure supported by said piston and operable upon inwardly movement of said piston under the action of said spring means to restrict the flow of fluid through said piston,

an auxiliary piston in the space between said piston and the end of said cylinder opposite that through which the piston rod extends,

said auxiliary piston being connected to said carrier,

said auxiliary piston having a one-way valve therein operable upon sudden movement of the main piston inwardly of the cylinder to close and entrap fluid between the auxiliary piston and cylinder end.

References Cited

UNITED STATES PATENTS

1,205,433	11/1916	Christman	16—51
3,216,050	11/1965	Whelan	16—52
3,218,052	11/1965	Peterson	188—96 X

BOBBY R. GAY, Primary Examiner

J. L. KOHNEN, Assistant Examiner