April 19, 1966 A. JACKSON 3,246,362

DOOR CLOSER

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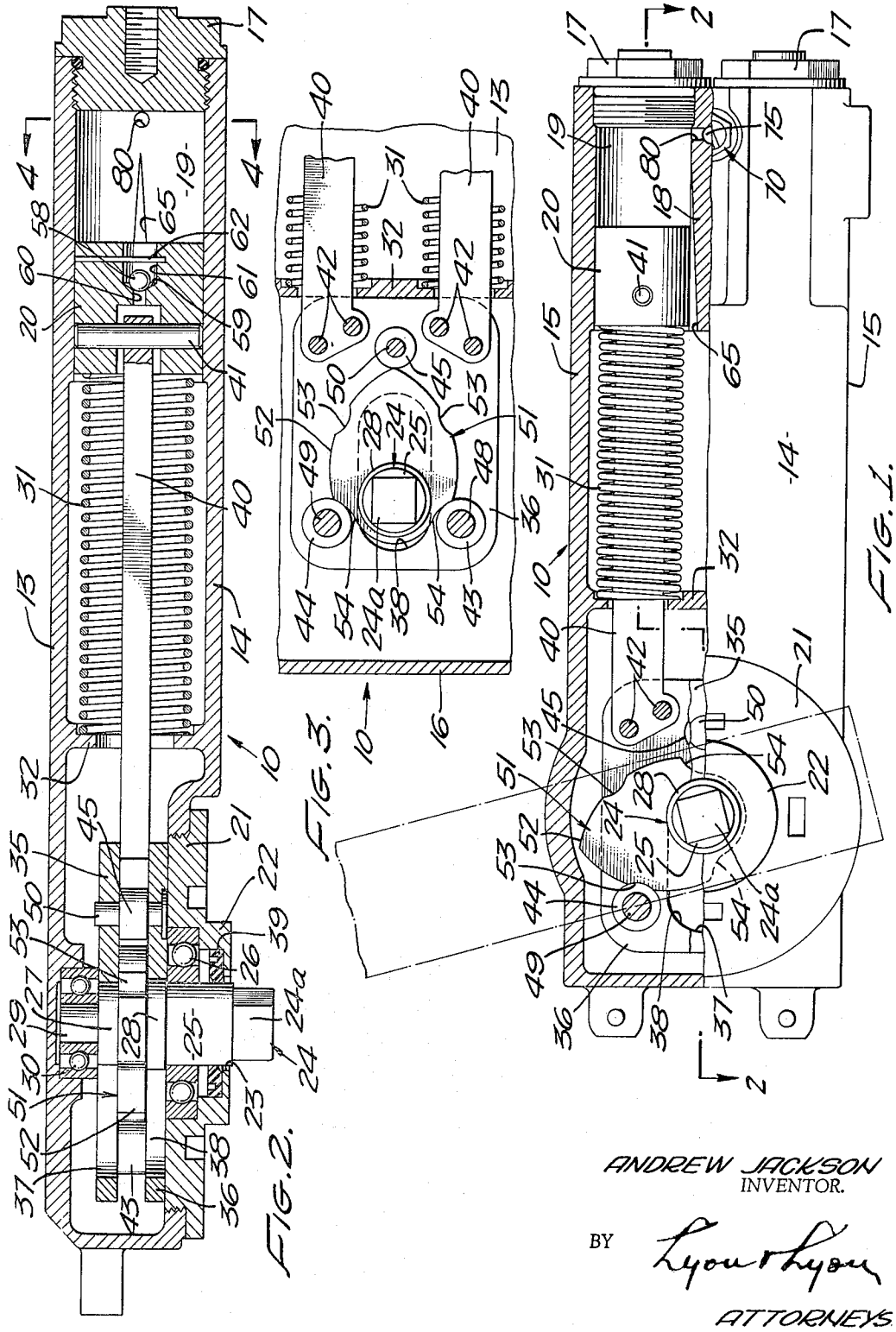

FIG. 1.

FIG. 2.

FIG. 3.

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DOOR CLOSER

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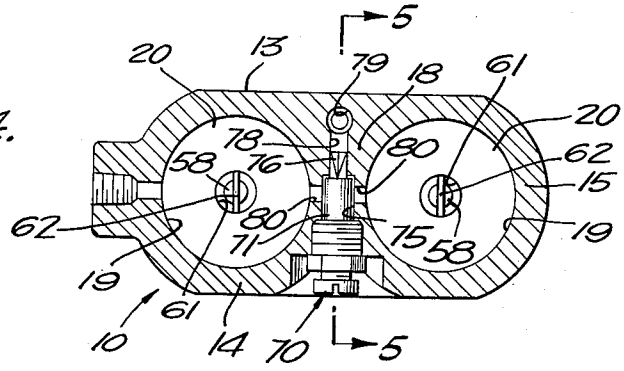
FIG. 4.



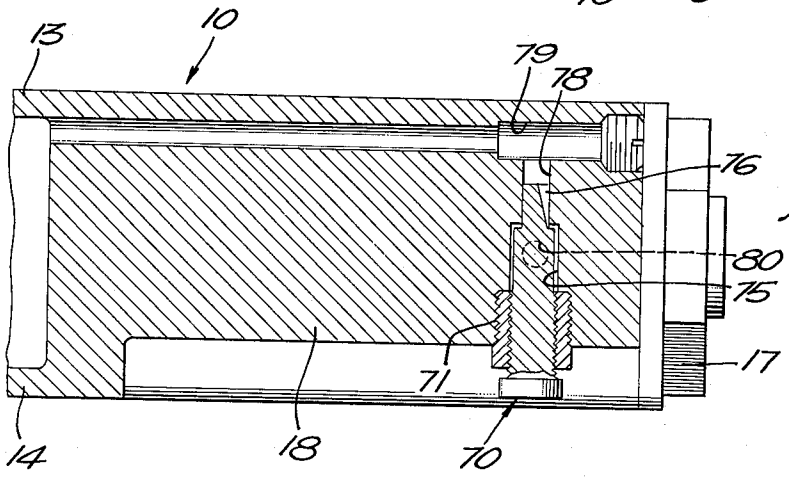
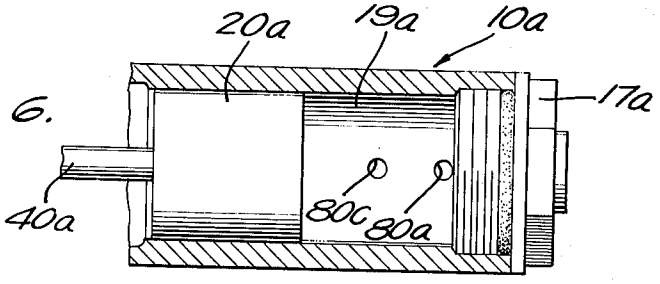


FIG. 5.

FIG. 6.



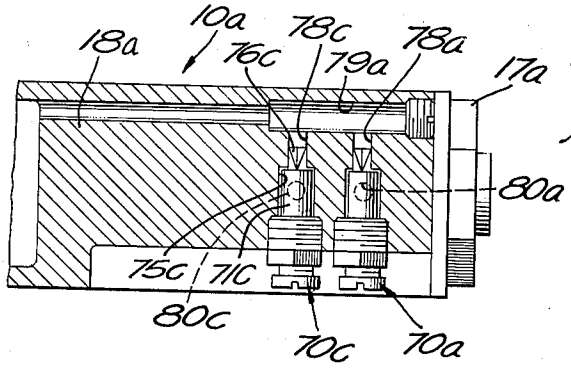


FIG. 7.

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DOOR CLOSER

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Filed Jan. 22, 1962, Ser. No. 167,559
4 Claims. (Cl. 16—51)

This invention relates to closers for doors and has particular reference to an automatic door closer of the spring actuated, hydraulic dash pot type.

A primary object of the present invention is to provide a novel and improved form of door closer of the spring actuated, hydraulic cam roller and follower type.

A further object of the present invention is to provide a novel door closer of simple and compact construction and adapted to be positioned and concealed in the header or overhead portion of the door frame.

Another object of this invention is to provide a door closer having novel valving means for controlling the closing and/or latching speed of the door.

Still another object of this invention is to provide a door closer having a valve for controlling the checking speed of the door, said valve incorporating a novel safety feature which prevents adjustment of the valve to a point where the door would fail to close completely.

Other objects and advantages of this invention it is believed, will be readily apparent from the following detailed description of preferred embodiments thereof when read in connection with the accompanying drawings.

In the drawings:

FIGURE 1 is a bottom plan view of the closer of this invention; partly broken away, the parts of the closer being in the door-open position.

FIGURE 2 is a sectional view taken substantially on the line 2—2 of FIGURE 1.

FIGURE 3 is a fragmentary sectional view, similar to FIGURE 1, but illustrating the closer parts in the door-closed position.

FIGURE 4 is a sectional view taken substantially on the line 4—4 of FIGURE 2.

FIGURE 5 is a sectional view taken substantially on the line 5—5 of FIGURE 4.

FIGURE 6 is a fragmentary sectional view, similar to FIGURE 2, but illustrating a modified form of the invention.

FIGURE 7 is a fragmentary sectional view, similar to FIGURE 5, but illustrating a modified form of the invention.

Briefly, the present invention consists of an improved door closer of the spring actuated, hydraulic dash pot type, having improved valving means for the hydraulic fluid for controlling the speed of closing of the door, either the initial closing speed or the final closing or latching speed, or both; having improved structure for operation of the pivot or spindle member; and having novel interconnecting means between the spring or springs and the pivot member, the closer parts being so designed and arranged as to provide a simple and compact structure.

Referring now to the drawings, the closer of the present invention as shown in FIGURES 1 through 5 is generally designated **10** and has a housing formed of top and bottom walls **13** and **14**, side walls **15**, an end wall **16**, the other end wall being provided by a pair of plug members **17**. The entire hollow portion within the housing forms a reservoir for a supply of oil (not shown) or other hydraulic fluid. A central partition **18** extends partially in from one end, the partition and the side walls **15** forming a pair of hollow cylinders **19** for a pair of pistons **20**.

The bottom wall **14** is provided with a threaded opening in which is engaged a threaded cover plate **21**, the plate having a boss **22** with a central opening **23**. Extending through the opening is the spindle or door pivot member **24**, this member having a non-circular end portion **24***a* for attachment to a door such as for reception in a non-circular hole in a door hinge arm (not shown). The member **24** also includes cylindrical portion **25** journaled in the ball bearing **26**, a pair of shoulder or collar portions **27** and **28**, and an end cylindrical portion **29** journaled in the ball bearing **30**. An annular oil seal **39** is provided around the portion **25**.

The closer is provided with a pair of coil springs **31**, one end of each bearing against one of a pair of internal wall portions **32**, the other end bearing against one of the pistons **20**. Means are provided for operably connecting the springs to the spindle member **24** and as shown in the drawings, these means may include a pair of spaced plate members **35** and **36**, each provided with a slot **37**, **38** within each of which is received the appropriate one of the shoulders **27** and **28**. A piston rod **40** is connected at one end to each of the pistons **20** by means of a pin **41**. The other ends of the rods **40** are secured to the plates **35** and **36** by means of pins **42**. The plates **35** and **36** are further spaced apart by means of three cam follower rollers **43**, **44** and **45** mounted for rotation on the respective shafts **48**, **49** and **50**. A cam **51** is carried on the spindle member **24** between the shoulder portions **27** and **28**, the cam having a cam surface **52** with a pair of hold-open recesses **53** and a pair of hold-closed recesses **54**.

Valve means are provided for the hydraulic fluid and as shown in the drawings, these means may include a ball valve member **58** positioned to close against a valve seat **59** formed in one of the portions **20** between a central bore **60** and enlarged counterbore **61**, a pin **62** preventing dislodgement of the ball from the counter-bore. The initial closing speed of the door is controlled by means of a valve formed by one of the pistons **20** operating in conjunction with a tapered groove **65** formed in the surface of one of the cylinders **19**. Control of the final closing or latching speed of the door is accomplished by means of a control valve **70**, which includes a valve stem **71** threadedly connected to the partition **18** and extending into a bore **75** formed therein. The inner end of the stem **71** is of reduced diameter, having a groove **76** formed therein, the groove being V-shaped, both in plan view and in radial section. The reduced diameter end of the valve stem extends into a reduced diameter counter-bore **78**, which bore in turn communicates with a bore **79** leading to the hydraulic fluid reservoir. A pair of ports **80** lead from the bore **75** into the interior of the cylinders **19**. As will be noted that there is a slight clearance between the valve stem and the bore **75**, for a purpose to be explained below.

In installation and use of the closer **10**, it is rigidly mounted in the door frame, preferably in a concealed position in the header or overhead portion of the frame. The non-circular portion **24***a* of the spindle member **24** is connected to the door to form one of the door pivots and to be turned by opening and closing of the door, such as by inserting it in a mating non-circular hinge arm (not shown) which is carried on the door, in a manner familiar to those skilled in the art. The door, shown in phantom lines in FIGURE 1, is in the full open position in this figure. In this position it will be noted that the cam follower **44** is seated in the hold-open recess **53** and, by virtue of the forces exerted by the springs **31** in a direction to tend to move the pistons **20** and hence the plate members **35** and **36** and the follower **44** to the right as seen in FIGURE 1, the follower **44** is caused to bear firmly against the cam surface defining the recess **53**,

thus holding the door in the full open position. It will be noted that the recess **53** is located on a portion of the cam surface having an over center relationship with respect to the pivotal motion of the cam and that because of this location, additional compression of spring **31** with resultant axial movement of follower **44** is required to unseat the follower from its hold-open position. It will be understood that for swinging doors, the cam follower **43** engages in the other recess **53** to hold the door open in the other position.

The door is easily closed by swinging it manually against the spring tension, to clear the cam follower out of the recess, whereupon the energy stored in the springs during opening of the door (described below) is released to move the pistons **20** and the connected plate members **35** and **36** to the right as seen in FIGURE 1. Thus, the cam follower roller **44** bears against the cam surface **52**, rotating the cam **51** and its associated spindle member **24**, forcing the door toward the closed position. At the same time, the movement of the pistons **20** to the right places the oil in the cylinders **19** under pressure, the oil in turn forcing the ball **58** onto its seat **59**. The oil in the cylinders **19** can then move out into the main portion of the oil reservoir only through the groove **65**, the speed of such flow and hence the speed of closing of the door being governed primarily by the dimensions of the groove **65**. As the piston **20** moves to the right, it gradually cuts off the flow of oil through the groove **65**, until the end of the groove is completely covered by the piston, whereupon the latching speed valve **70** comes into play and controls the speed of the continued flow of oil from the cylinders **19** through the valve **70** into the bore **79** and hence into the main oil reservoir, depending upon the adjustment of the valve.

It will be noted that even if the valve **70** is inadvertently fully closed, as by turning the valve stem **71** all the way in, a small flow of oil will still pass through the valve **70**, that is, through the ports **80** from the cylinders **19** and into the main oil reservoir via the clearance between the valve stem and bore **75**, the groove **76** and the ports **78** and **79**. Thus, even though the valve **70** is not properly adjusted, there will be some flow of oil to permit complete closing and latching of the door. The valve is adapted to be adjusted to vary this latching speed, which is generally desired to be slower than the initial closing speed, such adjustment merely comprising turning the valve stem **71** until the desired volume of the groove **76** is in communication with the ports **80**.

During opening of the door, the above-described sequence of operation is virtually reversed. Thus, as the door is manually opened, the parts move from the position shown in FIGURE 3 to that shown in FIGURES 1 and 2, the pistons **20** moving to the left as seen on these latter figures. During this movement, oil flows from the main reservoir through the port **60**, forcing the ball **58** off its seat, so that a portion of the oil in the main reservoir can be displaced back into the cylinders **19**. Also during this opening of the door, the springs **31** are compressed, storing up energy to be expended during the closing operation.

A modified form of closer **10***a* is illustrated in FIGURES 6 and 7. This embodiment of the invention is substantially the same as described above, including piston rods **40***a*, pistons **20***a*, cylinders **19***a*, partition **18***a*, valve **70***a*, port **79***a*, and ports **80***a*, but here the V-shaped groove **65** is replaced by a valve **70***c*, which provides adjustment of the initial closing speed. The construction and operation of the valve **70***c* and its associated ports is identical to that of **70** and **70***a*, the valve having a stem **71***c* working in a bore **75***c*, the reduced end of the valve stem having a V-groove **76***c*, ports **80***c* being provided for passage of oil therethrough and through the bore **78***c* to the bore **79***a*, in the manner described above.

Having fully described my invention, it is to be understood that I do not wish to be limited to the details set forth, but my invention is of the full scope of the appended claims.

I claim:

1. A door closer comprising the combination of a housing forming a reservoir for hydraulic fluid, a spindle member rotatably mounted in said housing and providing a means of attachment of said closer to a door, a cylinder formed interiorly of said housing and forming an auxiliary reservoir, a piston operable in said cylinder and having a piston rod, means interconnecting said piston and said spindle member for rotation of said spindle member upon movement of said piston in said cylinder including a cam follower carried by said piston rod and a cam carried on said spindle member, said cam having a cam surface engageable by said cam follower and said cam surface having a hold-open recess therein, said recess being positioned on a portion of the cam surface having an over center relationship with respect to the pivotal motion of the cam, spring means adapted to be compressed upon rotation of said spindle member in a door-opening direction and requiring additional compression of said spring to unseat said cam follower from the said hold-open recess in said cam surface, said spring means being operably connected to said piston to move the same forwardly into said cylinder upon closing of said door, valve means for permitting a main flow of fluid from said reservoir to said cylinder upon opening movement of the door and shutting off the main flow of fluid in the reverse direction from said cylinder to said reservoir during such forward movement of said piston, means permitting a restricted flow of fluid from said cylinder to the reservoir during such forward movement, and means for adjusting said restricted flow during the final portion of such forward movement, said last-named means comprising a valve including means preventing full shutting off of the flow of fluid through said valve.

2. The apparatus of claim **1** wherein a pair of cam followers is provided, one operable for each direction of opening of said door.

3. A door closer comprising the combination of a housing forming a reservoir for hydraulic fluid, a spindle member rotatably mounted in said housing and providing a means of attachment of said closer to a door, a cylinder formed interiorly of said housing and forming an auxiliary reservoir, a piston operable in said cylinder, means interconnecting said piston and said spindle member for rotation of said spindle member upon movement of said piston in said cylinder, spring means adapted to be compressed upon rotation of said spindle member in a door-opening direction, said spring means being operably connected to said piston to move the same forwardly into said cylinder upon closing of said door, valve means for permitting a main flow of fluid from said reservoir to said cylinder upon opening movement of the door and shutting off the main flow of fluid in the reverse direction from said cylinder to said reservoir during such forward movement of said piston, means permitting a restricted flow of fluid from said cylinder to the reservoir during such forward movement including an axially extending tapered groove formed in the cylinder wall, and means for adjusting said restricted flow during the final portion of such forward movement, said last-named means comprising a valve including means preventing full shutting off of the flow of fluid through said valve.

4. A door closer comprising the combination of a housing forming a reservoir for hydraulic fluid, a spindle member rotatably mounted in said housing and providing a means of attachment of said closer to a door, a cylinder formed interiorly of said housing and forming an auxiliary reservoir, a piston operable in said cylinder, means interconnecting said piston and said spindle member for rotation of said spindle member upon movement of said piston in said cylinder, spring means adapted to be compressed

upon rotation of said spindle member in a door-opening direction, said spring means being operably connected to said piston to move the same forwardly into said cylinder upon closing of said door, valve means for permitting a main flow of fluid from said reservoir to said cylinder upon opening movement of the door and shutting off the main flow of fluid in the reverse direction from said cylinder to said reservoir during such forward movement of said piston, means permitting a restricted flow of fluid from said cylinder to the reservoir during such forward movement, and means for adjusting said restricted flow during the final portion of such forward movement, said last-named means comprising a valve having a valve stem with a V-shaped groove therein operable to pass fluid therethrough and said valve stem is received in a bore, a port leading from said cylinder to said bore, a second bore leading from said first bore to said reservoir, and a clearance space provided between said valve stem and said first bore for preventing full shutting off of the flow of fluid through said valve.

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