May 7, 1957 E. L. SCHLAGE 2,790,991

DOOR CLOSER AND CHECK

Filed Dec. 9, 1952 2 Sheets-Sheet 1

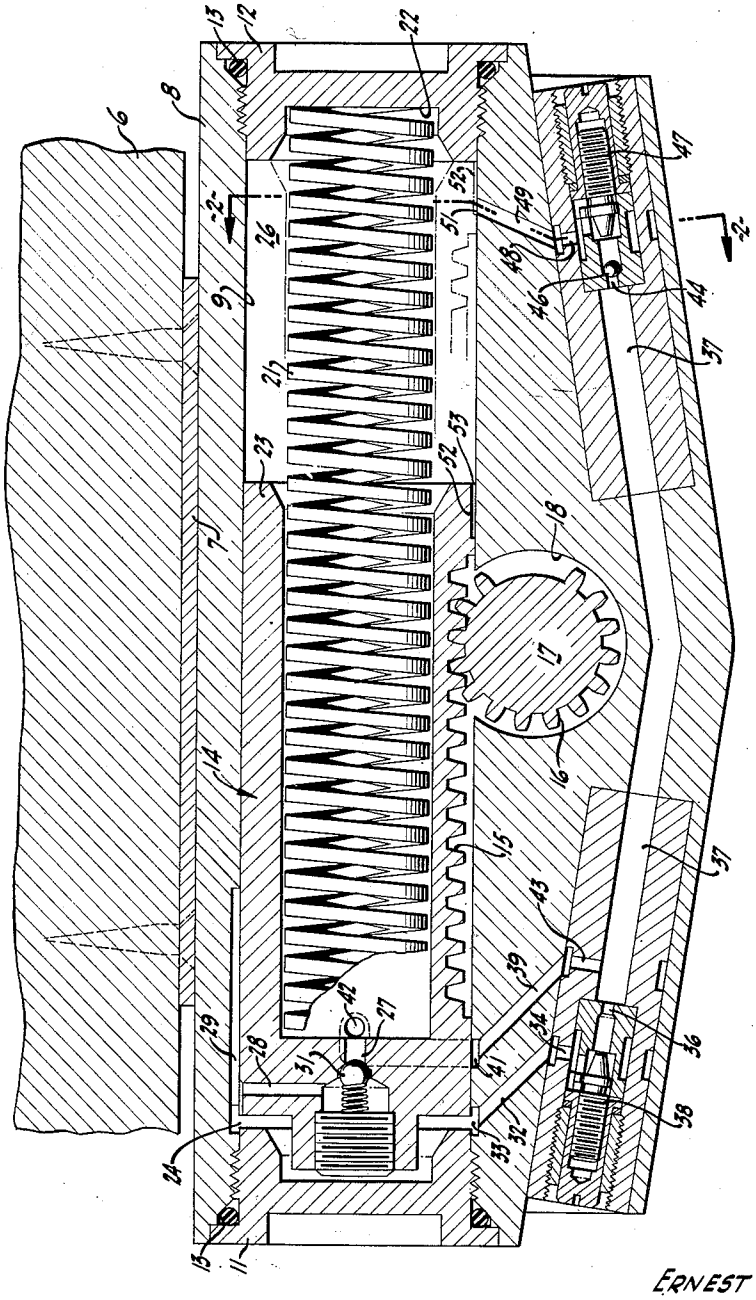


FIG. 1

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FIG. 3

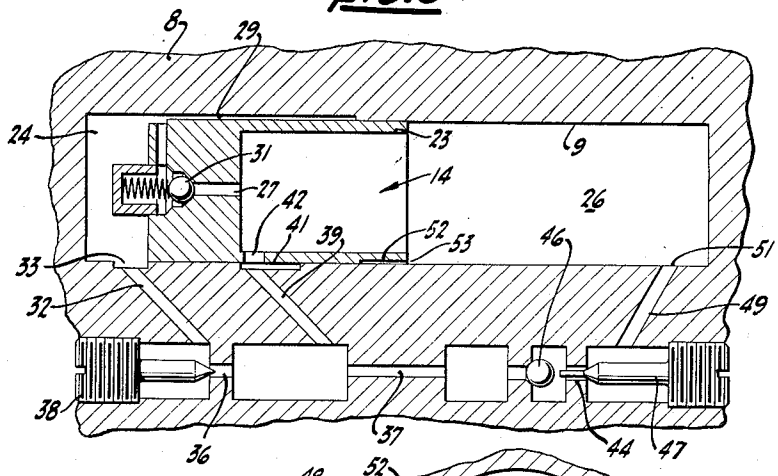
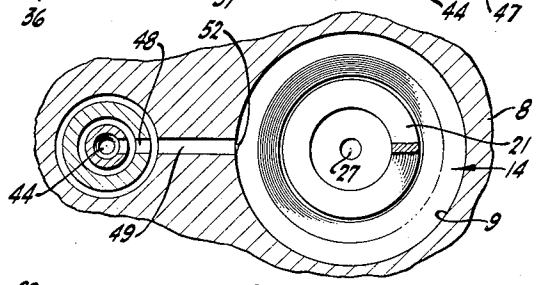


FIG. 2



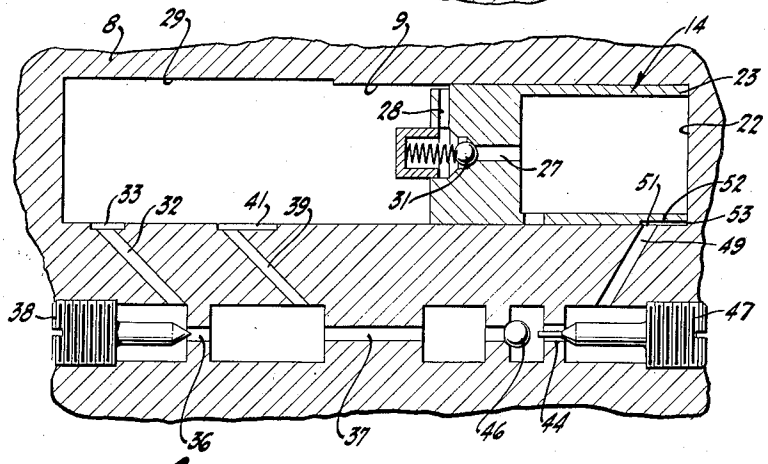


FIG. 4

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DOOR CLOSER AND CHECK

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Application December 9, 1952, Serial No. 324,879

5 Claims. (Cl. 16—62)

My invention relates to door closers and checks and is especially concerned with a door closer and check of the sort shown in my co-pending application, Serial Number 234,362, filed June 29, 1951, now Patent No. 2,723,-416, dated November 15, 1955, and assigned to the assignee of the present application.

Door closers and checks have as their prime function the controlled closure of a door that has been manually or otherwise opened. This is usually accomplished by storing energy during opening in a spring and then releasing the energy at a controlled rate by means of a hydraulic orifice mechanism. While many door closers and checks are provided with means for holding the door open indefinitely against the stored energy in the spring, that "hold open" feature usually necessitates extra mechanism and an extra manual operation upon the closer by the user not only to put the hold open device into effect but also to release it when it is no longer desired and so that the closer and check will go back into regular operation. There are many instances, however, when it is desired to arrest the operation of the closure cycle for a hold open function but without involving an extra manual operation upon the closer either in setting the structure or in releasing it.

It is therefore an object of my invention to provide a door closer and check having a means for holding the door in its open or nearly open position for a short time interval.

Another object of the invention is to provide a door closer and check having means for momentarily arresting the operation of the door closer, such means not necessarily being operated in every cycle of the closer.

An additional object of the invention is to provide a door closer and check in which the time the door is held open is variable and can be readily controlled by the user.

Another object of my invention is to provide a momentary hold open feature that can be incorporated in a door closer and check of the sort shown in my mentioned pending application.

A still further object of my invention is to provide a means for holding a door open or nearly open for a variable time.

An additional object of the invention is in general to improve door closers and checks.

While the door closer and check of the present invention can be embodied in widely variant forms depending upon its environment and the operating circumstances it has been successfully embodied in the form shown in the drawings, in which:

Figure 1 is a longitudinal section on a horizontal plane through the axis of a door closer and check constructed in accordance with the present invention and of the type shown in my co-pending application.

Figure 2 is a fragmentary view in cross section, the planes of section being indicated by the lines 2—2 of Figure 1.

Figure 3 is a diagrammatic longitudinal section corresponding approximately to Figure 1 and showing the door closer and check in one operating position.

Figure 4 is a view comparable to Figure 3, but showing the door closer and check in a different operating position.

In the present instance, the door closer and check is intended for installation on a support 6 which conveniently is a door movable with respect to a door frame, not shown. Mechanism is provided for mounting the door closer and check on the door and this conveniently takes the form of a bracket 7 secured to the door and holding the body 8 of the door closer in appropriate position. The body 8 is preferably a metallic casting provided with a number of cavities and especially including a longitudinal bore 9 of cylindrical cross section extending throughout the length of the body and closed at its opposite ends by caps 11 and 12 screwed into position against sealing washers 13.

Adapted to operate in the bore 9 by reciprocating longitudinally therein is a piston 14, usually a metallic body of cylindrical cross section adjacent both its ends and interrupted between its ends by a series of straight rack teeth 15. The piston teeth are in engagement with the axially extending teeth of a partial pinion 16 cut on a shaft 17 suitably journalled in the body 8. The pinion 16 operates in a cavity 18 communicating with the central portion of the bore 9 and is connected by appropriate mechanism, not shown, to the door frame. The connecting mechanism is such that as the door is opened the pinion shaft 17 is rotated to translate the piston 14 toward the right in Figure 1 and so that upon closing movement of the door the piston 14 is translated toward the left in Figure 1.

During the opening movement, the piston compresses a coil spring 21 at one end appropriately nested within the hollowed out piston and at the other end nested in a recess 22 in the cap 12. When the door is fully open the skirt 23 of the piston abuts against the end plug 12 and the spring 21 is substantially fully compressed. When the door is free to close, the energy stored in the spring tends to move the piston 14 but this motion is appropriately damped. This is accomplished by a hydraulic fluid filling the closer body and flowing between a first chamber 24 in one end of the bore 9 on one side of the piston 14 and a second chamber 26 in the other end of the bore on the other side of the piston 14.

Although various kinds of control instrumentalities can be utilized for the hydraulic fluid flow, I preferably provide, among others, a passage 27 in the piston 14 opening into the chamber 26 and extending to a duct 28 opening into the side of the piston and registering with a longitudinal groove 29 cut in the side wall of the body 8 and merging with the chamber 24. A spring pressed check valve 31 for the passage 27 permits free translation of the piston 14 during door opening movement. Flow is then virtually unrestricted from the second chamber 26 through the passage 27 and past valve 31 and then through the duct 28 and the groove 29 into the first chamber 24. Upon attempted return motion of the piston, the valve 31 immediately seats and there can be no flow between the first chamber 24 and the second chamber 26 through the passage 27. Under these conditions the door could not be shut at all.

Additional flow conducting means are therefore provided. A channel 32 extends from an enlarged groove 33, open to the chamber 24, to passages 34 communicating through an orifice 36 with a conduit 37. An adjustable needle valve 38 governs flow through the orifice 36. A shunt passage 39 extends from a groove 41 in the wall of the bore 9. The groove 41 communicates with the second chamber 26 through an opening 42 in the piston 14. The shunt passage 39 opens through a duct 43 into

the conduit 37 near one end. At the other end the conduit 37 opens into an orifice 44, the direction of flow being governed by a check valve 46 and the area for flow being governed by an adjustable needle valve 47. A passage 48 communicates with the orifice 44 and in an appropriate fashion opens into the second chamber 26.

In accordance with my invention, I provide a special means of communication between the passage 48 and the second chamber 26. This is particularly accomplished by forming a duct 49 extending from the passage 48 at a slight angle with the body 8 and opening through a port 51 disposed with its axis substantially radial and communicating with the chamber 26. In other words, the port 51 opens through the side wall of the bore 9 into the chamber 26, but is so located that it is alternately covered toward the end of the piston stroke and uncovered as the piston skirt 23 reciprocates during the operation of the closer. When the piston 14 is in its extreme right hand position (shown in Figure 4 and corresponding to a fully open door) the port 51 is covered by the piston. After the piston has moved out of its fully open position toward a closed position for a predetermined distance, the port 51 is completely uncovered.

So that the piston does not entirely block or blank off the radial port 51, I provide in the piston a longitudinally or axially extending groove 52. At one end 53, the groove 52 opens into the second chamber 26 but stops short at its other end and does not communicate either with the part of the bore which opens into the cavity 18 nor does it extend to open into the first chamber 24. The groove 52, however, is so located in the periphery of the piston that it registers with or overrides the radial port 51 for the initial and final motion of the piston 14 adjacent the plug 12. The registry of the groove 52 and the port 51 is maintained since the straight rack teeth 15 in engagement with the axially extending teeth on pinion 16 do not permit any relative rotation of the piston within the closer body.

In the operation of this structure, the door is opened partially or until such time as the edge or skirt of the piston 23 comes just up to the edge of the radial port 51. If the door is opened no farther and is then released, the closer checks the return movement in the customary way, the speed of return being regulated by the adjustment of the needle valves 38 and 47. If, however, a "hold open" function or dwell in open position is required, the door is opened farther. The piston skirt 23 then rides over the radial port 51 to an extent depending upon the amount of opening of the door or the closeness of approach to fully open position. There is no hindrance to the opening movement of the door, since the check valve 31 opens and permits free flow through the groove 29 to the first chamber 24. A slight hindrance to flow, for back checking, is provided since the groove 29 stops short of the full piston travel. Back checking can be eliminated by extending the groove 29 for the full stroke of the piston.

When the door is released near fully open position, the energy of the spring endeavors to start the door toward closed position. But the movement thereof is extremely slow since the only path for hydraulic flow, the check valve 31 having closed, is through the minute groove 52. This is much smaller than any of the passageways connecting with the conduit 37. In fact, in an extreme case, the groove 52 can be virtually eliminated allowing only the clearance space between the piston 14 and the bore wall to serve as an elongated but very small cross section flow path. The rate of closure of the door from its nearly open or fully open position depends only on the rate of flow through the groove 52, leakage being assumed to be nil. Since the rate of flow through the groove 52 is extremely small, the door closes very slowly indeed. The groove 52 is effective as long as the piston overlies the radial port 51. That means that the farther the door is moved toward its fully opened position the longer it will take in creeping toward its position for normal closure movement, or the longer it will take the piston 14 to over ride the radial port 51. Once the piston has over ridden the radial port 51 and communication then is directly between that port and the second chamber 26, there is only the normal hindrance to flow as regulated by the various needle valves 38 and 47 and the door closes at the regular rate.

In the operation of this device, therefore, a user wishing to have the door remain open momentarily need only open the door to its fully opened position. He can then release the door and it will close very slowly for the first few degrees of its travel, being practically or effectively nearly stationary in open position, and then will ultimately close in the regular way. If only a momentary hold open is necessary, the door can be opened nearly all the way and can then be moved only slightly farther toward its fully opened position. The user, by governing the amount of opening of the door, can govern the duration of time during which the door is held nearly in fully open position.

What is claimed is:

1. A door closer and check comprising a body having a cylindrical bore therein, a piston in said bore dividing the same into first and second chambers at opposite ends of said piston, spring means for urging said piston along said bore in one direction from said second chamber toward said first chamber, means for permitting free flow from said second chamber into said first chamber when said piston is moving in the opposite direction, a passageway in said body communicating between said first chamber and said second chamber, and a groove on the periphery of said piston opening into said second chamber and overlying the adjacent end of said passageway when said piston is adjacent the end of its travel in said opposite direction.

2. A door closer and check comprising a body having a cylindrical bore therein, a piston in said bore dividing the same into first and second chambers at opposite ends of said piston, spring means for urging said piston along said bore in one direction from said second chamber toward said first chamber, means for permitting free flow from said second chamber into said first chamber when said piston is moving in the opposite direction, a passageway in said body communicating between said first chamber and said second chamber, and a groove on the periphery of said piston opening into said second chamber and overlying the adjacent end of said passageway when said piston is adjacent the end of its travel in said opposite direction, the cross sectional extent of said groove being substantially smaller than that of said passageway.

3. A door closer and check comprising a body having a cylindrical bore therein, a piston reciprocable in said bore and provided with a cylindrical skirt portion at one end thereof, a spring for urging said piston along said bore in one direction with the opposite end leading, means for permitting free flow through said piston when the latter is moving in the opposite direction and a passageway in said body permitting relatively restricted flow between the opposite ends of the cylinder bore when said piston is moving in said one direction, said passageway terminating at a point spaced inwardly of said piston from said one end of said piston when the latter is at the end of its travel in said opposite direction, said skirt being provided with a groove extending axially from said one end to said point when said piston is in said last mentioned position.

4. A door closer and check comprising a body having a cylindrical bore therein, a piston reciprocable in said bore and provided with a cylindrical skirt portion at one end thereof, a spring for urging said piston along said bore in one direction with the opposite end leading, means for permitting free flow through said piston when the latter is moving in the opposite direction and a passageway in said body permitting relatively restricted flow between the opposite ends of the cylinder bore when said piston is moving in said one direction, said passageway termi-

nating at a point spaced inwardly of said piston from said one end of said piston when the piston is at the end of its travel in said opposite direction, said skirt being provided with a groove extending axially from said one end to said point when said piston is in said last mentioned position, and the cross sectional extent of said groove being substantially less than that of said passageway for greatly restricting flow through the latter.

5. A door closer and check comprising a body formed with a cylindrical bore having opposite end closures and a piston reciprocable therein, and a spring urging said piston toward one closure at all times, the end of said piston adjacent the opposite closure of said bore being provided with an axially outwardly opening groove extending axially a relatively short distance along the sidewall of said piston, said body being formed with a passageway opening at its opposite ends into said bore at points adjacent said opposite end closures, and said groove being positioned on said piston to overlie one end of said passageway when said piston is closely adjacent said opposite closure.

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