Sept. 19, 1961 M. M. CHECK 3,000,043

DOOR CLOSER WITH BACK CHECK

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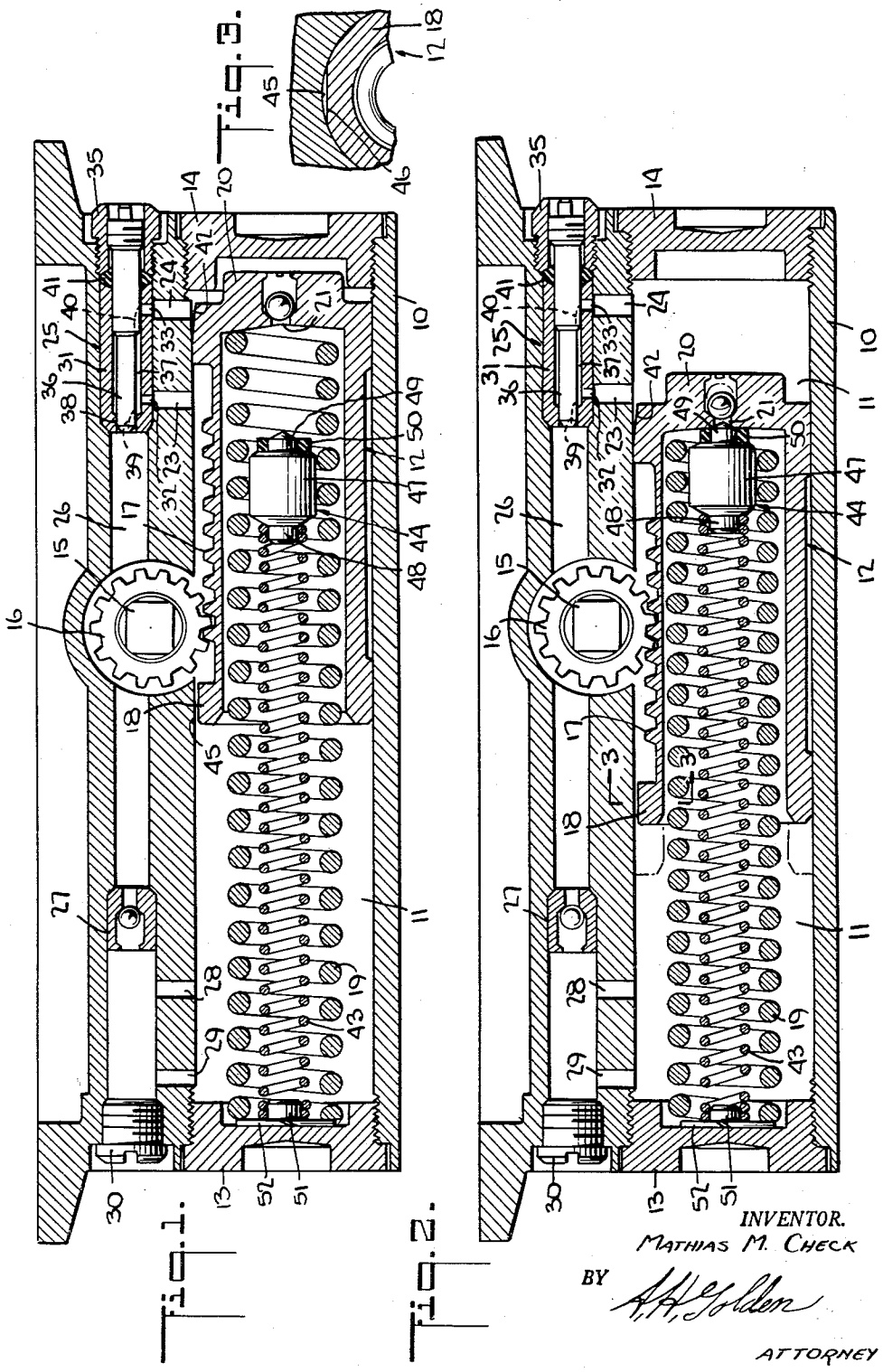


Fig. 1.

Fig. 2.

Fig. 3.

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DOOR CLOSER WITH BACK CHECK

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This invention relates to a door check and closer of the piston type in which the piston is provided with a fairly large port through which the checking fluid may freely pass from one side of the piston to the other during movement of the piston in a door-opening direction so that there is little resistance to opening of the door.

More particularly, the invention relates to a back check arrangement for such a closer whereby the speed of the piston in the door-opening direction is checked or retarded just before the piston reaches its limit of movement in the door-opening direction.

The advantage of a back check arrangement in reducing the shock imposed on the closer and the mounting means when a door is rapidly opened to its extreme position is well-known, and various back check arrangements have heretofore been proposed. Such arrangements, however, are quite complicated and costly and are not adapted to be used on conventional closers without substantial modification and alteration of such closers.

The present invention provides a very simple back check arrangement which may be quickly and easily applied to conventional types of closers without substantial modifications or alteration of the closers. The invention, therefore, permits the same basic closer to be used with or without a back check arrangement, thus reducing the number of parts that must be manufactured and stocked by the closer manufacturer. Furthermore, a closer without a back check arrangement may be quickly and easily converted to one having a back check arrangement at a later date if such is desired.

In accordance with the invention, the back check arrangement includes a closure member which is yieldingly supported in the path of movement of the piston and is adapted to be engaged by and moved with the piston to close the port through the piston during the final movement of the piston in the door-opening direction. Thus, during initial movement of the piston in the door-opening direction, the port through the piston remains open to permit the free flow of fluid from one side of the piston to the other so that there is little resistance to the opening of the door. However, during the final movement of the piston the closure member closes the port through the piston to provide fluid checking during the final movement of the piston so that the closer is not subjected to a sudden shock when the piston reaches its limit of movement in the door-opening direction.

As a feature of the invention, the closure member is yieldingly supported on the end of a helical compression spring which bears against one end of the piston chamber of the closer and extends toward the piston. This compression spring is conveniently mounted within the usual door-closing spring so that the closure member is supported and guided by the door-closing spring. The closure member and its spring support may therefore be readily mounted in the closure through the same opening as that used for mounting the usual door-closing spring.

The invention and its advantages having been broadly described, a more detailed description of one embodiment of the invention is given hereafter by reference to the accompanying drawing, wherein:

FIG. 1 is a sectional view of a door check and closer incorporating the back check arrangement of the invention, and showing the piston in a position corresponding to a closed position of the door,

FIG. 2 is a sectional view similar to that shown in FIG. 1 but showing the piston moved to a position in which the piston has just engaged the closure member of the back check arrangement so that a port through the piston is closed to provide fluid checking of the piston during its final movement in the door-opening direction, and

FIG. 3 is a sectional view taken on the line 3—3 of FIG. 2 to show a flat portion provided on the piston to provide controlled leakage of fluid past the piston during back checking of the piston.

Referring to the drawing, and in particular to FIGS. 1 and 2, the back check arrangement of the invention is shown applied to a door check and closer of a conventional type which includes a body or housing **10** providing a fluid-filled piston chamber **11** in which a piston **12** is slidably disposed. The ends of the piston chamber **11** are conveniently closed by threaded end caps **13** and **14** which are screwed into the ends of the chamber.

As is well-known to those skilled in the art, the housing **10** is secured to the face of a door to be controlled adjacent the top of the door by suitable fastening means, and opening and closing movement of the door is translated into sliding movement of the piston **12** by hinged arms (not shown) which are connected at one end to the frame of the door and are connected at the other end to a vertical shaft **15** which is suitably journaled in the housing **10** and carries a pinion **16** which meshes with rack teeth **17** formed on a skirt portion **18** of the piston **12**. When the door is moved toward a closed position the pinion **16** rotates in a counter-clockwise direction and the piston **12** moves toward the right to the position shown in FIG. 1. When the door is moved toward an open position the pinion **16** rotates in a clockwise direction and the piston **12** moves toward the left as shown in FIG. 2.

During movement of the piston **12** to the right as the door is opened, a helical compression spring **19**, interposed between the head **20** of the piston **12** and the end cap **13**, is compressed so that when the door is released the spring **19** will move the piston to the right thereby closing the door.

During a major portion of the movement of the piston **12** to the left during opening of the door, fluid in the chamber **11** may freely pass from the left side of the piston **12** to the right side of the piston through a relatively large port **21** formed through the head **20** of the piston **12**. Thus, during the major portion of the opening movement of the door there is little fluid resistance to the movement of the piston **12** so that relatively little effort is necessary to open the door.

When, however, the door is released, and the compressed spring **19** moves the piston **12** to the right to close the door, a ball check **22** closes the port **21** thereby preventing the flow of fluid through the port **21** from the right-hand side of the piston **12** to the left-hand side. Thus, in order for the fluid to pass from the right-hand side of the piston to the left-hand side of the piston, the fluid in the chamber **11** on the right-hand side of the piston **12** must flow through ports **23** and **24** formed through the wall of the chamber **11**, through a regulating valve **25**, a bore **26**, a ball check valve **27** and ports **28** and **29** provided at the opposite end of the chamber from the ports **23** and **24**, and into the chamber **11** on the left-hand side of the piston. The regulating valve **25** allows the rate of flow of the fluid from the right-hand side of the piston to the left-hand side of the piston to be adjusted to check the speed of the piston **12** in its movement toward the right to prevent slamming of the door.

The particular regulating valve disclosed is of the general type and functions in a similar manner to that shown in U.S. Patent 1,151,339, and is conveniently mounted in one end of the bore **26**. The opposite end of the bore **26** is closed by a suitable plug **30**. The regulating valve **25** includes a valve sleeve **31** which is received in the end of the bore **26** and has ports **32** and **33** which align

with ports 23 and 24. A regulating plunger or screw 34 is received in the sleeve 31 and is threaded through a bushing 35 so that it may be adjusted relatively to the sleeve 31 by rotation thereof in the bushing 35. The bushing 35 is threaded into the end of the bore 26. The plunger 34 has an end portion 36 of reduced diameter to provide clearance 37 with the sleeve 31. The end of the reduced portion 36 extends through an opening 38 in the end of the sleeve 31 and has a tapered metering surface or groove 39 formed therein. A second metering surface 40 is formed on the plunger 34 at the juncture of the reduced portion 36 and the remainder of the plunger. The rate of flow of fluid from the ports 23 and 24 through the valve may be adjusted by varying the degree that the metering surface 39 overlaps the inner edge of the opening 38 in the sleeve 31, and the degree that the metering surface 40 overlaps the port 32. A gasket 41 interposed between the end of the sleeve 31 and the bushing 35 prevents leakage of fluid past the plunger 34.

As the piston 12 moves toward the right, the port 23 is gradually closed by a tapered surface 42 formed on the outer periphery of the head 20 of the piston 12 so that the fluid checking is gradually increased. When, however, the tapered surface 42 passes the port 23 the checking effect is decreased as the fluid may flow from the right-hand side of the piston through the port 24, port 33, surface 40, clearance 37, port 32, port 23, past the pinion 16, and in to the bore 26. This ensures sufficient force to provide proper latching of the door during final movement of the door.

It will be appreciated that as so far described the check and closer is a completely operable unit which may be used without modification when back checking is not necessary or desired. In accordance with the invention, this conventional closer may be quickly and easily converted to a closer incorporating back checking by inserting a smaller and shorter helical compression spring 43 through the usual door-closing spring 19, and supporting a closure member 44 on the free end of the spring in alignment with port 21 through the piston head 20. The spring 43 is easily inserted at any time by removal of the end cap 13. The length of the spring 43 is selected so that the closure member 44 is spaced a predetermined distance from the port 21 when the piston 12 is in the extreme position to the right as shown in FIG. 1. Preferably, this predetermined distance is equal to the distance the piston 12 must travel when the door is opened about seventy-five percent. Thus, when the door is moved from a closed position, fluid may flow freely through the port 21 from the left side of the piston 12 to the right side until the door has been opened approximately seventy-five percent. At this time the closure member 44 is engaged by the piston 12 and the port 21 is closed by the closure member 44, as shown in FIG. 2, so that the fluid can no longer flow through the port 21 from the left side of the piston to the right side. The fluid must, therefore, flow at a much slower rate through a passage 45, best shown in FIG. 3, formed between the piston 12 and the chamber wall by a flat portion 46 provided on the periphery of the skirt 18 of the piston 12. Thus, the final movement of the piston 12 in the door opening direction toward the left, as indicated by the broken lines in FIG. 2, is checked or retarded so that there is no sudden shock when the piston 12 reaches its limit of movement.

The passage 45 formed by the flat portion 46 is of course only one way of providing a restricted passage for the fluid to flow from the left-hand side of the piston to the right-hand side of the piston during the back checking of the piston. Small passages for the same purpose can be provided at other points in the closer. For example, a small passageway could be provided through the closure member 44, or through the check valve 27.

The closure member 44 preferably has an enlarged cylindrical body portion 47 so that the closure member is guided by the inner surface of the convolutions of the closing spring 19. The closure member 44 is conveniently supported on the end of the spring 43 by means of an integral shank portion 48 which extends into the end of the spring 43. The opposite end of the closure member 44 is provided with a pilot portion 49 having a tapered end which is adapted to engage in and center the closure member 44 relatively to the port 21. A rubber washer or gasket 50 surrounds the pilot portion 49 and engages the surface of the head of the piston 20 surrounding the port 21 to ensure proper closing of the port.

The opposite end of the spring 43 from the closure member 44 is held centered on a pin 51 which extends from an annular disc 52 which is held against the end cap 13 by the pressure of the closer spring 19.

From the preceding description it can be seen that there is provided a novel back checking arrangement which may be quickly and easily applied to a conventional door check and closer with very little modification or alteration of the closer. Thus, the invention permits the same closer and check to be offered with or without back checking, depending on the particular use to which the closer is to be put, and also permits back checking to be added to a closer at a later date if such is desired.

While a preferred form of the invention has been shown and described, it will be appreciated that this is for the purpose of illustration, and that changes and modifications may be made therein without departing from the spirit and scope of the invention.

I now claim:

1. A door closer comprising, a housing having a fluid filled chamber therein, a piston movable in said chamber, a port through said piston whereby said fluid may pass freely from one side of the piston to the other side when said piston is moved in one direction in said chamber, a check valve for closing said port to prevent the free flow of fluid through said port when said piston is moved in the other direction in said chamber whereby to check the movement of said piston in said other direction, a helical compression spring extending from one end of said chamber toward said one side of said piston, and a closure member supported on the free end of said spring in alignment with said port and spaced a predetermined distance from said port when said piston is displaced to an extreme position in said other direction whereby said closure member will be engaged by said piston and close said port to provide fluid checking of the final movement of said piston in said one direction.

2. A door closer comprising, a housing having a fluid filled chamber therein, a piston movable in said chamber, a port through said piston whereby said fluid may pass freely from one side of the piston to the other side when said piston is moved in one direction in said chamber, a check valve for closing said port to prevent the free flow of fluid through said port when said piston is moved in the other direction in said chamber whereby to check the movement of said piston in said other direction, a first helical compression spring extending between one end of said chamber and said one side of said piston for moving said piston in said other direction, a second shorter helical compression spring extending from said one end of said chamber through the center of said first helical compression spring, and a closure member supported on the free end of said second spring in alignment with said port and spaced a predetermined distance from said port when said piston is displaced to an extreme position in said other direction, whereby said closure member will be engaged by said piston and close said port to provide fluid checking of said piston during the final movement of said piston in said one direction.

3. A door closer comprising, a housing having a fluid filled chamber therein, a piston movable in said chamber, a port through said piston whereby said fluid may pass

freely from one side of the piston to the other side when said piston is moved in one direction in said chamber, a check valve for closing said port to prevent the free flow of fluid through said port when said piston is moved in the other direction in said chamber whereby to check the movement of said piston in said other direction, a first helical compression spring extending between one end of said chamber and said one side of said piston for moving said piston in said other direction, a second shorter helical compression spring extending from said one end of said chamber through the center of said first helical compression spring, and a closure member supported on the free end of said second spring in alignment with said port and spaced a predetermined distance from said port when said piston is displaced to an extreme position in said other direction, whereby said closure member will be engaged by said piston and close said port to provide fluid checking of said piston during the final movement of said piston in said one direction, said closure member having a cylindrical body portion guided by the inner surface of said first helical compression spring.

4. A door closer adapted to control opening and closing of a door and comprising, a housing having a fluid filled chamber therein, a piston movable in said chamber, a port through said piston whereby said fluid may pass freely from one side of the piston to the other side when said piston is moved in one direction in said chamber corresponding to opening movement of the door which the closer is adapted to control, a check valve for closing said port to prevent the free flow of fluid through said port when said piston is moved in a reverse direction in said chamber corresponding to closing movement of the door whereby to check the movement of said piston in said reverse direction and the closing movement of the door, a closure member of a size and shape to close said port in said piston, said closure member being disposed on that one side of said piston toward which the piston moves during opening movement of the door, and means yieldingly supporting said closure member in said chamber on said one side of said piston in position to engage said port while spaced from said port when said piston is displaced to an extreme position in said other direction with the said door closed, whereby said piston may move in said one direction toward said closure member during opening movement of the door with fluid flowing freely through said port and thereafter engage and move said closure member therewith so that said port is closed by said closure member to provide fluid checking of said piston during final movement of said piston in said one direction so as to check the final opening movement of the door.

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