Nov. 12, 1957 H. W. FALK 2,812,533

DOOR CHECK

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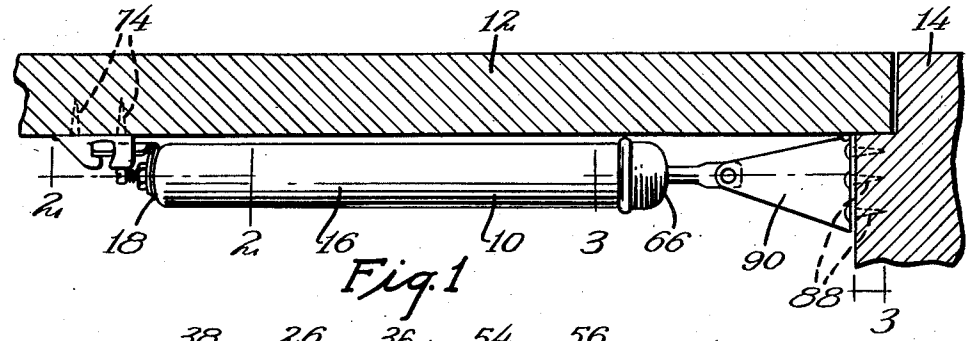


Fig. 1

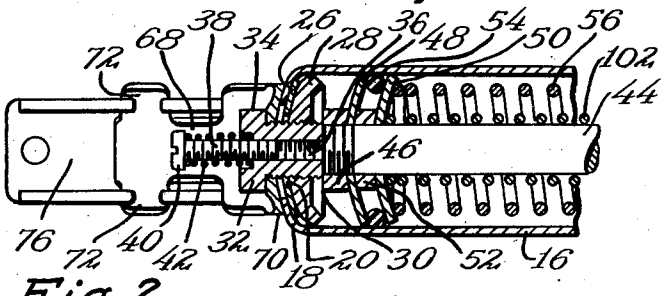


Fig. 2

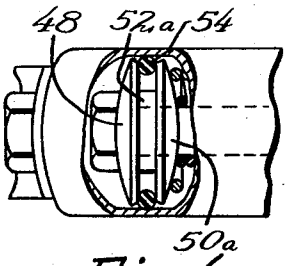


Fig. 4

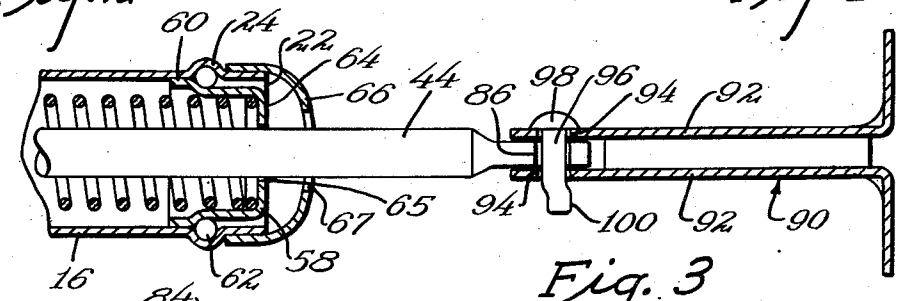


Fig. 3

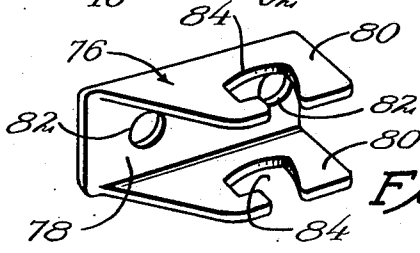


Fig. 5

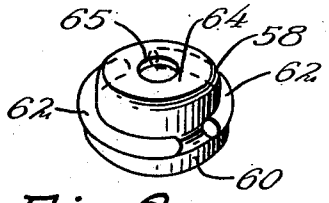


Fig. 6

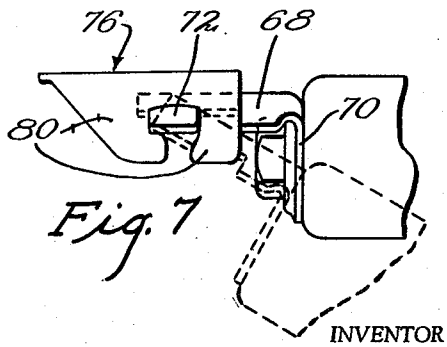


Fig. 7

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DOOR CHECK

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16 Claims. (Cl. 16—66)

This invention relates to door checks, and pertains more particularly to a door check of the surface variety.

Inasmuch as the instant invention deals with a door check or closer intended to be attached to one side of a swinging door, it is an aim of the invention to provide a closer of this type which will be compact, relatively inconspicuous and of pleasing appearance. In this connection, it is contemplated that the door check forming the subject matter of the instant invention will be generally cylindrical, of small diameter, and devoid of swinging arms that would detract from the overall appearance of the device.

Another feature of the invention resides in an envisaged construction that lends itself readily to the use of aluminum tubing for the cylindrical barrel or housing, thereby avoiding the likelihood of rust forming from water that might condense or otherwise collect on or within the confines of the housing. In this regard, the constructions of the parts are such that the checking device will withstand the shocks and prolonged usage that are encountered with door closers of this kind, the instant device being simple, rugged and exceptionally long lasting without attention from its owner.

A further feature of the invention lies in the use of concavo-convex discs on either side of a resilient O-ring, the direction in which the discs face influencing the sealing pressure exerted upon the inside wall of the tubular housing by the O-ring.

Another feature of the invention concerns the mode of assembling the parts at the factory, such action being facilitated by means of a split ring and groove arrangement that retains the compression spring within the tubular housing.

Still another feature resides in the ease with which the door check can be mounted on and removed from the door and its frame. In this connection, the mounting bracket for one end of the checking device is so configured that this end will be securely locked in place by merely pivoting the tubular housing from one extreme angular position into its normal operating angular range. With the aforenoted end pivotally secured, the other end of the closer is retained in operating position by reason of a stepped or off-set pin which is readily forced through the bracket and piston rod apertures, it being necessary to overcome to a partial extent the action of the closing spring in effecting the pin's release when detachment or removal of the closer from its mounting is desired.

Other objects will be in part obvious and in part pointed out more in detail hereinafter.

The invention accordingly consists in the features of construction, combination of elements and arrangement of parts which will be exemplified in the construction hereafter set forth and the scope of the application of which will be indicated in the appended claims.

In the drawing:

Figure 1 is a plan view showing the checking device already installed;

Figure 2 is a sectional view taken in the general direction of line 2—2 of Figure 1;

Figure 3 is a second sectional view of Figure 1, this view being taken in the direction of line 3—3 at the opposite end of the device;

Figure 4 is a fragmentary view with a portion of the tubular housing removed to expose a different arrangement of the concavo-convex discs from that sectionally shown in Figure 2;

Figures 5 and 6 are perspective detail views of parts comprising the checking device; and

Figure 7 is an enlarged, fragmentary plan view of Figure 2, an open door position of the checking device being superimposed thereon in phantom outline.

Referring now in detail to the drawing, the door check has been designated in its entirety by the reference numeral **10** and is pictured in an installed condition in Figure 1 attached to a door **12** hinging to a frame member **14**, both the door and frame being fragmentarily shown in section, by means hereinafter described. The device **10** includes a generally tubular housing or barrel **16** substantially closed at one end **18** except for an aperture **20**. The opposite end **22** is open, and disposed axially from the extreme edge of this end is an inwardly facing circumferential groove **24** for a purpose presently to be explained.

Within the end **18** is an annular gasket **26**. This gasket is maintained in a compressed state by reason of a backing nut **28** having a tapped bore **30**. A bushing **32** is threadedly received in the bore **30** and by virtue of an integral head or collar **34** on the bushing the above alluded to state of compression is assured. For the purpose of bleeding air from within the cylindrical housing **16** in a controlled manner, a threaded bore or passage **36** extends axially through the bushing **32** and has adjustably retained therein a valve member **38** in the form of a machine screw equipped with a slotted head **40** for facile adjustment of the rate of air leakage. The threaded passageway **30** somewhat loosely engages the threads of the screw **38** to provide a restricted air outlet of increased and decreased capacity, dependent upon the number of turns of the threads of screw **38** into the threaded passageway **30**. That is, with the geratest number of turns there is a greater restriction of air flow between the threaded fitting, and with the lesser turns of the screw there is provided a less restricted air flow. Maintaining the threads of the screw **38** in frictional engagement with the threads of the passage **36** is a compression spring **42** interposed between the heads **34** and **40**. In this manner, the member **38** will remain in whatever adjusted position it is rotated into, and the amount of air leakage will be governed by the degree of interengagement with the bushing **32**.

A piston rod **44** is reciprocable within the housing **16**. From Figure 2 it can be seen that the end of this rod nearest the bushing **32** is threaded and has screwed thereon a nut **46**, the nut serving as the left end means of retention for a pair of concavo-convex washers or apertured discs **48** and **50**. The discs are separated from each other owing to the intermediacy of an annular spacer **52**. Inasmuch as an O-ring **54** of rubber, neoprene or the like is contemplated between the discs **48** and **50**, the spacer **52** should be of adequate thickness to prevent undue compression of the relatively soft material constituting the O-ring. Preferably, the spacer is of sufficient thickness so as to leave the O-ring loosely interposed between the discs **48** and **50**.

A concave surface of disc **48** engages the O-ring **54**, while a convex surface of the disc **50** engages the O-ring. Movement of the piston rod **44** to the right from the position shown in Figure 2 of the drawing causes the disc **48** to move the O-ring, and the concave surface

thereof tends to contract the ring by pulling the ring inwardly toward its axis. Movement of the piston rod **44** in the opposite direction causes the disc **50** to move the ring; and the convex surface of this disc tends to expand the diameter of the ring, the convexity acting as a sort of wedge.

As will later be made manifest the discs **48** and **50**, together with the O-ring **54**, act as a piston, the O-ring providing a sliding seal with the housing **16**. Biasing the piston and the rod **44** to the left as viewed in Figure 2 is a coil spring **56** which encircles the rod, abutting the concave side of the disc **50**. A plug **58** in the form of a somewhat cylindrical shell retains the other end of the spring **56** within the tube **16**. It is in this connection that the previously referred to groove **24** plays an important role, for the plug is belled or flanged outwardly at **60** to such an extent that the outer diameter of the flange **60** is substantially equal to the inner diameter or bore of the tubular housing **16**. A pair of semi-circular rings **62** are designed to nest partially within the groove **24** and project radially inward into engagement with the flange **60**. Thus, it should be recognized that the cross-sectional radius of the groove **24** should be equivalent to that of the rings **62**, and the flange **60** should flare out an incremental distance also equal to the said radius. The plug **58** is necked in to provide an inwardly directed flange at **64** with an aperture **65** of sufficient diameter to accommodate the piston rod **44** without interference.

To insert the rings **62**, all that need be done is to compress the spring **56** by forcing the plug **58** inwardly thereagainst until the flange **64** has been moved longitudinally to the left (Figure 3) just past the groove **24**. This is easily performed, inasmuch as the end **22** is still open once having moved the plug **58** far enough to the left, then the rings **62** may be laid in the groove **24**, and release of pressure upon the plug **58** will permit it to be urged to the right by the action of the spring **56** until the flange **60** abuts these semi-circular rings, the rings arresting further travel and thereafter absorbing all reaction imposed upon the plug **58** owing to compressive forces to which the spring is subjected during the functioning of the entire device **10**.

A cap **66**, preferably of steel and especially so where the tube **16** is of aluminum as contemplated by the invention, fits snugly over the end **22** and prevents the tube from spreading in this region when subjected to heavy spring loads. The cap is apertured at **67** for free movement of the rod **44** relative thereto.

Up to this point nothing has been said concerning the specific manner by which the door check **10** is affixed to the door **12** and frame **14**. To this end, a hinge member **68** is employed. The hinge member **68** is equipped with a perpendicularly directed flange **70** apertured so as to embrace the bushing **32**, the head **34** of the bushing retaining the member **68** in a fixed relation concomitantly with the supply of the earlier mentioned compressive action against the gasket **26**. Approximately mid-way of the hinge member **68** it is notched inwardly to form laterally extending ears or wings **72**.

Secured to the door **12**, as by screws **74**, is a bracket **76**. The bracket is generally channel-shaped to provide a web **78** and side flanges **80** at right angles therewith. The web **78** contains apertures **82** for the accommodation of the screws **74**, whereas each flange contains a substantially L-shaped slot **84** for the reception of the wings **72**. In this way, the wings **72** function as pintles and the flanges **80** as journals therefor, as may be observed from the phantom outline of Figure 7. From Figure 1 it can be discerned that when the housing **16** is rotated through 90° from the position pictured, the wings **72** can be easily engaged or disengaged from the slots **84**.

The L-shaped slots include an entrance portion communicating with the free edges of the side flanges **80** which are parallel to the web **78**, and an angular portion extending generally parallel to these free edges of the flanges. The forward walls of the entrance portions of the slots against which the wings **72** engage as the door is opened are preferably rounded forwardly so that the outer ends of these forward walls are at an acute angle to the free edges of the side flanges. The walls of the angular portions of the slots which are most remote from the free edges of the flanges **80** are also centrally bowed toward the web **78**. As the wings are inserted, the housing **16** is held substantially normal to the surface of the door **12**, and the flanges enter the entrance portions of the slots until the edges thereof engage the bowed walls of the angular portions of the slots. The housing **16** is then swung forwardly, one side of each wing sliding rearwardly along the bowed wall of the angular slot portion and the opposite side of each wing sliding along the forwardly curved wall of the entrance portion of the corresponding slot. The slots are properly proportioned to permit the insertion of the wings in this manner; and the wings **72** are wider than the entrance portions of the slots, so that the housing **16** must be swung through substantially 90 degrees for engagement with, or disengagement from, the bracket **76**.

Passing now to the manner in which the other end of the door check is mounted, it will be noted that the piston rod **44** is provided with an aperture **86**. By means of screws **88** a bracket **90** is anchored to the door frame **14**. The bracket **90** is channel-shaped and each flange **92** contains an aligned aperture **94**, which when in registry with the aperture **86** permit insertion of a pin **96** therethrough. At one end of the pin **96** is an enlarged head **98** and the other end of the pin's shank is off-set slightly at **100**, as may be seen in Figure 3. The major portion of the shank is perfectly straight and it is this portion that extends through the bracket **90** and the apertured piston rod **44**. By reason of the off-set **100**, however, the pin resists disengagement to the extent that the action of the spring **56** must be partially overcome to effect its release. Thus, it will be appreciated that the pin **96** is retained in place in a simple fashion, only a unitary member securing connection between the bracket **90** and rod **44**.

From the foregoing description the operation of the door check **10** is thought to be readily apparent. As the door **12** is opened, the door swings on an arc greater than that which the device **10** swings. This action causes relative movement between the tubular housing **16** and the piston rod **44**, the spring **56** becoming compressed. During this period the disc **48** drags the O-ring **54** within the housing **16**, but since the concave side confronts the O-ring there is little or no tendency for the disc **48** to urge the ring against the inner wall of the housing, the inclination of this side of the disc being such as to cause contraction of the O-ring rather than enlargement thereof.

If the door **12** is completely opened, the spring **56** will be considerably compressed and this compression is subsequently used to return the door to closed position. To avoid total compression of the spring **56** with a resultant shock or jar as the adjacent turns strike each other, it is desirable to employ a buffer spring **102**, perhaps only a third of the natural length of the main spring **56** having a greater spring constant so that it comes into effective action to moderate or minimize the jarring that would otherwise occur. This last named spring need only loosely circumscribe the piston rod **44**.

Because the spring **56** is compressed during the opening of the door, it is effective to later close the door when the door is released by the person supplying the opening force. It is then that the disc **50** functions to expand the O-ring **54** against the inner wall of the tube **16**, the convexity thereof acting as a sort of wedge. In other words, the return action, in so far as the O-ring is concerned, is opposite in result from that transpiring during the opening part of the cycle. In many instances this action is most desirable, for air is thereby entrapped more

positively, there being less leakage past the O-ring seal, and as the door is closed the only, or easiest, avenue of escape is through the passage 36. Of course, the rate at which air can escape (and the rate of door closing) is controlled by the position of the threaded valve member 38.

A nicety of the arrangement of the discs 48 and 50, as pictured in Figure 2, is that the friction of the O-ring 54 is lessened against the tube 16 during the opening of the door when no sealing is needed, and is increased during closing when sealing is required. This of course contributes greatly to a longer life of the O-ring 54 and is much to be desired.

In some installations, depending largely on the weight of the door 12 and the constant of the spring 56, a lesser sealing action can be tolerated with an even more prolonged O-ring life. To this end the disc 50 may be reversed so that its concave face bears against the O-ring. Such a condition is illustrated in Figure 4 and while the right hand disc there shown is structurally the same as that of Figure 2, it has been given the reference character 50*a* because of its reversal of facial direction. Also, the spacer 52 is thicker and it bears the character 52*a* for this reason. Of course, the spacer need not be a separate and distinct element, for it could, if desired, be integral with one of the discs 48 or 50 in either instance.

In accordance with the patent statutes, I have described the principles of construction and operation of my door check, and while I have endeavored to set forth the best embodiment thereof, I desire to have it understood that this is only illustrative thereof and that obvious changes may be made within the scope of the following claims without departing from the spirit of my invention.

I claim:

1. A door check including a housing, a piston rod telescopically and reciprocably received in said housing, a pair of concavo-convex discs carried by the rod, a resilient O-ring seal interposed between said discs, and annular means spaced inwardly of said O-ring spacing said discs sufficiently far apart in an axial direction to avoid compression of said O-ring seal.

2. A door check including a housing, a piston rod telescopically and reciprocably received in said housing, a pair of axially spaced members carried by the rod having opposed convex and concave surfaces, spacer means and an O-ring seal interposed between said surfaces, said spacer means being spaced inwardly from said O-ring seal.

3. A door check including a housing, a piston rod telescopically and reciprocably received in said housing, a pair of axially spaced members carried by the rod having opposed concave surfaces, and an O-ring seal interposed between said surfaces.

4. A door check including a cylindrical housing, the inner wall of which is provided with an inwardly facing annular groove near one end, a piston rod telescopically and reciprocably received in said housing, a coil spring encircling said piston rod and biasing said rod toward the other end of said housing, a plug engaged in said one end of the housing having a circular flange extending inwardly of said groove and an external diameter substantially coextensive with that of said inner wall, and a pair of substantially semi-circular rings partially received in said groove and engaging said flange to prevent ejectment of said plug by said spring, said plug also being provided with a cylindrical portion extending outwardly of said groove and having a diameter corresponding substantially to the inner diameter of said rings and terminating in an end portion seating one end of said spring.

5. The structure described in claim 4 in which the housing is of aluminum.

6. The structure described in claim 5 in which said one end of the housing has a steel cap circumscribed thereabout.

7. A door check including a housing, a piston rod telescopically and reciprocably received in said housing, a hinge member secured to one end of said housing provided with laterally and oppositely directed ears, and a channel-shaped bracket member cooperable with said hinge member comprising a pair of substantially parallel, spaced flanges each having an L-shaped slot for receiving one of said ears and a web, one leg of each L-shaped slot extending approximately parallel to said web and the other leg of each slot extending approximately normal to said web.

8. The structure described in claim 7 in which the end of said piston rod adjacent the other end of said housing is provided with a transverse aperture, a second bracket member comprising a pair of substantially parallel, spaced flanges straddling the piston rod in the region of its aperture and having aligned apertures in said flanges registrable with said piston rod aperture, and a pin extending through said apertures equipped with a head at one end and off-set at the other end to aid in retaining said pin in engagement with said piston rod and said second bracket member.

9. A door check including a housing the inner wall of which is provided with an inwardly facing groove, a piston rod telescopically and reciprocably received in said housing, a coil spring encircling said piston rod, a spring retainer engaged in said one end of the housing having a diametrically extending flange, ring means received in said groove and engaging said flange to prevent ejectment of said retainer by said spring, a pair of axially spaced concavo-convex discs carried by the rod, one of which discs engages said spring, and sealing means interposed between said discs and engaging the inner wall of the housing, and spacer means interposed between and engaging said discs to prevent undue compression of said sealing means.

10. A door check including a housing the inner wall of which is provided with an inwardly facing groove, a piston rod telescopically and reciprocably received in said housing, a coil spring encircling said piston rod, a spring retainer engaged in said one end of the housing having a diametrically extending flange, ring means received in said groove and engaging said flange to prevent ejectment of said retainer by said spring, a pair of axially spaced concavo-convex discs carried by the rod, one of which discs engages said spring, spacer means interposed between and engaging said discs, sealing means interposed between said discs and engaging the inner wall of the housing, a hinge member secured to one end of said housing provided with laterally and oppositely directed ears, a bracket member cooperable with said hinge member comprising a pair of substantially parallel, spaced flanges each having an L-shaped slot for receiving one of said ears, the end of the piston rod adjacent the other end of said housing being provided with an aperture, a second bracket member comprising a pair of substantially parallel, spaced flanges straddling the piston rod in the region of its aperture and having aligned apertures in said flanges registrable with said piston rod aperture, and a pin extending through said apertures equipped with a head at one end and off-set at the other end to aid in retaining said pin in engagement with said piston rod and said second bracket member.

11. A door check including a cylindrical housing having a circumferential groove disposed around the inner wall thereof near one end, a plug member received in said one end comprising a shell having a radially projecting flange at one end and an inturned flange at the other forming a central aperture, a pair of substantially semi-circular rings nested in said groove and engaging said projecting flange to prevent outward movement of said plug, a piston rod telescopically and reciprocably received in said housing, said rod having one end projecting outwardly from said housing through said central aperture, a coil spring encircling said piston rod having one end abutting said inturned flange, a pair of concavo-convex

axially spaced discs encircling said rod, one of said discs abutting the other end of said spring, a resilient O-ring interposed between said discs, and restricted passage means at the other end of said housing for bleeding air from said housing at a controlled rate.

12. The structure described in claim 11 in which the convex sides of said discs face toward said passage means.

13. The structure described in claim 11 in which the concave sides of said discs confront said O-ring.

14. The structure described in claim 11 including a steel cap snugly circumscribing said one end of the housing.

15. The structure described in claim 11 in which a hinge member equipped with laterally extending wings is secured to said other end of the housing, and a cooperable bracket equipped with parallel flanges, each flange having an L-shaped slot for receiving one of said wings.

16. The structure described in claim 11 in which the projecting end of said piston rod contains a transverse aperture, a cooperable bracket equipped with parallel flanges, each flange having an aligned aperture registrable with the piston rod aperture, and a headed pin having an off-set end extending through said apertures.

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