Aug. 8, 1961 M. M. CHECK 2,994,906

DOOR CLOSER WITH EXPANSION CHAMBER

Filed Jan. 8, 1958

Fig. 1.

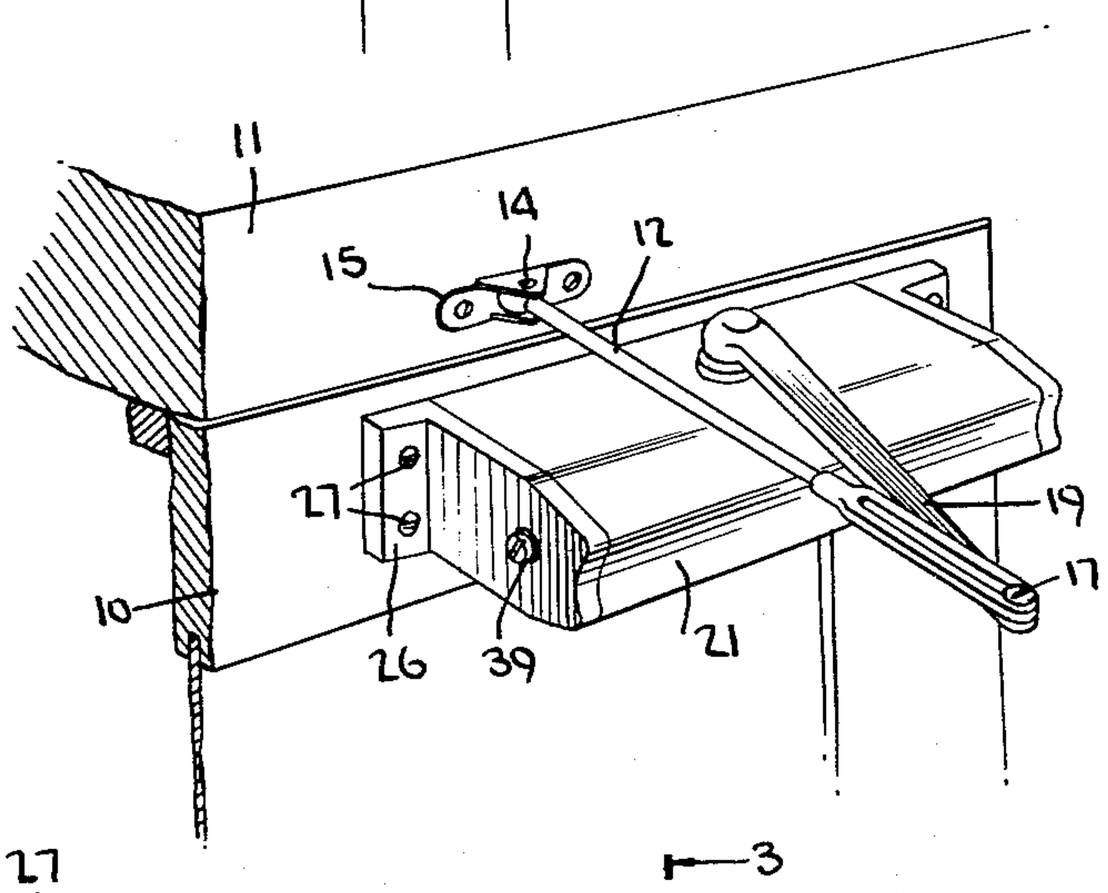


Fig. 2.

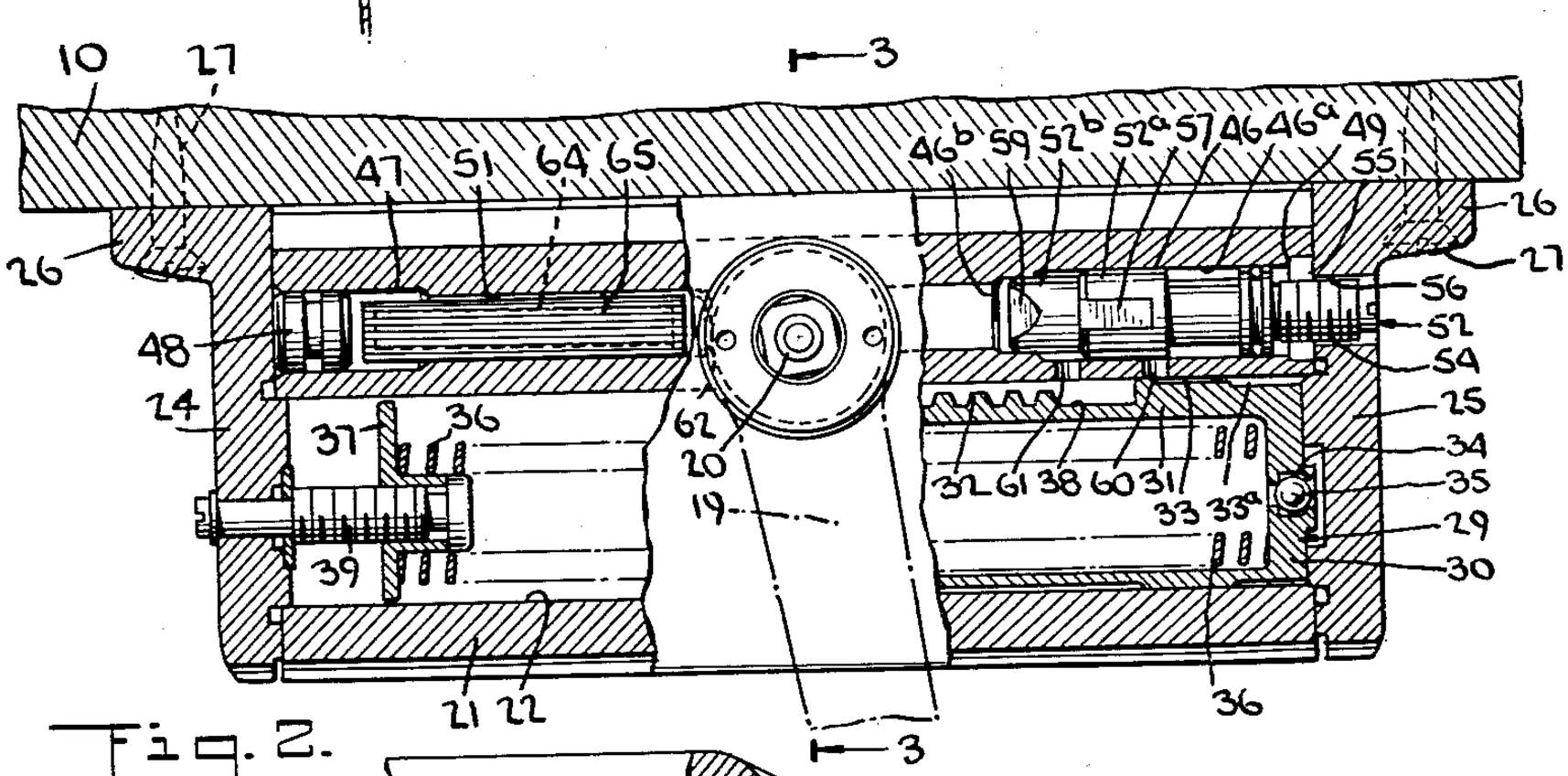
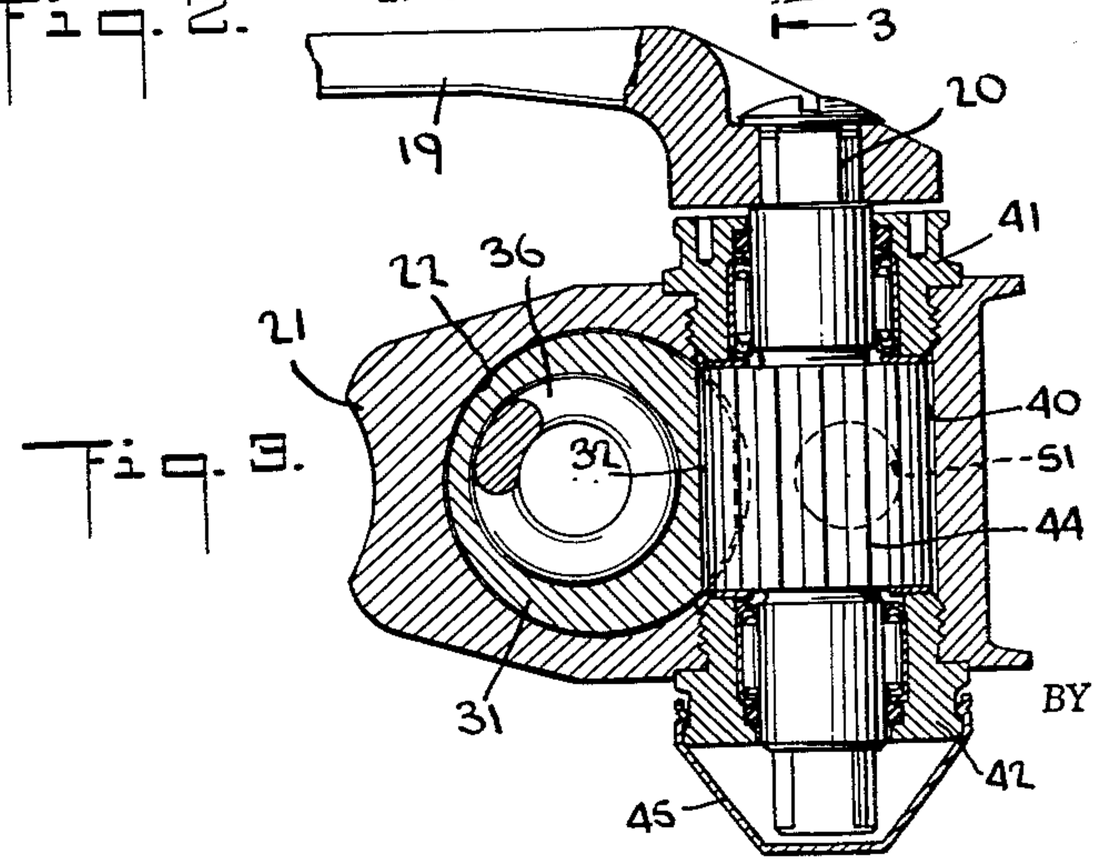


Fig. 3.



INVENTOR.
MATHIAS M. CHECK

BY

A. H. Golden

ATTORNEY

United States Patent Office

2,994,906

Patented Aug. 8, 1961

2,994,906

DOOR CLOSER WITH EXPANSION CHAMBER

Mathias M. Check, Valley Forge, Pa., assignor to The Yale and Towne Manufacturing Company, Stamford, Conn., a corporation of Connecticut

Filed Jan. 8, 1958, Ser. No. 707,739
2 Claims. (Cl. 16—51)

This invention relates to a door closer of the type that is applied to a door for controlling the closing speed of the door as the door is moved to a closed position by a a spring or other power mechanism.

In door closers of the particular class, it is customary to mount a piston for movement in a cylinder or chamber, with fluid maintained in the cylinder or chamber and moved by the piston through a valved passage as the piston moves from a position corresponding to the open position of the door to a position corresponding to the fully closed position of the door. By regulating the valved passage, the door closing speed is fully and completely controlled.

In door closers of the class described, it is desirable to fill the piston chamber and connecting passages with fluid in order that upon evaporation or dissipation of the fluid for any reason, there will be a sufficient quantity remaining in the door closer to assure its continued proper operation. However, filling the door closer to its maximum capacity provides a very considerable problem. Thus, if the closer is filled fully and is exposed to heat, the fluid will expand and great pressures will be exerted upon the seals.

I have conceived by my invention a novel construction whereby I am able fully to fill the door closer and yet to provide for expansion of the fluid without the generation of excessive pressures.

In essence, my invention resides in the provision of resilient, space-occupying means in the door closer compressible to permit expansion of the fluid while holding to a minimum the attendant increase of fluid pressure. I prefer that the resilient means consist of a deformable, gas-filled bag or capsule supported conveniently within the door closer.

As a feature of my invention, the capsule is disposed in one of the passages of the door closer in communication with the piston chamber and accessible to the fluid. I prefer that the exterior surface of the capsule be corrugated or ribbed longitudinally in order to permit passage of the fluid around the capsule so that the fluid contacts a substantial portion of the exterior surface of he capsule.

I have thus outlined rather broadly the more important features of my invention in order that the detailed description thereof that follows may be better understood, and in order that my contribution to the art may be better appreciated. There are, of course, additional features of my invention that will be described hereinafter and which will form the subject of the claims appended hereto. Those skilled in the art will appreciate that the conception on which my disclosure is based may readily be utilized as a basis for the designing of other structures for carrying out the several purposes of my invention. It is important, therefore, that the claims be regarded as including such equivalent constructions as do not depart from the spirit and scope of my invention, in order to prevent the appropriation of my invention by those skilled in the art.

An illustrative embodiment of the invention has been chosen for purposes of illustration and description, and is shown in the accompanying drawing forming a part of the specification.

In the drawing:

FIG. 1 is a perspective view showing the door closer embodying my invention applied to a door and frame,

FIG. 2 is a horizontal sectional view of the closer illustrated in FIG. 1 and showing a portion of the operating arm in broken lines, and

FIG. 3 is a cross-sectional view taken along the lines 3—3 of FIG. 2.

Referring to the drawing, there is shown in FIG. 1 a door closer in accordance with my invention applied to a door **10** for movement with the door upon opening or closing thereof. The door closer that I have chosen for the purpose of illustrating my invention has a lever arm **12** of well known construction pivoted at **14** to a bracket **15** that is secured to the door frame **11**. Lever arm **12** is pivoted at **17** to an arm **19** that is secured to the main rotating shaft **20** of the door closer.

The door closer has a body **21** formed with a longitudinal through bore **22** forming a piston chamber and sealed at its ends by end caps **24** and **25**. Each of the end caps **24** and **25** is flanged as at **26** at one side, and the flanges are bored for the reception of suitable mounting screws **27**.

A piston **29** is slidably disposed in the chamber **22** and is formed with a head **30** and a skirt **31**. The rear side of the skirt is thickened to provide for the formation of a series of rack teeth **32** thereon, and the piston head **30** has a port **34** with a ball check **35** therein for checking the flow of fluid through the port from right to left, as viewed in FIG. 2. The rear side surface of the piston between the rack teeth and the forward or head end has milled thereon a stepped flat portion having two levels, **33**, **33***a* spaced from the wall of the bore **22**, and a recess **38** for a purpose to be later described.

A helical compression spring **36** bears against the inner surface of the piston head at one end, and against an eccentric bushing **37** at its other end to urge the piston to the right, as viewed. The bushing **37** is supported on an adjusting screw **39** that has a shank portion extending through a bore in the end cap **24** for engagement by a suitable adjusting tool so that the spring force may be varied as desired.

The body **21** has a vertical bore **40** midway between the end caps but set back from the bore **22** so that only a small portion of its periphery opens into the bore **22**. As best seen in FIG. 3, this bore **40** is bushed at both ends by bushings **41** and **42**, which mount a vertical pinion **44**, the teeth of which are enmeshed with the rack teeth **32** and the upper end of which is formed into the main shaft **20** that is secured to the arm **19** as has already been described. A pinion cap **45** protects the lower ends of the pinion and the bushing **42**.

The body **21** has additional opposed bores **46** and **47** disposed parallel to the piston chamber **22**. The bore **47** is sealed by a plug **48** while the bore **46** is shouldered as at **49** and is stepped to provide a main bore **46***a* and a concentric sub-bore **46***b* of reduced diameter. A counterbore **51** connects the bores **46** and **47** and passes through the vertical bore **40**.

The bore **46** is provided with a regulating valve **52** having a threaded shank **54** engaged by a regulating nut **55** that rests against the shoulder **49**. The shank **54** extends through an opening **56** in the end cap **25** for engagement by a suitable regulating tool.

The valve **52** is formed with a pair of adjacent peripheral valve surfaces **52***a* and **52***b* in fluid sealing engagement with the main bore **46***a* and the sub-bore **46***b*, respectively. In order to allow the fluid to flow past the valve surfaces **52***a* and **52***b*, each of these surfaces has a flat **57** and **59**, respectively, milled thereon.

To complete the flow circuit, a pair of ports **60** and **61** are provided to interconnect the piston chamber **22** with the bore **46***a* opposite the valve surfaces **52***a* and **52***b*, respectively.

While I have now described a particular type of door closer, it should be understood that my invention is applicable to other types of door closers including not only rack and pinion types, but also the crank type, the wing piston type, etc.

In putting my novel concept into practice, I provide resilient space occupying means in the closer. To this end I insert into the counterbore **51**, preferably through the bore **47**, a shakeproof washer or spider **62** that is frictionally maintained in the position shown in FIG. 2. I then insert into the counterbore my resilient space occupying means which I have chosen to illustrate as a deformable capsule or bag **64**, filled to a very low pressure with air and formed with a series of external longitudinal ribs or corrugations **65**.

In operation, when the door **10** is opened, the arm **19** cranks the pinion **44** to move the piston **29**, through the rack teeth **32**, to the left, as viewed in FIG. 2, compressing the spring **36**. During this movement, fluid in the chamber **22** passes freely by the ball check **35**. When the door is released, the spring **36** urges the piston to the right. During this movement the ball check **35** seats itself checking off the flow of fluid through the port **34**. The fluid is then forced through the ports **60** and **61**, past the flats **57** and **59** on the regulating valve surfaces **52***a* and **52***b*, into the counterbore **51**, the vertical bore **40** and finally back to the chamber **22**, to the left of the piston.

The rate of fluid flow from the ports **60** and **61** to the counter bore **51** may be regulated by rotating the regulating valve **52** relative to the regulating nut **55**. By rotating the regulating valve **52** only slightly, the flat **57** may be made to overlap the port **60** to any desired degree without substantial axial movement of the regulating valve **52**. In this manner, the rate of flow between port **60** and the bore **46***a* may be regulated as desired. By rotating the regulating valve **52** a substantial amount, the regulating valve may be moved axially, by reason of its being threaded in the regulating nut **55**, to vary the overlap of the flat **59** with the inner end of the bore **46***a*. In this manner, flow of fluid from the inner end of the bore **46***a* to the bore **46***b* may be regulated as desired.

The flow of fluid through the ports **60** and **61** is somewhat restricted as the flats **33**, **33***a* formed on the piston **29** move past these ports, and when the peripheral portion of the piston between the flat **33** and the recess **38** passes the port **61**, the fluid flows through port **60**, past flat **57**, assuming that flat **57** has been turned to overlap port **60**, into the inner end of bore **46***a* and out to the rear of the piston through port **61**, bypassing the counterbore **51**.

By reason of the presence of the space occupying means **64**, it will be seen that the door closer may be completely filled with fluid, and, should the closer be subjected to temperature variations causing expansion of the fluid, the capsule will compensate for such expansion by deforming thereby minimizing any increase in the fluid pressure. The ribs **65** formed on the capsule allow the fluid to pass around the capsule so that the fluid contacts a substantial portion of the exterior of the capsule.

I believe that the construction and operation of my novel invention will now be fully appreciated by those persons skilled in the art. It should be emphasized further that while my invention makes possible the advantages outlined, I still maintain the inherent advantages of the prior art that are considered desirable, regardless of the particular type of door closer with which my contribution is used.

I claim:

1. In a door closer, a fluid-filled chamber, a piston movable within said chamber, means for moving said piston in said chamber incidental to the opening and closing of a door to be controlled, said means including a part connected to said piston and movable in said chamber with said piston, said piston and said part being entirely confined within said chamber in all positions of said piston whereby no change in the volume of the fluid-occupying space of said chamber and therefore no corresponding change in pressure of said fluid occurs by movement of said piston, a passageway external of said chamber in communication with said chamber on both sides of said piston, a second chamber in communication with said passageway, and a compressible self-contained space occupying unit in said second chamber to decrease the fluid required to fully fill said closer.

2. In a door closer, a fluid-filled chamber, a piston movable within said chamber, means for moving said piston in said chamber incidental to the opening and closing of a door to be controlled, said means including a part connected to said piston and movable in said chamber with said piston, said piston and said part being entirely confined within said chamber in all positions of said piston whereby no change in the volume of the fluid-occupying space of said chamber and therefore no corresponding change in pressure of said fluid occurs by movement of said piston, a passageway through said piston, means in said passageway for preventing fluid from passing through said piston from one side of the piston to the other, as the piston is moved in one direction, a second passageway external of said chamber and communicating with said chamber at spaced points by which said fluid can flow from said one side of the piston to said other side of the piston as the piston is moved in an opposite direction, means for adjusting the rate of flow of the fluid through said second passageway, a second chamber communicating with said second passageway, and compressible space-occupying means within said second chamber to decrease the fluid required to fully fill said closer.

References Cited in the file of this patent

UNITED STATES PATENTS

2,116,185	Bernhard	May 3, 1938
2,571,279	Myklestad	Oct. 16, 1951
2,586,135	Woodruff	Feb. 19, 1952
2,640,693	Magrum	June 2, 1953
2,723,416	Schlage	Nov. 15, 1955
2,770,003	Comey et al.	Nov. 13, 1956
2,781,869	Boehm et al.	Feb. 19, 1957

FOREIGN PATENTS

1,121,131	France	Apr. 30, 1956