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**M. M. CHECK**

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# DOOR CLOSER WITH EXPANSION CHAMBER

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Fig. 1.

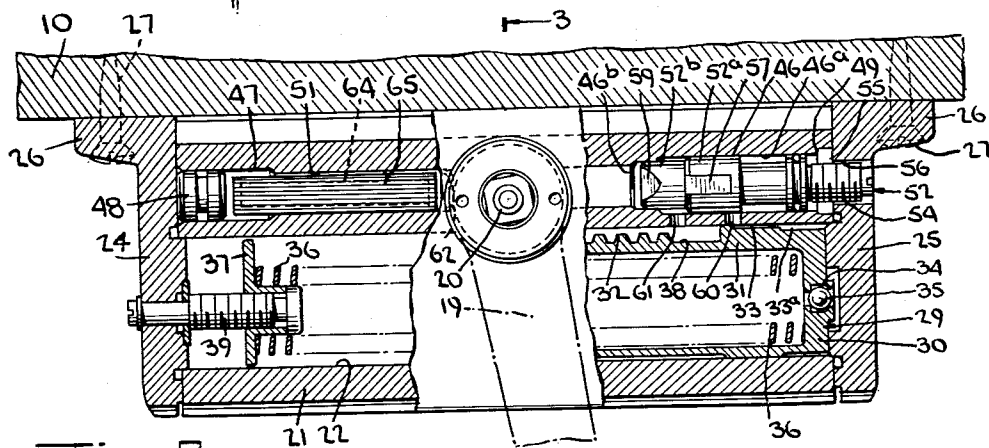
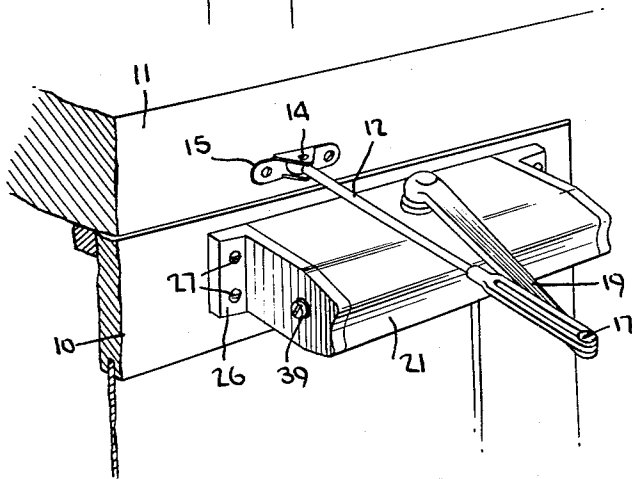


Fig. 2.

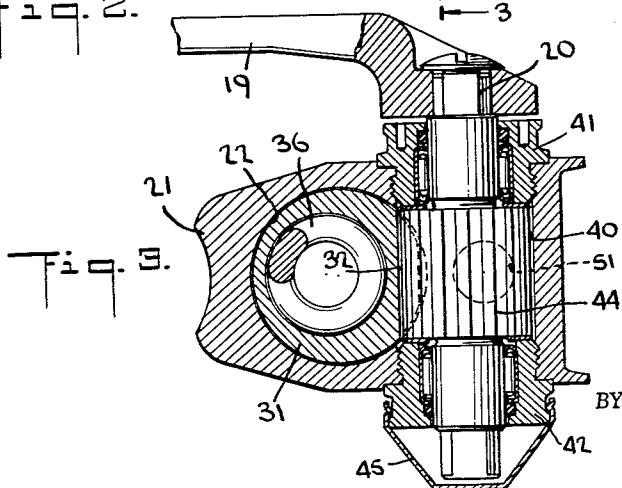


Fig. 3.

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## DOOR CLOSER WITH EXPANSION CHAMBER

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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 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 the 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.

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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, 33a 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 46a and a concentric sub-bore 46b of reduced diameter. A counter-bore 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 52a and 52b in fluid sealing engagement with the main bore 46a and the sub-bore 46b, respectively. In order to allow the fluid to flow past the valve surfaces 52a and 52b, each of these surfaces has a flat 57 and 59, respectively, milled thereon.

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To complete the flow circuit, a pair of ports 60 and 61 are provided to interconnect the piston chamber 22 with the bore 46a opposite the valve surfaces 52a and 52b, 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 52a and 52b, 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 46a 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 46a. In this manner, flow of fluid from the inner end of the bore 46a to the bore 46b may be regulated as desired.

The flow of fluid through the ports 60 and 61 is somewhat restricted as the flats 33, 33a 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 46a 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.

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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.

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