United States Patent [19]

Christy et al.

[11] **3,909,877**

[45] **Oct. 7, 1975**

[54] **DETENT DOOR HOLDER**

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[73] Assignee: **Eaton Corporation,** Cleveland, Ohio

[22] Filed: **Jan. 17, 1975**

[21] Appl. No.: **541,833**

[52] **U.S. Cl.** **16/85;** 16/49; 16/DIG. 17

[51] **Int. Cl.²** **E05F 5/06**

[58] **Field of Search** ..... 16/49, 52, 53, 71, 82, 16/85, 51, DIG. 17; 74/526; 292/275

[56] **References Cited**

UNITED STATES PATENTS

2,960,718	11/1960	Lasier	16/49
3,259,936	7/1966	Sheridan	16/49
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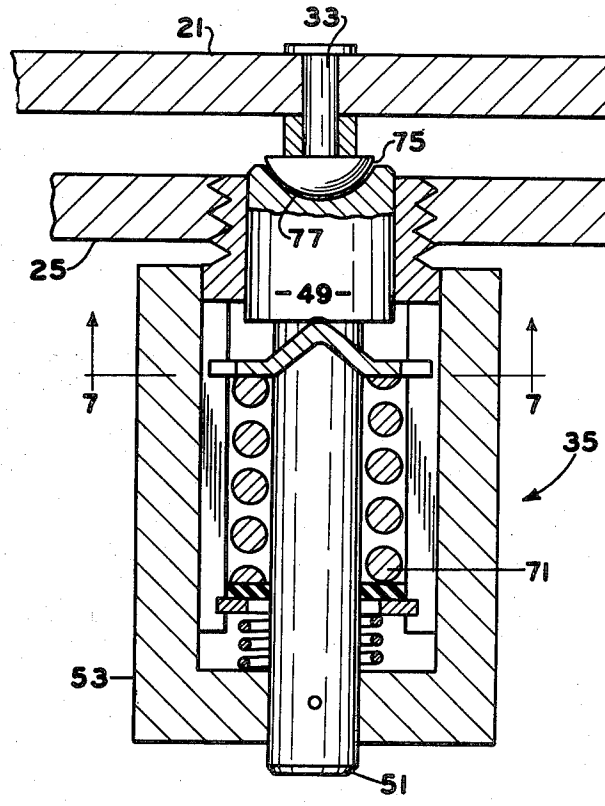
Primary Examiner—Geo. V. Larkin

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[57] **ABSTRACT**

A detent door holder is provided for use with a door closer assembly to hold the door in a predetermined position (normally, an open-door position), upon engagement of the detent with a detent surface. The detent includes a body and a plunger assembly associated therewith. The plunger assembly has a retracted position in which the detent is inoperable to engage the detent surface and the door is freely movable. The plunger assembly also has an extended position in which the plunger assembly is operable to engage the detent surface, thus holding the door in the predetermined position. A main spring exerts a first biasing force opposing movement of the plunger assembly from the extended, operable position toward the retracted position, and a secondary spring exerts a second biasing force on the plunger assembly opposing movement of the plunger assembly from the retracted position toward the extended position. Preferably, the first biasing force is substantially greater than the second biasing force. Thus, it is possible with the detent of the present invention to set the plunger assembly, i.e., move it from the retracted position to the extended, operable position, in opposition to a relatively small spring force, while maintaining the plunger assembly operable to engage the detent surface under the influence of a much larger spring force.

13 Claims, 8 Drawing Figures



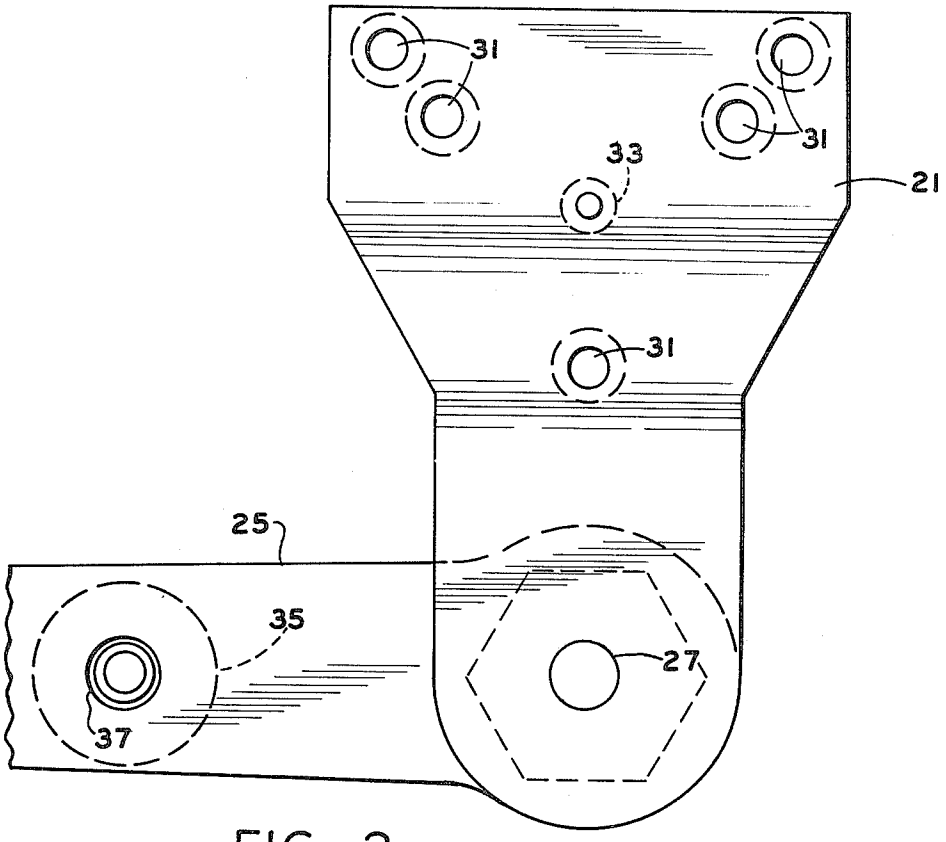


FIG. 2

FIG. 1

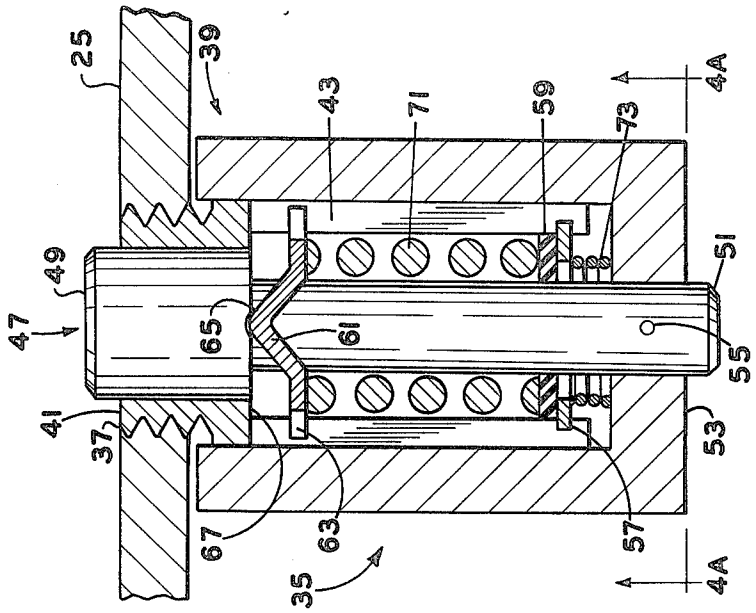


FIG. 4

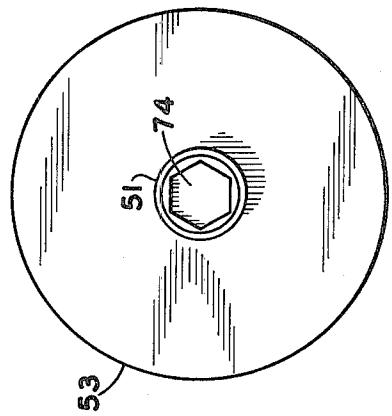


FIG. 4A

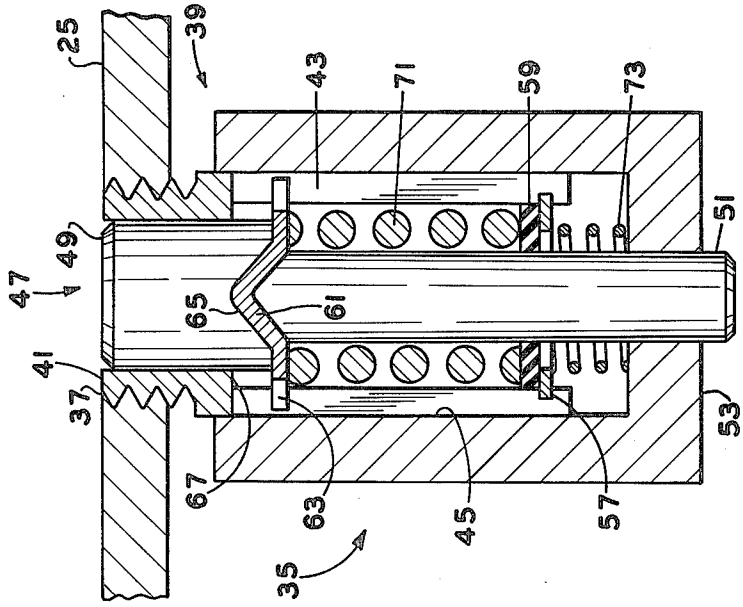


FIG. 3

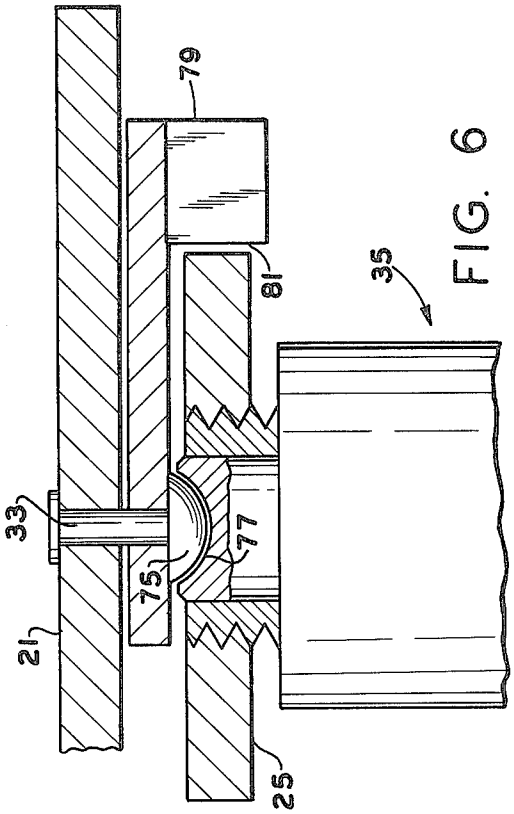


FIG. 6

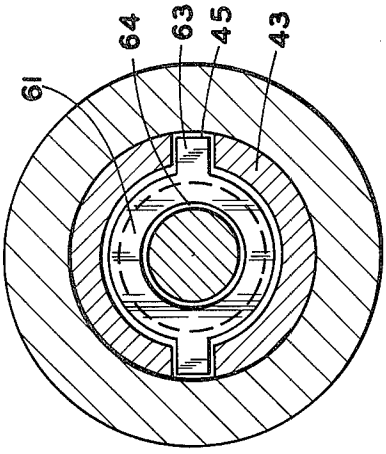


FIG. 7

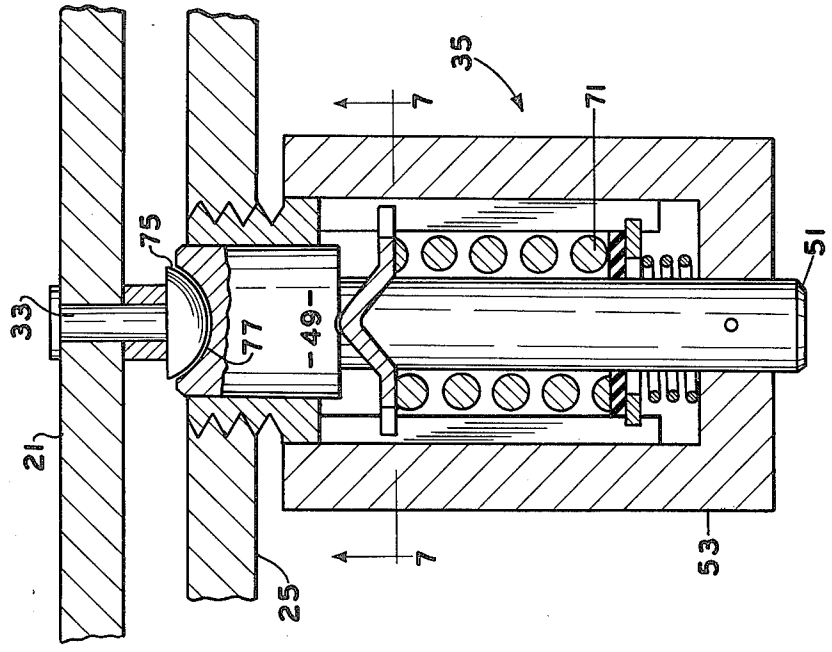


FIG. 5

DETENT DOOR HOLDER

BACKGROUND OF THE DISCLOSURE

The present invention relates to door closer assemblies, and more particularly, to an improved detent-hold open mechanism for maintaining a door biased by the closer assembly in a predetermined, open-door position. More specifically, the present invention relates to such a detent hold open of the type utilizing a movable plunger assembly which is biased toward engagement with a detent surface.

Plunger-type detent door holders have become generally well known in the art, an example of which is illustrated by U.S. Pat. No. **3,259,936** and assigned to the assignee of the present invention. In the detent mechanism of the cited patent, the plunger is axially movable from the retracted position to the extended, operable position by rotation of the plunger assembly through an angle of about **90°**. This is referred to in the art as "setting" the detent.

In the development of detent door holders of the type to which the present invention applies, it was found desirable to employ larger springs capable of exerting greater holding forces on the plunger assembly. However, the use of stronger springs caused a problem in connection with the setting of such detents, whereby it was necessary to overcome the biasing force of the spring when rotating the plunger assembly to move the plunger from the retracted position to the extended, operable position. Thus, the desired level of biasing force needed to maintain the door in the predetermined position was substantially greater than the force which could be conveniently applied to manually set the detent.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide an improved detent door holder of the type utilizing a plunger assembly biased toward engagement with a detent surface.

It is a more specific object of the present invention to provide a detent door holder of the type described in which only a relatively small biasing force must be overcome to set the detent in the extended, operable position, while a substantially larger biasing force maintains the plunger in engagement with the detent surface.

It is an even more detailed object of the present invention to provide such a detent door holder wherein the above-stated objects are accomplished by the provision of an improved means for biasing the plunger assembly. The biasing means exerts a first biasing force which opposes movement of the plunger assembly inwardly, i.e., from the extended, operable position toward the retracted position. Therefore, upon engagement of the detent surface of the plunger assembly, the first biasing force holds the door in the predetermined position by resisting disengagement of the plunger assembly from the detent surface. The biasing means also exerts a second biasing force on the plunger assembly opposing movement of the plunger assembly outwardly, i.e., from the retracted position toward the extended position. It is this outward movement which occurs when the plunger assembly is being set. The first biasing force is preferably substantially greater than the second biasing force.

In accordance with another aspect of the present invention, the detent door closer includes a body axially and rotatably movable relative to the plunger and the biasing means includes first and second spring means operable to exert the first and second biasing forces, respectively, the first and second spring means having seat means axially fixed with respect to the body. The second spring means biases the plunger toward the retracted position.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a somewhat schematic plan view of a door with a door closer assembly illustrating both the closed door and open door positions.

FIG. **2** is an enlarged, fragmentary plan view similar to a portion of FIG. **1.**

FIG. **3** is a cross-sectional view of the detent of the present invention in the retracted position, on a scale twice that of FIG. **2.**

FIG. **4** is a cross-sectional view similar to FIG. **3,** illustrating the extended or set position.

FIG. **4A** is a bottom plan view taken along line **4A—4A** of FIG. **4.**

FIG. **5** is a cross-sectional view similar to FIGS. **3** and **4** illustrating the engaged position of the detent of the present invention.

FIG. **6** is a view, partly in cross-section and partly in elevation, of an alternative embodiment of the present invention.

FIG. **7** is a cross-sectional view taken on line **7—7** of FIG. **5,** and on the same scale.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, which are for the purpose of illustrating preferred embodiments of the present invention, and not for limiting the same, FIG. **1** illustrates the environment for which the detent of the present invention is especially adapted. In FIG. **1,** a door **11** is mounted to swing within a door frame **13** by means of a set of hinges **15.** The opening and closing action of the door **11** is controlled by a door closer assembly **17,** including a door closer **19** which may be of the type illustrated in U.S. Pat. No. **2,994,906,** assigned to the assignee of the present invention. The closer **19,** which is mounted on the door **11,** is interconnected with a soffit plate **21,** disposed on the door frame **13,** by means of a closing arm assembly which includes a main closing arm **23** and a secondary closing arm **25.** Thus, as used hereinafter, the term "closing arm" may refer to and include either the main arm **23,** the secondary arm **25** or the combination of the arms **23** and **25.** Furthermore, it will be appreciated by those skilled in the art that the present invention may be utilized with a door closer assembly without the door closer **19,** the closing arm merely being pivotally mounted relative to the door.

Referring now to the fragmentary view of FIG. **2,** there is shown the soffit plate **21** and a fragmentary portion of the secondary closing arm **25,** which is pivotally mounted to the soffit plate **21** as by means of a shoulder bolt **27.** The soffit plate **21** includes a number of counter-bored holes **31,** usable for fastening the soffit plate to the door frame **13,** such as by means of flat-headed screws. Extending through the soffit plate **21** is a rivet **33,** the function of which will be described subsequently. Mounted to extend from the underside of

the secondary arm 25 is a detent door holder 35, a portion of which is threaded into a detent opening 37, extending through the arm 25.

Referring now to FIG. 3, the detent door holder 35 is shown in greater detail threaded into the detent opening 37. The detent door holder 35 comprises a spring housing 39 including a housing upper portion 41, threaded into detent opening 37, and a housing guide portion 43. As is better shown in FIG. 7, housing guide portion 43 includes a pair of axially extending, diametrically opposed guide grooves 45, the function of which will be described subsequently.

Extending axially through the spring housing 39 is a plunger assembly 47 including a plunger head 49 and a plunger stem 51, the plunger assembly 47 being axially and rotatably movable relative to the spring housing 39. Surrounding the spring housing 39 is a housing cover 53 which is held in a fixed relationship with the plunger assembly 47 by a suitable means, such as a press-fit pin 55 (see FIG. 4) passing through the plunger stem 51.

Disposed within a circumferential groove formed on the inner surface of housing guide portion 43 is a retaining ring 57, and seated on the upper surface thereof is a housing washer 59. Disposed within the housing guide portion 43 is a plunger cam 61 including a pair of oppositely-disposed guide tabs 63 disposed within the guide grooves 45 to permit axial movement of the cam 61 within the guide portion 43, while preventing relative rotational movement. As may be seen in FIG. 7, the plunger cam 61 is generally circular, and defines a generally circular, central orifice 64 to permit the plunger stem 51 to pass therethrough. The plunger cam 61 is formed to have a cross-section (as seen in FIG. 3) shaped generally like a broad V and the plunger head 49 has a similarly configured, diametrically-extending surface 65 to provide engagement of the plunger cam 61 and plunger head 49. It should be noted that the housing upper portion 41 defines a circular housing shoulder 67 which is engaged by the peak of the plunger cam 61 when the cam is in the position shown in FIGS. 3 and 4, thus limiting upward movement of the cam.

Disposed between the plunger cam 61 and the housing washer 59 is a main spring 71, and disposed between the retaining ring 57 and the inside, bottom surface of the housing cover 53 is a plunger spring 73, both of which are shown in the subject embodiment as being helical compression springs, although it should be appreciated that any suitable biasing means may be used in accordance with the teachings herein. In the subject embodiment, the main spring 71 exerts a biasing force in the range of about 100 pounds (444 newtons) to about 150 pounds (666 newtons), depending on the degree of compression, whereas the plunger spring 73 exerts a biasing force in the range of about 4.6 pounds (21 newtons) to about 10.4 pounds (46 newtons), depending again on the degree of compression. Thus, it may be seen that the main spring 71 exerts a biasing force which may be at least about 10 times greater than the biasing force exerted by the plunger spring 73, and in the subject embodiment is roughly 15 to 25 times greater. The significance of these relative biasing forces will become more apparent in connection with the subsequent description of the operation of the detent door holder of the present invention.

OPERATION

In describing the operation of the detent 35, reference will be made primarily to FIGS. 3, 4 and 5 which illustrate, respectively, the retracted (or off) position, the extended, operable position and the engaged position. The retracted position of the plunger assembly 47, as shown in FIG. 3, is the normal condition for the detent when the door 11 is in the closed-door position represented in FIG. 1 (solid lines) and in the fragmentary view of FIG. 2.

When it is desired to "set" the detent 35 in preparation for opening the door, the plunger assembly 47 and housing cover 53 are rotated, as a unit, about 90° to the position shown in FIG. 4. This may be accomplished by any suitable means, such as by inserting an Allen wrench into an hexagonal opening 74 (see FIG. 4A) formed in the bottom of plunger stem 51 and turning the wrench 90°, thus turning the plunger assembly 47 and housing cover 53. In the set position shown in FIG. 4, the plunger head 49 is rotated relative to the plunger cam 61 so that the V-shaped surface 65 on the underside of the plunger head 49 becomes oriented approximately perpendicular to the peak of the plunger cam 61, thus moving the plunger assembly axially, relative to the cam 61, to the extended, operable position shown in FIG. 4. It should be noted by comparing FIGS. 3 and 4 that when the plunger head 49 is rotated, it is the plunger spring 73 which is compressed, permitting the housing cover 53 and plunger assembly 47 to rise relative to the closing arm 25, rather than the main spring 71 being compressed, which would permit the plunger cam 61 to be depressed. In the set position illustrated in FIG. 4, the detent door holder 35 is ready to perform its hold open function.

Referring now to FIG. 5, the detent 35 is in the engaged position which occurs when the door reaches the open-door position illustrated in FIG. 1 (dotted lines). The rivet 33 passing through soffit plate 21 terminates at its downward end in a head 75, generally defining a portion of a sphere, and which serves as the detent surface. For clarity, the plunger head 49 is shown partly broken away to show an opening 77 formed in the upper end of plunger head 49, the opening 77 generally conforming to the shape of rivet head 75. By comparing FIGS. 4 and 5 it may be seen that when plunger head 49 engages rivet head 75, plunger assembly 47 is initially depressed, compressing main spring 71, until the head 75 and opening 77 reach the relative positions shown in FIG. 5, at which point the plunger assembly 47 has again moved upward a short distance (approximately the height of rivet head 75) to engage the detent surface. Thus, in the engaged position of FIG. 5, it is the substantially larger biasing force exerted by main spring 71 which maintains the plunger assembly 47 in engagement with the detent surface to hold the door in the open door position.

When it is desired to again close the door, necessitating disengagement of the plunger head and detent surface, the door may be closed by merely exerting a force on the door sufficient to overcome the force of main spring 71, causing the plunger head 49 to momentarily depress in opposition to the biasing force of main spring 71, until the opening 77 is disengaged from the detent surface, allowing the plunger head 49 to return to the extended, operable position illustrated in FIG. 4.

The door then closes under the force of the door closer 19.

Alternatively, disengagement of the opening 77 and detent surface may be brought about by returning the plunger assembly 47 and housing cover 53 to the retracted position illustrated in FIG. 3, without first moving the door. This is accomplished by the reverse process of setting the detent, i.e., rotating the plunger assembly and housing cover 90° in either direction so that the surface 65 on the underside of plunger head 49 again engages the peak of plunger cam 61 as is shown in FIG. 3.

From the above discussion of the operation of the present invention, it will be appreciated that the detent 35 and the rivet head 75 must be disposed at equal distances from the pivot point of secondary arm 25 and soffit plate 21, i.e., the bolt 27. It should also be appreciated by those skilled in the art that the detent door holder 35 and detent surface may be both located elsewhere on the door closer assembly 17. For example, the detent 35 may be located on either the main closing arm 23 or the secondary closing arm 25 and the detent surface may be located on the other of the closing arms 23 and 25 in a manner generally similar to that illustrated in the U.S. Pat. No. 3,259,936 cited above.

FIG. 6 illustrates another embodiment of the invention in which the detent 35 engages a detent surface in the manner described above, but in addition, a stop member 79 is provided such that the edge of closing arm 25 engages a stop surface 81 just as the opening 77 achieves engagement with the detent surface.

While the invention has been described with reference to a preferred embodiment, neither the illustrated embodiment nor the terminology employed in describing it is intended to be limiting; rather, it is intended to be limited only by the scope of the appended claims.

I now claimm:

1. A detent means for use with a door closer assembly to hold a door in a predetermined position upon engagement of said detent means with a detent surface, said detent means comprising:

a. a body;

b. a plunger assembly associated with said body, said plunger assembly having a retracted position in which the door is freely movable, and an extended position in which said plunger assembly is operable to engage said detent surface;

c. means biasing said plunger and said biasing means exerting a first biasing force opposing movement of said plunger assembly from said extended, operable position toward said retracted position; and

d. said biasing means exerting a second biasing force opposing movement of said plunger assembly from said retracted position toward said extended, operable position, said first biasing force being substantially greater than said second biasing force.

2. A detent means as defined in claim 1 wherein said first biasing force is at least about 10 times greater than said second biasing force.

3. A detent means as defined in claim 1 including cam means axially movable relative to said body, said plunger assembly defining a cam actuating surface normally in engagement with said cam means, said cam actuating surface being configured to permit movement of said plunger assembly between said retracted position and said extended, operable position in response to relative rotation of said cam means and said plunger assembly.

4. A detent means as defined in claim 3 including a housing generally surrounding said body and being rotatably and axially movable with respect thereto, said plunger assembly being fixed with respect to said housing to prevent substantial axial and rotational movement therebetween.

5. A detent means as defined in claim 4 wherein said biasing means includes first and second biasing means operable to exert, respectively, said first and second biasing forces, said second biasing means biasing said plunger assembly toward said retracted position.

6. A detent means as defined in claim 5 wherein said body includes first and second seat means axially fixed with respect to said housing, said first biasing means comprises a first spring and said first seat means and said second biasing means comprises a second spring and said second seat means.

7. A detent means as defined in claim 6 wherein said first biasing force is from about 100 to about 150 pounds and said second biasing force is from about 5 to about 10 pounds.

8. A detent means as defined in claim 1 wherein said biasing means includes a first spring means operable to exert said first biasing force and a second spring means operable to exert said second biasing force.

9. A detent means as defined in claim 8 wherein said first spring means has seat means axially fixed with respect to said body and said second spring means has seat means axially fixed with respect to said body and said second biasing force biases said plunger assembly toward said retracted position.

10. A detent means as defined in claim 9 including cam means axially movable relative to said body, said plunger assembly defining a cam actuating surface normally in engagement with said cam means, said cam actuating surface being configured to permit movement of said plunger assembly between said retracted position and said extended, operable position in response to relative rotation of said cam means and said plunger assembly.

11. A detent means as defined in claim 10 wherein said cam means is biased toward engagement with said cam actuating surface by said first spring means.

12. A detent means as defined in claim 11 wherein said body includes axially extending guide means and said cam means includes means engaging said guide means to permit axial movement of said cam means within said body and substantially prevent rotation of said cam means relative to said body.

13. A detent means adapted to be mounted on a pivotable arm to hold said arm in a predetermined position upon engagement of said detent means with a detent surface, said detent means comprising:

a. a body including means for fixedly mounting said body on said pivotable arm;

b. a plunger assembly disposed at least partly within said body and being rotatably and axially movable relative thereto, said plunger assembly including means for engaging said detent surface;

c. a housing generally surrounding said body and being fixed with respect to said plunger assembly;

d. cam means axially movable relative to said plunger assembly, said plunger assembly defining a cam actuating surface normally in engagement with said cam means to permit axial movement of said

plunger assembly in response to relative rotation of said cam means and said plunger assembly;

e. a first spring means including a seat fixed with respect to said body and exerting a first biasing force biasing said cam means outwardly toward engagement with said cam actuating surface and opposing movement of said plunger assembly inwardly; and

f. a second spring means including a seat fixed with respect to said body and exerting a second biasing force opposing movement of said plunger assembly outwardly, said first biasing force being at least about 10 times greater than said second biasing force.

* * * * *