Nov. 10, 1964 R. W. SCHMID 3,156,002

HOLD-OPEN MECHANISM FOR DOOR CLOSER

Filed May 28, 1962 2 Sheets-Sheet 1

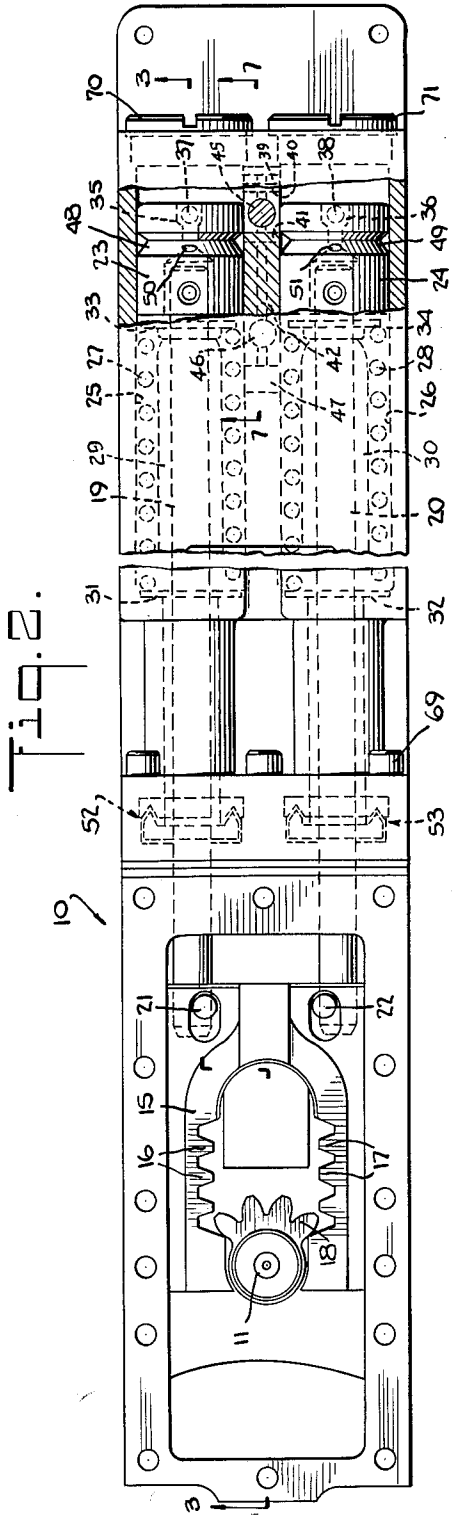

Fig. 2.

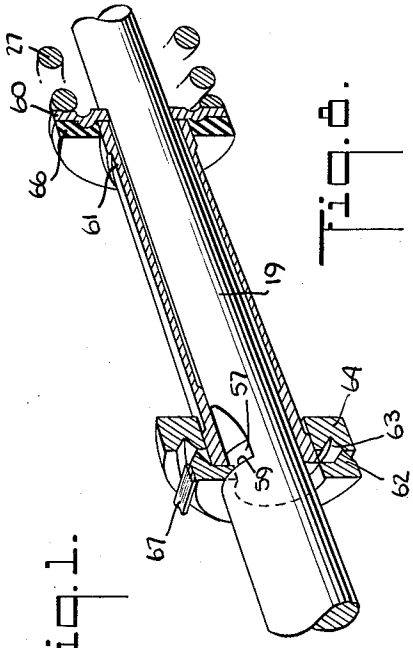

Fig. 3.

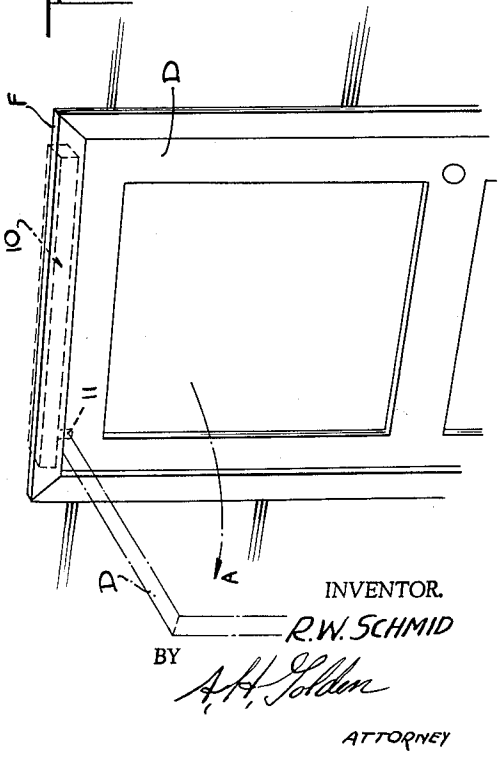

Fig. 1.

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HOLD-OPEN MECHANISM FOR DOOR CLOSER

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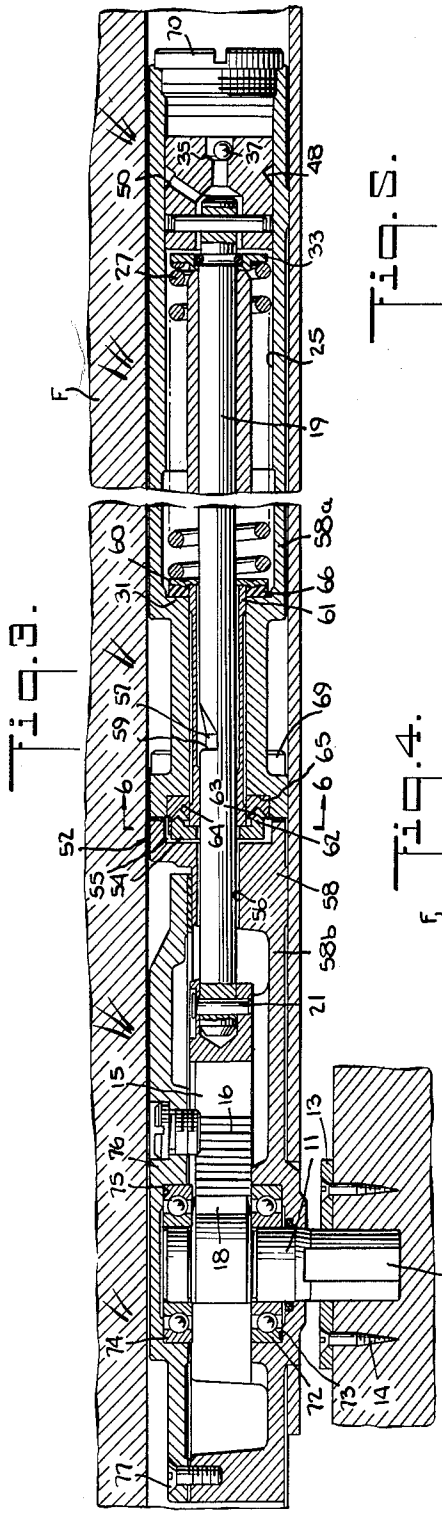

Fig. 3.

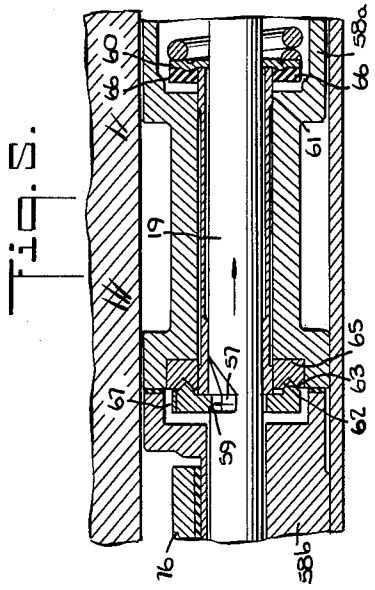

Fig. 5.

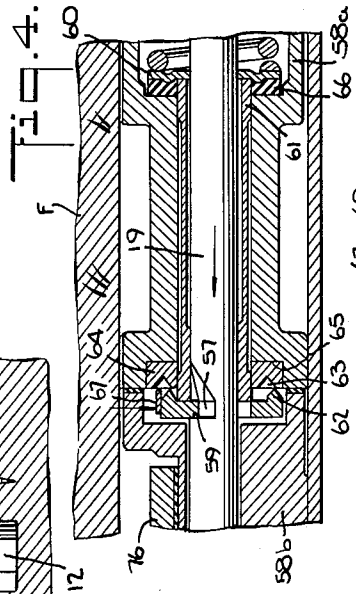

Fig. 4.

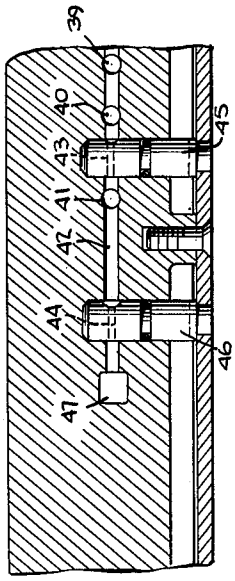

Fig. 7.

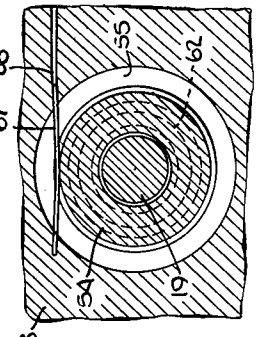

Fig. 6.

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3,156,002

HOLD-OPEN MECHANISM FOR DOOR CLOSER

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8 Claims. (Cl. 16—79)

This invention relates to a hold open mechanism for a door closer.

Door closers are quite frequently provided with hold open mechanisms which will releaseably hold the door in an open position. These hold open mechanisms commonly include a detent which is adapted to engage in a notch in a moving part of the closer when the door has been opened to a particular position. The door may be again closed by applying sufficient force to the door to cam the detent out of the retaining notch.

While various detent arrangements have been proposed and used for this purpose, these arrangements have required the use of detent springs of sufficient strength to hold the detents in the retaining notches with such force that the heavy closer spring for returning the door to closed position will not cam the detent from the retaining notch and release the door. Thus, the force exerted by the detent spring on the detent must be correlated to that exerted by the closer spring, and relatively heavy, expensive detent springs must be used with these arrangements. Furthermore, these detent springs occupy considerable space within the closer, thereby increasing the overall size of the closer.

The purpose of this invention is to provide a detent type of hold open mechanism which requires no detent spring, or at most only a light spring, thereby eliminating the heavy, expensive detent spring heretofore used, and allowing the closer to have a smaller overall size. This latter advantage makes the detent arrangement of the invention particularly useful for concealed type closers which must have relatively small overall dimensions to allow them to be mounted within the narrow door frame above the door opening.

In accordance with the invention, the hold open mechanism includes a detent adapted to have positive engagement with a retaining surface in a moving part of the closer to hold the door open, and means cooperating with the detent when the detent is engaged in the retaining notch for locking the closer spring to the moving part. By this arrangement, the closer spring is rendered ineffective to move the moving part in a direction to disengage the detent from the notch. The door may be again closed by applying force to the door in the closing direction to move the moving part, closer spring and detent as a unit, until the detent engages a cooperating cam surface on the closer body to disengage the detent from the notch and release the closer spring to allow the closer spring to close the door.

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 drawings, wherein:

FIG. 1 is a perspective view of a door and frame showing a closer incorporating the hold open mechanism of the invention concealed within the door frame above the door opening;

FIG. 2 is a top plan view of the closer in FIG. 1, with a top cover plate removed and a portion broken away to show some of the internal construction;

FIG. 3 is a sectional view taken on the line 3—3 of FIG. 2 and showing the hold open mechanism in released position;

FIG. 4 is a partial sectional view showing the hold open mechanism in door holding position;

FIG. 5 is a partial sectional view similar to that of FIG. 4 but showing the hold open mechanism as it is being released by application of force to the door in the closing direction;

FIG. 6 is a sectional view taken on the line 6—6 of FIG. 3;

FIG. 7 is a sectional view taken on the line 7—7 of FIG. 2; and

FIG. 8 is a perspective view, partly in section, showing the hold open mechanism apart from the other structure of the closer.

Referring to the drawings and in particular to FIG. 1, a closer 10, incorporating the hold open mechanism of the invention, is shown concealed within the door frame F above the door opening and connected to the door D through an operating shaft 11. As best shown in FIG. 3, the lower end of the operating shaft 11 is provided with flat portions 12 through which the operating shaft 11 is keyed to a plate 13 which in turn is secured to the top of the door D by screws 14.

The closer 10 is of the rack and pinion type, and includes, as best shown in FIG. 2, a rack member 15 having opposed sets of rack teeth 16 and 17, and a pinion 18 which is secured to the operating shaft 11 and meshes with the one set or the other of the rack teeth 16 and 17 to move the rack member 15 to the left when the operating shaft 11 is rotated through opening of the door D in either direction.

A pair of piston rods 19 and 20 are pivotally connected through pins 21 and 22, to the end of the rack member 15, and as the rack member 15 is moved to the left by opening of the door D, pistons 23 and 24 secured to the ends of the rods 19 and 20 are also moved to the left in fluid filled cylindrical chambers 25 and 26. As the pistons 23 and 24 are moved to the left, coil springs 27 and 28, which surround guides 29 and 30 carried by the rods 19 and 20, are compressed between the ends 31 and 32 of the cylindrical chambers 25 and 26 and collars 33 and 34, secured to the rods 19 and 20 adjacent the pistons 23 and 24. When the door is released, the compressed springs 27 and 28 move the rods 19 and 20 to the right causing the door D to close.

As the pistons 23 and 24 are moved to the left incidental to the opening of the door D, fluid within the cylindrical chambers 25 and 26 passes freely from the left side of the pistons 23 and 24 to the right side of the pistons through enlarged ports 35 and 36 formed through the pistons 23 and 24. Thus the fluid provides little resistance to the opening of the door. When, however, the pistons 23 and 24 are moved to the right by the compressed springs 27 and 28 during closing of the door D, ball checks 37 and 38 close the ports 35 and 36 preventing flow of fluid through the ports 35 and 36 from the right-hand side of the pistons 23 and 24 to the left-hand side of the pistons. The fluid, therefore, must flow through ports 39, 40 and 41, best shown in FIG. 7, extending through the walls of the cylindrical chambers 25 and 26, through a longitudinally extending passage 42, through restricted ports 43 and 44 in adjustable valve members 45 and 46 which extend into the passage 42, and through a port 47 extending through the walls of the cylindrical chambers 25 and 26 on the left-hand sides of the pistons 23 and 24. The regulating valves 45 and 46 may be rotated to vary the effective sizes of the ports 43 and 44 to adjust the rate of flow of fluid from the right-hand side of the pistons 23 and 24 to the left-hand side of the pistons to control the movement of the pistons by the springs to prevent slamming of the door.

As the pistons 23 and 24 move to the right, the pistons first cover ports 41 to slow down the movement of the pistons just prior to final closing movement of the door. During the final closing movement, annular grooves 48

and 49 in the peripheries of the pistons 23 and 24 align with the ports 41 to allow the flow of fluid from the right-hand side of the piston through the ports 39, 40, 43 and 41 and grooves 48 and 49, and through ports 50 and 51 extending through the pistons 23 and 24 and communicating with the grooves 48 and 49, thereby bypassing the regulating valve 44 to allow a sudden spurt of movement of the pistons 23 and 24 by the springs 27 and 28 to insure proper latching of the door.

The particular closer 10 illustrated includes two hold open mechanisms constructed in accordance with the invention, one generally indicated at 52 which cooperates with the piston rod 19 and one generally indicated at 53 which cooperates with the piston rod 20. As both these hold open mechanisms are of the same structure and operate in the same manner, only the mechanism 52 will be described.

As best shown in FIG. 3, the hold open mechanism 52 includes a simple detent in the form of an annular collar 54 which is slidably mounted in an annular recess 55 which surrounds the bore 56 through which the rod 19 extends. The rod 19 is provided with a notch 57 which is spaced from the collar 54 when the door D is closed, but which is moved to a position of alignment with the collar 54 when the rod 19 is moved to a position corresponding to the open position of the door D. When the notch reaches the position of alignment with the collar 54, the collar 54 drops into the notch as shown in FIG. 4, thereby locking the rod 19 to the closer housing 58, so that the door D is held in open position. The notch 57 is provided with a vertical surface 59 which cooperates with the side surface of the collar 54 to provide positive locking action.

It will be noted that the reaction force of the closer spring 27 is not taken directly by the end 31 of the cylindrical chamber 25, but rather the end of the spring 27 bears against a washer 60 which in turn bears against the end of a sleeve 61 which is slidably mounted on the rod 19. The opposite end of the sleeve 61 extends toward the collar 54. Thus, when the collar 54 is engaged in the notch 59, the left-hand end of the spring 27 is locked to the rod 19 through the washer 60, sleeve 61 and collar 54, while the right-hand end of the spring is locked to the rod 19 through the collar 33. Thus, while the spring 27 is compressed, it is ineffective to move the rod 19 toward the right, as long as the collar 54 is engaged in the notch 57 of the rod 19.

The collar 54 may be released from the notch 57 in the rod 19 by moving the door D in a closing direction to move the rod 19 and the collar 54 to the right, until a tapered flange 62 on the collar 54 engages tapered surfaces of a groove 63 formed in an annular cam member 64 and the collar member is cammed upwardly out of the notch 57, as shown in FIG. 5. The annular cam member 64 is carried in an annular seat or recess 65 surrounding the sleeve 61.

As the rod 19 and the collar 54 are moved to the right toward the annular member 64, the compressed spring 27 moves with the rod 19 so that the washer 60 moves away from the end 31 of the cylindrical chamber 25, as shown in FIG. 5. When, however, the collar 54 is completely released from the notch 57, the compressed spring 27 acting through the sleeve 61 moves the collar 54 to the left away from annular cam member 64, as shown in FIG. 3. A rubber buffer 66, interposed between the washer 60 and the end 31 of the cylindrical chamber 25, prevents objectionable noise as the washer is urged toward the end 31 by the spring 27 when the collar 54 is released from the notch 57.

As best shown in FIG. 3, sufficient clearance is provided between the end of the recess 55 and the side of the collar 54 so that the spring 27 acting through the sleeve 61 cannot press the collar 54 against the end of the recess 55 so as to prevent free movement of the collar 54 into the notch 57.

While the collar 54 would normally drop by gravity into the retaining notch 57 when the retaining notch 57 is moved to a position of alignment with the collar 54, the collar 54 is preferably urged downwardly by a simple leaf spring 67 which is mounted in a slot 68 formed in the body 58 of the closer and extends through the recess 55 and engages the upper portion of the periphery of the collar 54 to normally urge the collar 54 downwardly. The spring 67 may be relatively light as its function is only to prevent sticking of the collar 54 due to the presence of oil or other foreign matter.

As best shown in FIG. 4, the body portion 58 of the closer 10 is formed in two parts, 58*a* and 58*b*, with the part 58*a* providing the cylindrical chambers 25 and 26 for the pistons 23 and 24, and the part 58*b* supporting the rack member 15, operating shaft 11 and pinion segment 18. The two parts 58*a* and 58*b* are secured together by bolts 69 along a line separating the annular recess 55 in which the collar 54 is mounted and the recess 57 in which the annular cam member 64 is mounted. The collar 54 and the annular cam member 64 may be easily assembled in the recesses 55 and 65 when the two parts 58*a* and 58*b* are disassembled.

The outer ends of the cylindrical chambers 25 and 26 are closed by suitable plugs 70 and 71 which may be removed to allow assembly of the pistons 23 and 24, the rods 19 and 30, the springs 27 and 28, the washer 60, and the buffer 66 within the chambers 25 and 26.

The operating shaft 11 is mounted for rotation in the part 58*b* by a lower bearing 72 which is mounted in an annular seat 73 formed in the inner bottom surface of the inner part 58*b*, and an upper bearing 74 mounted in a seat 75 formed in the inner surface of a cover 76 which is removably secured to the part 58*b* by screws 77. The cover 76 may be removed to allow assembly of the shaft 11, bearings 72 and 74, and rack member 15, and to allow attachment of the rods 19 and 20 to the rack member 15 through the pivot pins 21 and 22.

From the preceding description, it can be seen that there is provided a novel hold open arrangement for a door closer which is very simple, occupies very little space, and requires only a very small spring member. While the invention has been described in conjunction with a closer incorporating two closer springs and two damping pistons, it will be appreciated that the invention is also applicable to closers incorporating only one closer spring and one damping piston.

It will also be appreciated that while one form of the invention has been shown and described, changes and modifications may be made therein without departing from the spirit and scope of the invention.

I now claim:

1. A hold open mechanism for a door closer of the type having a body part, a spring, and a part movable relatively to the body part through which the spring is energized as the door is opened and through which the energized spring acts to close the door when the door is released, comprising,

a detent surface on one of said parts,

a detent mounted on the other part for movement into locking engagement with said detent surface on said one part when said detent and surface are aligned through relative movement between said parts,

cooperating cam surfaces on said detent and one of said parts for camming said detent out of locking engagement with said detent surface through relative movement of said parts, and

means cooperating with said detent when said detent is in locking engagement with said detent surface to lock said spring to said movable part and render said spring ineffective to exert force between said body part and said movable part and therefore ineffective to cause relative movement between said parts to cam and said detent out of engagement with said detent surface, said detent being releas-

able by relative movement between said parts through application of an external force to the door.

2. A hold open mechanism for a door closer of the type having a body portion, a spring, and a part movable relatively to the body portion through which the spring is energized as the door is opened and through which the energized spring acts to close the door when the door is released, comprising,

a detent surface on said movable part,

a detent mounted on said body portion for limited movement in the direction of movement of said movable part and also for movement into locking engagement with said detent surface on said movable part when said detent surface is moved into alignment with said detent,

cooperating cam surfaces on said detent and on said body portion for camming said detent out of locking engagement with said detent surface through said limited movement of said detent in the direction of movement of said movable part, and

means cooperating with said detent when said detent is in locking engagement with said detent surface to lock said spring to said movable part and render said spring ineffective to exert force between said body part and said movable part and therefore ineffective to move said movable part and detent in a direction to cam said detent out of engagement with said detent surface, said detent being releaseable by relative movement between said detent and body portion effected through application of an external force to the door.

3. A hold open mechanism for a door closer of the type having a body portion, a spring, and a part movable relatively to the body portion through which the spring is compressed as the door is opened and through which the compressed spring acts to close the door when the door is released, comprising,

a detent surface on said movable part,

a detent mounted on said body portion for limited movement in the direction of movement of said movable part and also for movement into locking engagement with said detent surface on said movable part when said detent surface is moved into alignment with said detent,

cooperating cam surfaces on said detent and on said body portion for camming said detent out of locking engagement with said detent surface through said limited movement of said detent in the direction of movement of said movable part, and

means cooperating with said detent when said detent is in locking engagement with said detent surface to lock said spring to said movable part and render said spring ineffective to exert force between said body part and said movable part and therefore ineffective to move said movable part and detent in a direction to cam said detent out of engagement with said detent surface, said detent being releasable by relative movement between said detent and body portion effected through application of an external force to the door.

4. A hold open mechanism for a door closer of the type having a body portion, a movable rod, a compression spring connected at one end to said rod and reacting at the other end against said body portion whereby said spring is compressed as the door is opened and the compressed spring acts to close the door when the door is released, comprising,

a detent surface on said rod,

a detent mounted in said body portion for limited movement in the direction of movement of said rod and also for movement into positive engagement with said detent surface on said rod when said detent surface is moved into alignment with said detent,

cooperating cam surfaces on said detent and on said body portion for camming said detent out of locking engagement with said detent surface through said limited movement of said detent in the direction of movement of said rod, and

means extending between said other end of said spring and said detent and engageable with said detent when said detent is in locking engagement with said detent surface whereby both ends of said spring are locked to said rod and said spring is ineffective to exert force between said body part and said movable part and therefore ineffective to move said rod and detent in a direction to cam said detent out of engagement with said detent surface, said detent being releaseable by relative movement between said detent and said body portion effected through application of an external force to the door.

5. A hold open mechanism for a door closer of the type having a body portion, a rod movable within said body portion, a compression spring surrounding said rod and bearing at one end against means connected to said rod and bearing at the other end against a portion of said body portion whereby said spring is compressed as the door is opened and said compressed spring acts to close the door when the door is released, comprising,

a detent surface on said rod,

a detent mounted in said body portion for limited movement in the direction of movement of said rod and also for movement into positive locking engagement with said detent surface on said rod when said detent surface is moved into alignment with said detent,

cooperating cam surfaces on said detent and on said body portion for camming said detent out of locking engagement with said detent surface through said limited movement of said detent in the direction of movement of said movable part, and

a sleeve surrounding said rod with one end engaging said other end of said spring and the other end of said sleeve engaging said detent when said detent is in locking engagement with said detent surface whereby both ends of said spring are locked to said rod and said spring is ineffective to move said rod and detent in a direction to cam said detent out of engagement with said detent surface, said detent being releasable by relative movement between said detent and body portion effected through application of an external force to the door in a door closing direction.

6. A hold open mechanism for a door closer of the type having a body portion, a rod movable within said body portion, a compression spring surrounding said rod and bearing at one end against means connected to said rod and bearing at the other end against a portion of said body portion whereby said spring is compressed as the door is opened and said compressed spring acts to close the door when the door is released, comprising,

a detent surface on said rod,

a detent collar surrounding said rod and mounted in said body portion for limited movement in the direction of movement of said rod and also for movement into locking engagement with said detent surface on said rod when said detent surface is moved into alignment with said detent collar,

cooperating cam surfaces on said detent and on said body portion for camming said detent out of locking engagement with said detent surface through said limited movement of said detent in the direction of movement of said movable part, and

a sleeve surrounding said rod with one end engaging said other end of said spring and the other end of said sleeve engaging said detent when said detent is in locking engagement with said detent surface whereby both ends of said spring are locked to said rod and said spring is ineffective to move said rod and detent in a direction to cam said detent out of engagement with said detent surface, said detent

being releaseable by relative movement between said detent and body portion effected through application of an external force to the door in a door closing direction.

7. A hold open mechanism for a door closer of the type having a body portion, a rod movable within said body portion, a compression spring surrounding said rod and bearing at one end against means connected to said rod and bearing at the other end against a portion of said body portion whereby said spring is compressed as the door is opened and said compressed spring acts to close the door when the door is released, comprising,

a detent surface on said rod,

a detent collar surrounding said rod and mounted in said body portion for limited movement in the direction of movement of said rod and also for movement into positive engagement with said detent surface on said rod in which said detent surface is moved into alignment with said detent,

a detent spring carried by said body portion and urging said detent collar in the direction of locking engagement with said detent surface,

cooperating cam surfaces on said detent and on said body portion for camming said detent out of locking engagement with said detent surface through said limited movement of said detent in the direction of movement of said movable part, and

a sleeve surrounding said rod with one end engaging said other end of said spring and the other end of said sleeve engaging said detent when said detent is in locking engagement with said detent surface whereby both ends of said spring are locked to said rod and said spring is ineffective to move said rod and detent in a direction to cam said detent out of engagement with said detent surface, said detent being releasable by relative movement between said detent and body portion effected through application of an external force to the door in a door closing direction.

8. A hold open mechanism for a door closer of the type having a body portion, a pair of movable parts movable relatively to said body portion including a movable rod and movement transmitting means through which movement of the door is transmitted to said rod means, a compression spring connected at one end to said rod and reacting at the other end against said body portion whereby said spring is compressed as the door is opened and the compressed spring acts to close the door when the door is released,

a detent surface on said rod,

a detent mounted in said body portion for limited movement in the direction of movement of said rod and also for movement into locking engagement with said detent surface on said rod when said detent surface is moved into alignment with said detent,

cooperating cam surfaces on said detent and on said body portion for camming said detent out of locking engagement with said detent surface through said limited movement of said detent in the direction of movement of said rod, and

means engageable with said other end of said spring and said detent when said detent is in locking engagement with said detent surface whereby each end of said spring is locked to said rod and said spring is ineffective to move said rod and detent in a direction to cam said detent out of engagement with said detent surface,

said detent being releaseable by relative movement between said detent and body portion effected through application of an external force to the door.

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