Jan. 12, 1932. B. S. BERNHARD 1,840,558

DOOR CLOSER AND CHECK

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Fig. 1.

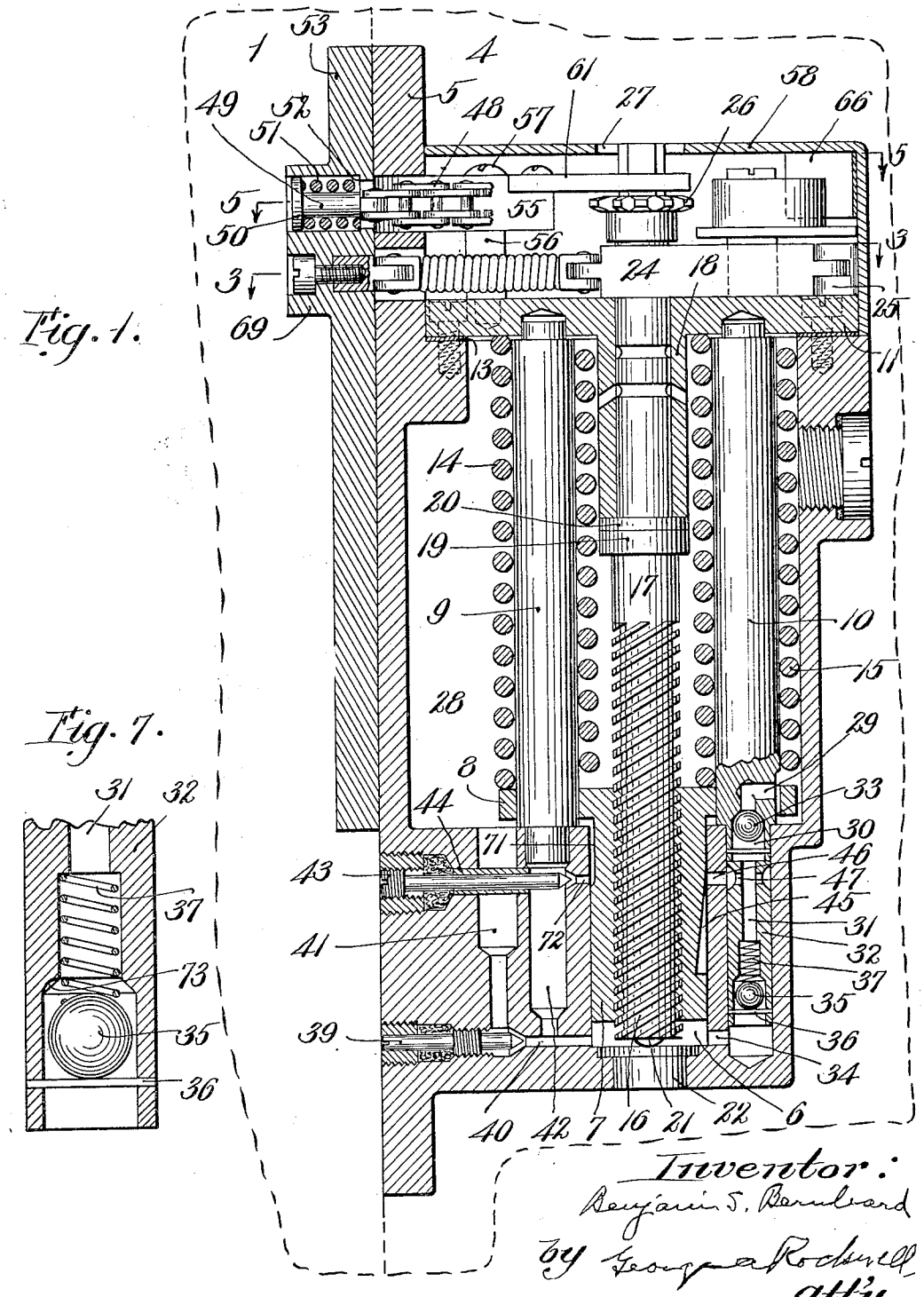

Fig. 7.

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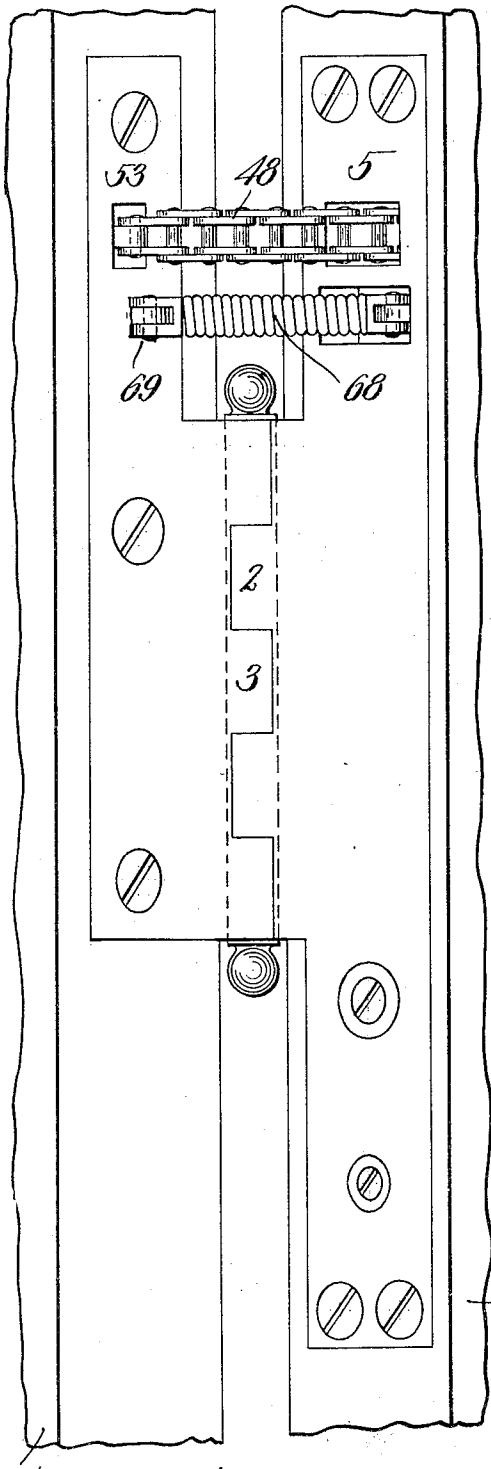

Fig. 2.

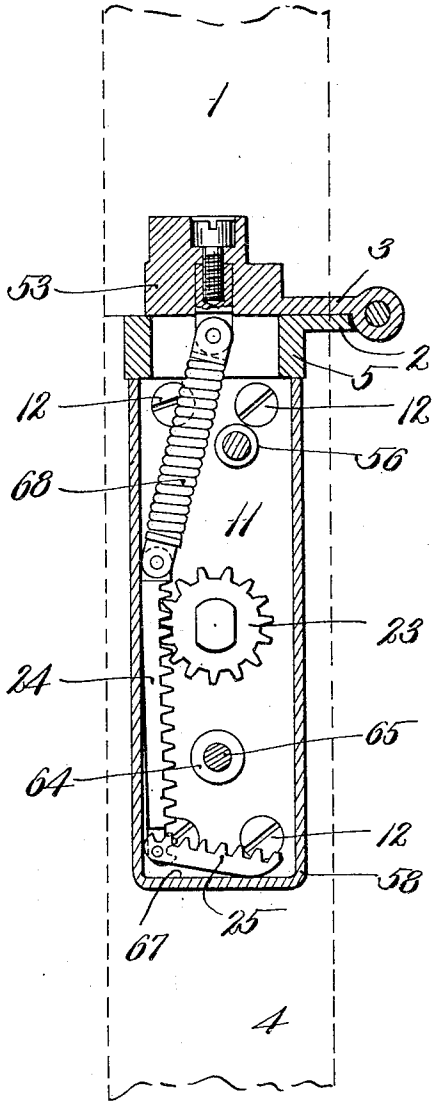

Fig. 3.

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Fig. 4.

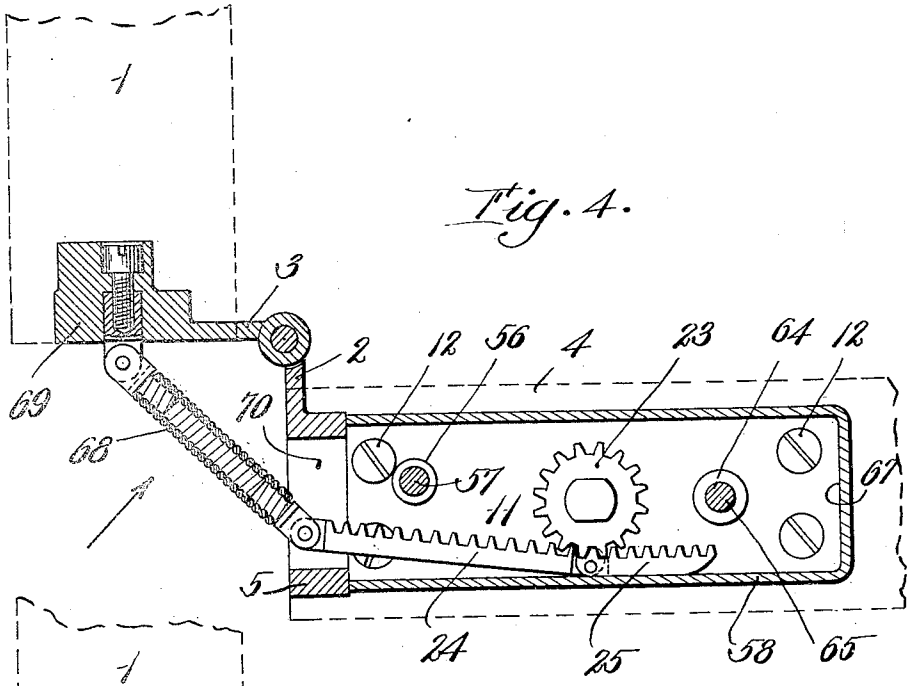

Fig. 5.

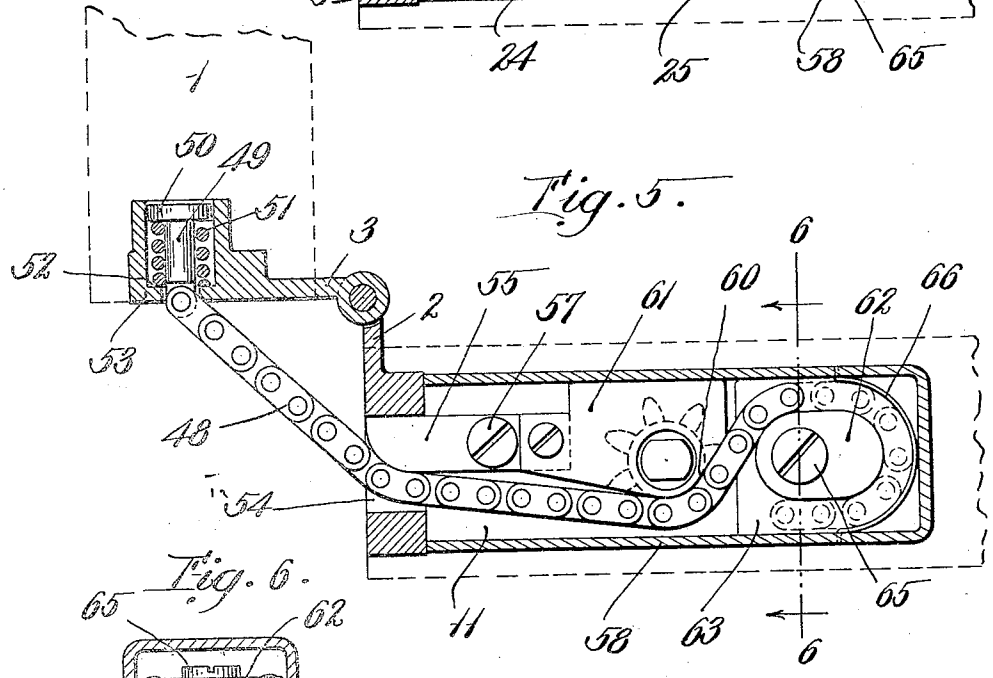

Fig. 6.

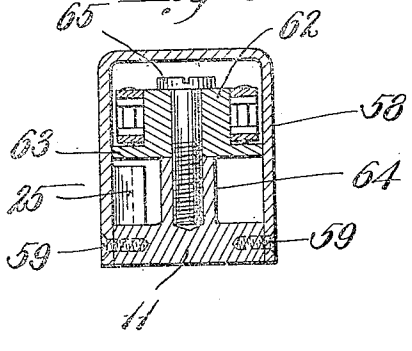

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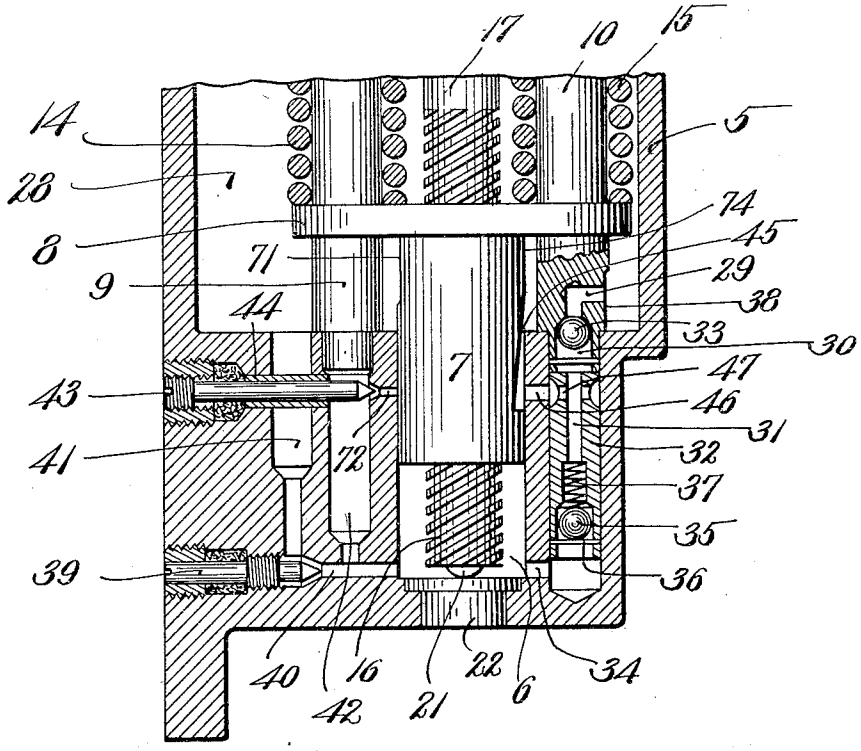
Fig. 8.



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Patented Jan. 12, 1932 1,840,558

UNITED STATES PATENT OFFICE

BENJAMIN S. BERNHARD, OF BOSTON, MASSACHUSETTS

DOOR CLOSER AND CHECK

Application filed November 30, 1927. Serial No. 236,659.

A feature of my invention consists in using a hinge and providing a direct and fixed connection between one member of the hinge and that portion of the device which is mounted on the door or other swinging member and in providing a direct and fixed connection between the other member of the hinge and that portion of the device which is mounted on the support, an important advantage of this construction being that said portions will necessarily have proper relation to each other vertically and horizontally and proper relation to the axis of the hinge.

Another feature is two rack members movable with relation to each other and preferably pivoted together to permit tilting or folding with relation to each other so that the rack teeth of both members may be available for use and yet a great saving of space may be had horizontally which is a very important factor especially in concealed door closers.

Another feature is a supporting member for the free end of the flexible element, the latter contributing to the closing of the door or other swinging member.

Another feature is a vertical guide for the free end of the flexible element.

Another feature is an automatic check valve which provides an additional checking function against external pressure.

Still another feature is a construction, preferably of the piston, which permits relatively quick closing during the first part of the closing movement and then provides relatively slow closing.

Other features will be pointed out below.

In the drawings

Figure 1 is a vertical section of a door closer and check embodying my invention and showing the door closed;

Figure 2 is an elevation of the same looking in the direction of the arrow in Figure 4;

Figure 3 is a plan, partly in section, on line 3—3 of Figure 1;

Figure 4 is a plan, partly in section, on line 3—3 of Figure 1 with the door open;

Figure 5 is a plan, partly in section, on line 5—5 of Figure 1 with the door open;

Figure 6 is a section on line 6—6 of Figure 5;

Figure 7 is an enlarged sectional detail of one of the ball valves; and

Figure 8 is a section similar to that of Figure 1 but with the piston on its downward stroke, the door being partly open.

Door 1 is hinged by hinged members 2 and 3 to support 4, the support, in the form of my invention shown, being recessed to receive casing 5 which has a checking chamber 6 within which moves piston 7, the latter having flange 8 guided by guide rods 9 and 10, which have lugs at each end, the lugs at the bottom being press fitted into the casing and the lugs at the top entering suitable openings in plate 11 which is held to the casing 5 by screws 12, gasket 13 being interposed if desired.

Springs 14 and 15 surround guide rods 9 and 10 and abut at their tops against plate 11 and at their bottoms against flange 8 and tend to force piston 7 downwardly.

The piston 7 is interiorly threaded to engage worm 16, the shaft 17 of which extends upwardly into a cylindrical bore in flange 18 of plate 11, said shaft having integral collar 19 bearing against thrust washer 20, the latter bearing against the bottom edge of flange 18. The worm member at the bottom thereof has pressed into it at its centre a hardened steel ball 21 which turns upon hardened steel disk 22, thus providing a single point bearing of very low friction and great durability. The shaft is provided at its upper end with a drain groove and a packing groove and extends upwardly through plate 11. To said shaft is connected pinion 23, which engages the two rack members 24 and 25, the shaft having a reduced portion to receive pinion 23 and sprocket 26 to be described below. The top of the shaft is accessible from the outside through opening 27 in the cover which is provided so that a suitable tool may be applied to the top of the shaft for installation purposes.

The two rack members 24 and 25 are pivoted together and member 25 is moved into engagement with the rear end of the casing and is then tilted as shown in Figure 3, this

arrangement providing a folding up of the rack so as to economize in horizontal length of the device.

Casing 5 is substantially filled with suitable fluid, such as oil, and in order to permit ready passage of fluid from chamber 28 to the space 6 I provide conduits 29 and 30 in guide rod 10, conduit 29 leading from chamber 28 to conduit 30 and the latter leading to conduit 31 in check-valve housing 32 which is set into the casing. Conduit 29 is controlled by ball valve 33 in conduit 30 from which conduit 31 leads to conduit 34, conduit 31 being controlled by ball valve 35 mounted between pin 36 and spring 37. Guide rod 10 is exteriorly flattened at 38 for permitting free passage of the liquid between it and flange 8 to the chamber 6 at the beginning of the up stroke.

When the piston is in the position of Figure 8 on the down stroke the flow of liquid from space 6 is controlled by valve 39 in its passage through conduits 40 and 41 to chamber 28. In order to prevent leakage the lower lug of guide rod 9 is a very tight fit in casing 5. In order to prevent leakage from conduit 42 past valve 43 and up through conduit 41 I provide a sleeve 44 pressed tightly into the casing 5, and further provide suitable packing to prevent leakage to the outside of the casing.

Piston 7 is flattened in tapered form at 45 to cooperate with conduit 46 in casing 5, conduit 46 cooperating with conduit 47 in housing 32 as shown in Figures 1 and 8.

Sprocket 26 is, as above explained, connected to the shaft 17 and is in engagement with chain 48, one end of which is pivoted to stud 49 having a flange 50 which forms one abutment for compression spring 51 the other abutment of which is the inwardly extending shoulder 52 of the part 53 which is embedded in the door 1 in the form shown, this part having a fixed and direct connection with hinge member 3 and being integral with member 3 in the form shown.

The chain 48 extends from stud 49 through openings 54 in the casing and runs on shoe 55 which is in the form of a block held in position with relation to plate 11 by spacing member 56 and held immovably by screw 57 which engages plate 11, shoe 55 abutting against a wall of opening 54 as appears clearly in Figure 5.

From shoe 55 the chain extends into engagement with sprocket 26 and any tendency to slip off the teeth of the sprocket would be prevented by cover 58 which is held in place by screws 59. The chain, as it moves to the right in Figure 5, is disengaged from the sprocket 26 by surface 60 of plate member 61 and then passes around boss 62 of tray 63, the latter holding the free end of the chain against vertical displacement. The tray 63 rests on boss 64 of plate 11 and is held there by screw 65, threaded into boss 64.

The chain 48 is guided around the boss of tray 63 by vertical plate 66 which has its ends sprung into holding engagement with slots in the cover 58.

Plate 61 is suitably fastened to shoe 55 and is located to abut snugly against the inside of one wall of cover 58.

The description just above given is of the movement of the chain when the door is being closed.

Rack members 24 and 25 rest on plate 11 and are kept in proper engagement with pinion 23 by the inside wall of cover 58, the free end of rack member 25 being curved to engage wall 67 of cover 58 so as to fold up member 25 as shown in Figure 3. The boss 64 is engaged by rack member 25 on the opening of the door with the result that said member is moved toward the position of Figure 4 in order to prevent locking between member 25 and pinion 23. A portion of rack member 24 and flexible member 68 pass through opening 70 in the casing 5, the latter being integral with hinge member 2.

Pivotally connected to the rack member 24 is one end of a flexible member 68 in the form of a coiled spring, the other end of said flexible member being pivoted to a lug having fixed connection with element or part 69, the latter being integral with hinge member 3.

I have described my piston and the fluid chamber as embedded in the support but they and their casing might be embedded in the door or the like.

When the door is closed no part of my device is visible from either side of the door. When the door is started in its opening movement the chain 48 moves through the opening 54 in contact with shoe 55, and the free end of the chain is guided into engagement with the sprocket 26.

During the closing movement the surface 60 of plate 61 acts to disengage the chain from sprocket 26.

The opening movement rotates sprocket 26 and shaft 17 and consequently worm 16 and thereby raises piston 7 on the guide rods and compresses springs 14 and 15 and during this raising the fluid enters chamber 6, passing through conduit 29, past ball valve 33 and then through conduits 30 and 31, past spring 37 and ball valve 35 and through conduit 34. During the opening movement the rack members 24 and 25 are moved to the left in Figure 4 by pinion 23. This movement is at substantially the same rate as that of the chain.

When the door is released by the operator the springs 14 and 15 act to force the piston down which forces fluid from chamber 6 through conduit 34 past the ball valve 35 which does not seat during normal operation, past spring 37, through conduit 31 and

then into conduit 30 forcing the ball valve 33 against its seat.

The regulation of the speed of movement of the door is controlled by adjustable valves 39 and 43.

The main control valve 39 is adjustable and controls the entire closing if adjustable valve 43 is closed, the fluid, during the closing, escaping from chamber 6 through conduit 40 past the open valve 39 and through conduit 41 back to chamber 28. If valve 43 is open, as shown, then, near the end of the closing movement the fluid, which is in conduit 42 is prevented from escape by the wall of piston 7 and may, when the flattened portion 71 of the piston comes opposite conduit 72, escape past the piston 7 into chamber 28, this being particularly useful in connection with the latching because it reduces the resistance to the springs 14 and 15 at the time of latching. If this additional force at the time of latching is not desired valve 43 may be permanently closed, such permanent closing of valve 43 having no effect of impairing the utility of the device if such additional force at latching is not desired.

During the first part of the closing movement the door swings relatively quickly because the fluid may escape through conduit 34, past ball valve 35 and spring 37 and through conduits 31, 47 and 46 and between the flattened portion 45 of piston 7 and the cylinder wall into chamber 28, this escape being gradually retarded by reason of the tapering of said flattened portion. If however, an external force, such as the wind, tends to undesirably close the door such force is transferred through member 68, rack 24 or rack 25, pinion 23 and worm 16 to piston 7, thus tending to force the piston downward and creating abnormal pressure in chamber 6, which abnormal pressure forces ball valve 35 against its seat in opposition to spring 37, thereby shutting off the free passage of the liquid and tending to stop the movement of the piston. In order to prevent too sudden stopping of the piston I provide a slight recess 73 in the seat for ball valve 35, which permits slight escape of the fluid until straight portion 74 of the piston is moved down into the cylinder, thereby providing a gradual braking function. From the above it will be clear that the shutting off of the free passage of the fluid automatically provides additional checking when such additional checking is necessary.

Among the advantages of my device I may point out that I have provided a combined hinge and door closer, the hinge having an active operating function in connection with checking as well as closing and especially in a very compact closer of the concealed type.

Another advantage is that my chain, and consequently the strain, is as close as practically possible to the hinge which resists the pull on the door caused by opening and this prevents sagging of the door and excess wear on the hinges.

What I claim is:

1. A device of the character described comprising a swinging member; a support therefor; means to close the swinging member; means to check the closing action of the closing means; and means to prevent undesired complete closing of the swinging member, said preventing means including two rack members pivoted together; and means to tilt one of said rack members with relation to the other in a direction concavely with relation to the toothed faces of the rack members.

2. A device of the character described comprising a swinging member; a supporting member therefor; means to close the swinging member including a flexible element extending into one of said members and having a free end portion; and a tray to prevent vertical displacement of said end portion, said tray having a raised portion to guide said end portion.

3. A device of the character described comprising a swinging member; a supporting member therefor; means to close the swinging member including a flexible element extending into one of said members and having a free end portion; a casing within which said free end moves; and a vertical guide within said casing for said free end, which guide has ends sprung into holding engagement with said casing.

BENJAMIN S. BERNHARD.