Oct. 23, 1928. 1,688,428

P. S. MORGAN

DOORCHECK AND CLOSER

Filed July 19. 1922 3 Sheets-Sheet 1

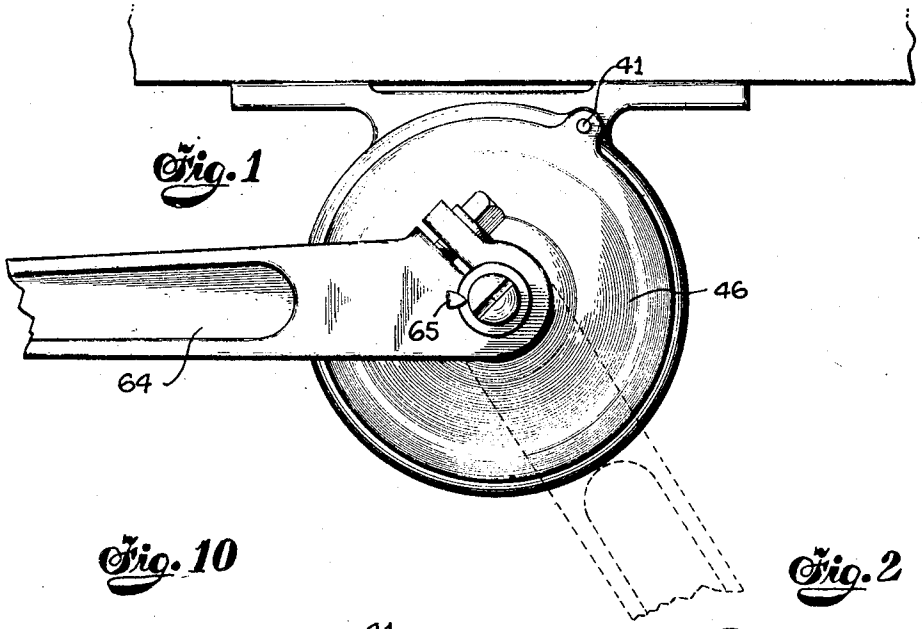


Fig. 1

Fig. 10

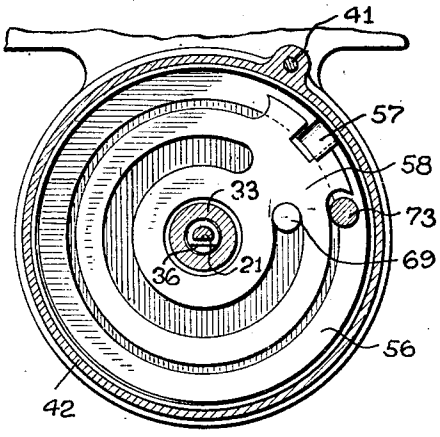
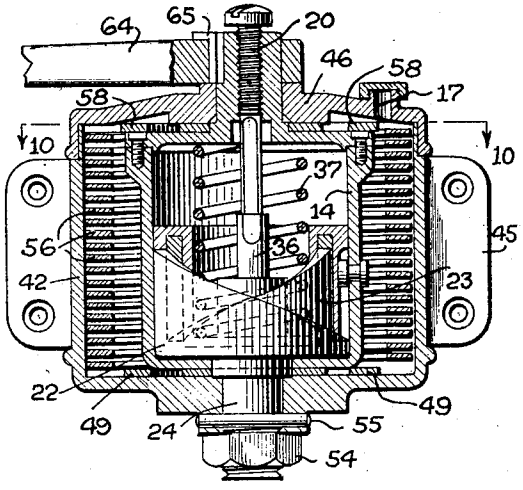


Fig. 2



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Porter S. Morgan.

By his Attorneys

Emery, Booth, Janney & Varney

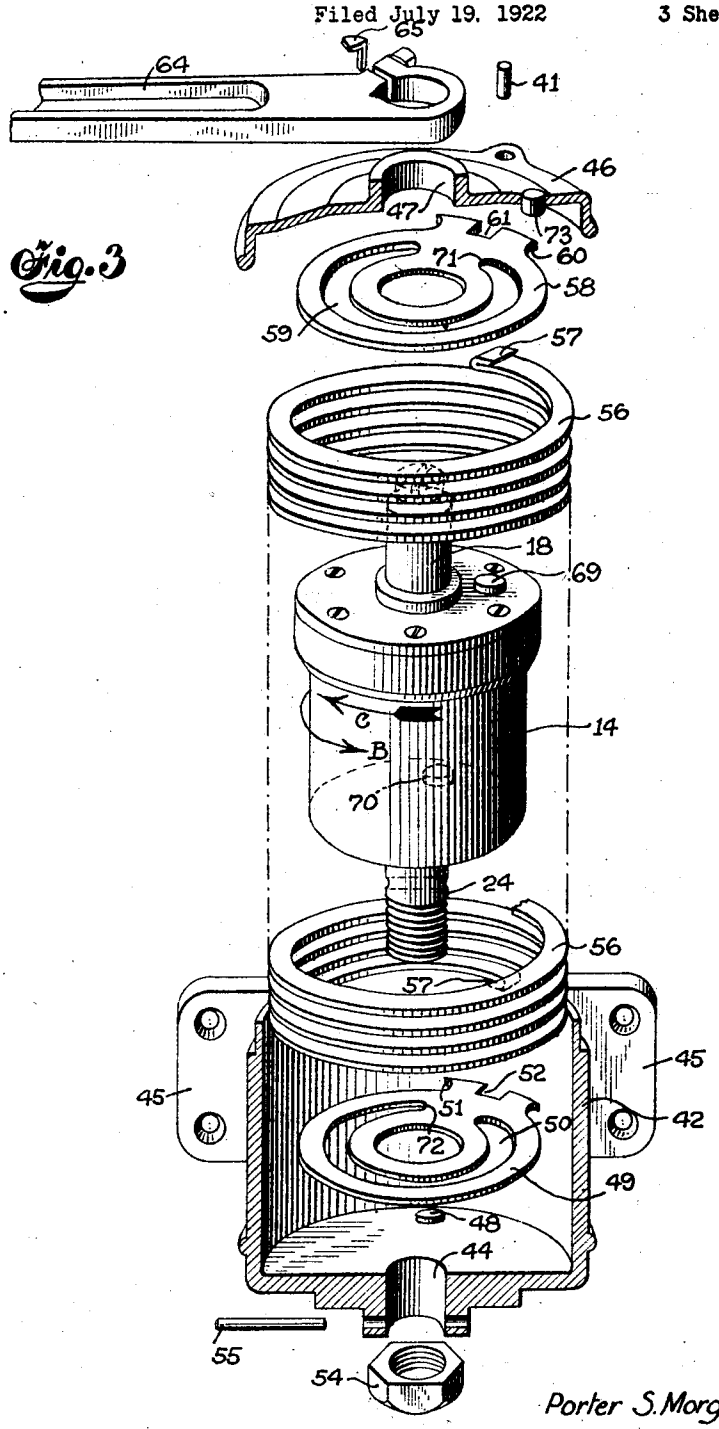
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P. S. MORGAN

DOORCHECK AND CLOSER

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Fig. 3



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DOORCHECK AND CLOSER

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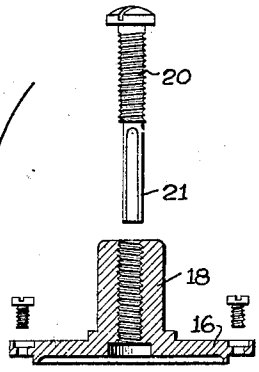


Fig. 6

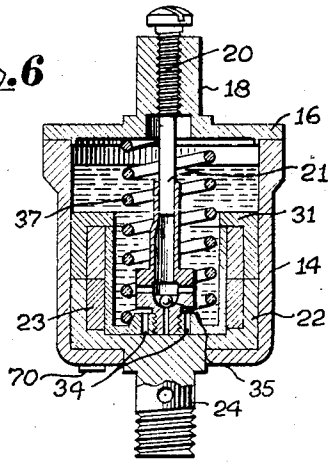


Fig. 4

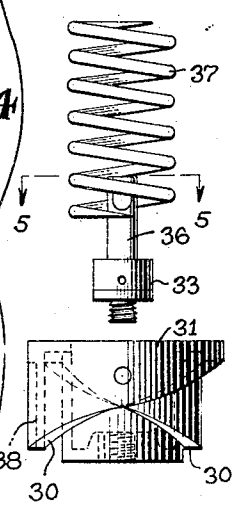


Fig. 5

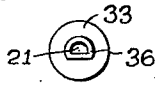


Fig. 7

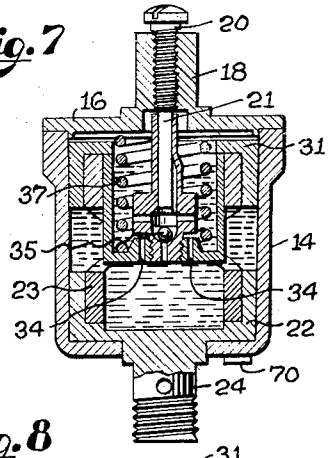


Fig. 8

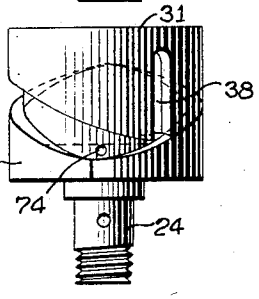
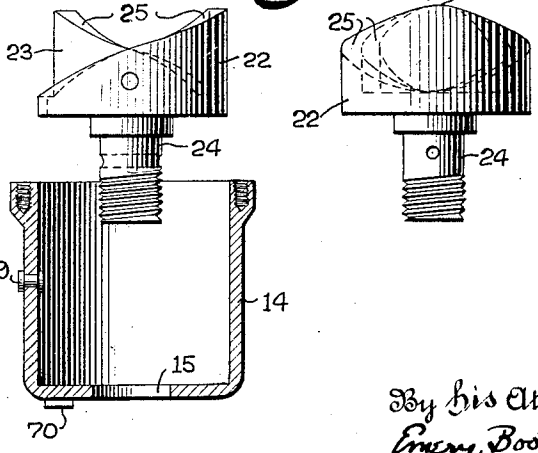


Fig. 9



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Patented Oct. 23, 1928. 1,688,428

UNITED STATES PATENT OFFICE.

PORTER S. MORGAN, OF NORWALK, CONNECTICUT, ASSIGNOR TO MORGAN BLODGETT MORGAN, INC., OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

DOOR CHECK AND CLOSER.

Application filed July 19, 1922. Serial No. 576,041.

This invention relates to improvements in door checks and closers. Among the objects of the invention are the production of a compact device, easy to manufacture and assemble, possessing the advantages of the present day devices of this class without their various disadvantages, and possessing numerous valuable features of construction and operation that have not hitherto been obtained.

The accompanying drawings illustrate one selected embodiment of the invention wherein

Figure 1 shows a top view of the illustrative door closer and check;

Figure 2 is a cross sectional view taken longitudinally through its center with the principal operative parts shown in section except the double cam 22—23, its integral shaft 24, and the pin 55 and nut 54 for fixedly attaching the cam to the casing 42.

Figure 3 is a perspective cluster view showing the parts spaced from each other but in their proper relative sequence to facilitate ready understanding of their assembly and operative relationship. Naming the more important of these parts, reading from the top downwardly: the door closing lever 64 which connects the device to the door casing; the housing cover 46; the upper spring-winding disc 58; the upper part of the door-closing spring 56 shown broken and separated from the lower part to disclose the hydraulic cylinder 14 (containing the checking mechanism) normally surrounded by the spring; the lower spring-winding disc 49; and surrounding the latter the housing 42 within which the spring, hydraulic cylinder and spring-winding discs are adapted to be concentrically housed.

At the top of the figure is shown a key 65 which locks the lever 64 to the cylinder 14 through the shaft 18 which, when the device is assembled, projects through the central aperture of the spring-winding disc 58 and through the aperture 47 in the housing cover 46. Thus the arm 64 and cylinder 14 are operatively integral. The housing cover 46 is prevented from rotation relative to the main housing 42 by the small pin 41 inserted through corresponding ears formed respectively upon the cover and the housing.

At the bottom of the figure the housing 42 is shown provided with an opening 44 wherethrough projects, when the device is assembled, the shaft 24, which also passes through an opening in the bottom of the cylinder 14 forming a bearing about which the cylinder may turn, and which is integral with stationary parts within the cylinder as will be later described. The shaft 24 is positively secured to the housing 42 by the pin 55 and the nut 54.

Figure 4 is a cluster view of the hydraulic cylinder 14 and its contents comprising the checking mechanism, the parts being separated and aligned in their respective sequence of assembly. Reading from the top downwardly these parts are: the adjusting screw 20 which threads through the shaft 18 of the cylinder cap 16, passing through the upper whorls of the light compression spring 37 into the stem 36 of the hydraulic action-adjuster 33, where its specially shaped extremity 21 is free to slide relative to the stem of the adjuster, but which, when rotated, rotates the adjuster; the double-cam-piston 31 into which the adjuster 33 is adapted to screw and which, constantly urged by the spring 37, rests and presses upon the double cam 22—23 which is locked to the outside casing 42 (see Figures 2 and 3) by its integral shaft 24 which passes through the bearing opening 15 in the bottom of the cylinder 14 permitting the cylinder 14 to be rotated relative to the cam 22—23 within it.

In the wall of the cylinder 14 is the key 39 adapted to engage the keyway 38 of the piston 31, compelling the piston to rotate as the cylinder is rotated but permitting the piston to move longitudinally within the cylinder as it rides upon the fixed cam 22—23.

When the parts are assembled the cylinder 14 concentrically houses the cam, piston, hydraulic action-adjuster, the lower portion of the adjusting screw fitting therein, and the compression spring surrounding the hydraulic action-adjuster and seating at its lower end within the central depression formed for it in the piston and at its upper end against the cylinder cap which is screwed to the upper edge of the cylinder, where leakage may be prevented by the provision of a suitable gasket.

Figure 5 is a plan view taken on the line 5—5 of Figure 4 and shows the hydraulic action-adjuster stem with the flat-sided ad-

justing screw slidably fitting therein, whereby the screw may turn the adjuster without impeding its free longitudinal movement.

Figures 6 and 7 are longitudinal sectional views through the hydraulic chamber 14 with its contained assembled checking mechanism. Figure 6 shows the position of the parts when the door is open; Figure 7 their position when the door is closed.

Figure 8 shows an assembly view of the cam and piston removed from the rotating cylinder, the piston being shown partially rotated from its lowest position upon the cam.

Figure 9 is another view of the cam projected from the cluster view in Figure 4 and turned ninety degrees from its position therein, to show more clearly the conformation of the cam surfaces.

Figure 10 is a sectional view taken on the line 10—10 of Figure 2 to show the connection between the ends of the closing spring and the hydraulic cylinder, and to show the means for holding one end of the spring against rotation while the opposite end is wound, and vice versa.

The general assembly of the device may be seen in Figure 2 and may be characterized as comprising a chamber within a chamber, the outer annular chamber containing the door-closing spring 56 capped at its ends by the winding discs 58 and 49, between which is disposed the cylinder 14, which forms the inner chamber, and wherein are assembled operative elements of the checking mechanism.

A suitable fluid, such as oil, is introduced into the outer chamber through the opening 17 and by the action of the parts (later described) is drawn into the cylinder 14 where the supply is automatically replenished from the surplus remaining in the outer or spring chamber.

Referring more particularly to Figures 4 to 9 inclusive, there is shown the rotatable hydraulic cylinder and its contained elements comprising the checking mechanism already partially described. As already stated, the double cam 22—23 within the cylinder is fixed (as best shown in Fig. 2) to the housing 42, the cylinder being free to rotate about it. This cam may be said to resemble a pair of cups, one setting within the other, the edges or sides of the cups being similarly configured to form cam surfaces, the cups being oppositely positioned one within the other so that any cam configuration of one cup is diametrically opposite to a similar and corresponding configuration of the other cup. The cam surfaces 25 are truncated at their summits as shown at 26, and recede therefrom in unvarying declivity to their lowest points.

Above and adapted to rotate upon the fixed cam 22—23 is the piston 31 which is also provided with an oppositely nested pair of cup cams positioned and shaped similarly to those of the stationary cam beneath them. The cam surfaces 30 of the piston meet and ride upon the surfaces 25 of the fixed cam 22—23, the inner cup of the piston upon the inner cup of the cam, and the outer cup of the piston upon the outer cup of the cam, in such a manner that when the cylinder 14 is rotated carrying with it in its rotary movement the piston 31, the piston rises or falls within the cylinder according to the extent and direction of the rotation and as governed by the pitch of the contiguous cam surfaces.

This double construction of the cam and piston provides two constant bearing points radially opposite each other between the cam surfaces and causes the piston to reciprocate upon evenly spaced supporting areas, without tilting and wearing the interior of the cylinder.

The piston 31 is centrally drilled and tapped to receive the threaded lower end of the hydraulic action-adjuster 33 which (see Figs. 6 and 7) has a flange extending over the upper apertures of the passages 34 through the piston 31. The hydraulic action-adjuster 33 contains a valve cage provided with a ball closure 35 to prevent liquid from flowing therethrough in a downward direction as the piston moves upwardly. When however the piston moves downwardly in the rotating cylinder 14 the ball 35 is unseated and allows the liquid to flow rapidly from the under side of the piston to the upper side through the valve cage and past the ball. When the cylinder moves upwardly the only path of escape for the compressed oil is through the passages 34 whose effective apertures may be relatively cleared or obstructed by screwing the action-adjuster 33 further into or out from the piston 31, which, as has already been explained, may be accomplished by turning the adjusting screw 20.

It will be observed that during the operation of the device all compression takes place within the upper portion of the cylinder above the piston; and all rarefaction or vacuity below the piston, thus effecting the automatic draught of fluid from the spring chamber into the lower part of the cylinder past and around the cam 22—23, its shaft 24, and the lower spring-winding disc 49, all of which parts are so fitted as to permit a gradual passage of oil.

If, consequent upon charging the device with fluid, or otherwise, undesirable air be admitted to its interior this air finds its way to the surface of the fluid into the cylinder 14 above the piston 31 and is expelled therefrom through the interstices between the screw 20 and its surrounding bore in the shaft 18, although it is found in practice that the fluid will not so escape.

Responsive and rapid operation of the piston 31 within the cylinder 14 is promoted

by providing a suitable opening through the inner cam member 23, as shown in Fig. 8 at 74, which prevents undue compression or rarefaction between the cam and the piston as the latter descends and ascends.

Referring now to Figure 3, the housing 42 carries an integral mounting plate or flange 45 by which the device may be secured to a door, and is closed at its upper end by the cover cap 46 which is locked against rotation relative to the main housing. Fixed respectively in the inner surface of the housing cover 46 and of the housing bottom 43 are the stop-pins 73 and 48, adapted to limit the rotation of the upper and lower ends of the closing-spring 56, as hereinafter described.

The two spring-winding discs 58 and 49, capping the extremities of the spring 56, are similarly constructed. Referring to the lower disc 49, it has a semi-circular slot 50 and a shoulder 51 which engages the stop-pin 48 to limit its counter-clockwise rotation and that of the spring 56, the lower end of the spring being shaped, 57, to hook into the disc in the notch 52 formed in the outer periphery thereof. Similarly, the upper end of the spring hooks into the upper winding disc 58 at its notch 61, this upper disc (like the lower one) having its semi-circular slot 59 and peripheral shoulder 60; but the upper disc is initially operative in the opposite direction to that in which the other disc is initially operative, the two discs differing in the disposition of their shoulders 51 and 60—shoulder 51 of the lower disc being to the left of the notch 52 while shoulder 60 of the upper disc is to the right of notch 61.

The discs, resting between and in contact with the cylinder ends and the housing ends, are free to rotate within their operative limits about the shafts 18 and 24. Secured upon the upper end of the cylinder 14 is a stop-pin 69, and similarly secured to the lower end of the cylinder is the stop-pin 70. These pins respectively register with and travel in the slots 59 and 50 of the two winding-discs 58 and 49 in such a manner that the pin 69 picks up and rotates the disc 58 by engaging the end of the slot 59 at the point 71 when the cylinder 14 is revolved in the direction of the arrow B, thus winding the spring 56 at the top end in a counter-clockwise direction; similarly the lower stop-pin 70 picks up and rotates the disc 49 by engagement with the end of the slot 50 at the point 72, thereby winding the lower end of the spring in the reverse direction when the cylinder is turned in the direction of the arrow C.

Under the expanding force of the tensioned spring 56 the normal position of the spring-winding disc 58 is with its peripheral shoulder 60 pressed against the stop-pin 73, while that of the lower disc 49 is with its peripheral shoulder 51 pressed against the stop-pin 48. It is therefore apparent that the lower disc 49 is prevented from initial counter-clockwise rotation by this engagement of the pin 48 with the shoulder 51; and that the upper disc 58 is similarly prevented from initial rotation in the opposite direction by the engagement of the shoulder 60 with the pin 73; but that both discs are permitted a partial rotary oscillation limited by the two stop-pins 48 and 73. Thus the spring 56 has its upper end held fast when the lower end is wound clockwise; and when the lower end has returned to its original position, it is there held fast while the upper end is wound counter-clockwise.

This construction combined with the double cam action within the cylinder 14 permits the lever arm 64 to be swung in either direction, thereby adapting this door check to both right and left-hand doors without altering or adjusting the device in any manner whatsoever.

Having described the physical construction of this one illustrative apparatus and having alluded to its operation, hereinafter follows a more complete description of the joint action between the spring means which forces the door to close and the cushioning or checking means which retards its closing movement while permitting the final closure to be effected with full closing power, yet without slamming the door.

As has been previously pointed out, when the door is shut the parts are in the position shown in Figure 7. Opening the door rotates the cylinder 14 through a partial revolution, as in the direction of the arrow B (see Fig. 3), rotating the upper disc 58 in the direction of its arrow and winding the top end of the spring 56 in the same direction. During this stage of operation the lower disc 49 is securely holding the lower end of the spring in fixed relation with the housing 42 through the engagement of the disc shoulder 51 with the stop-pin 48. Reverting to Figure 7, as the cylinder 14 rotates the piston 31 is impelled by the expansion of the spring 37 to descend from its uppermost position on the cam 22—23 towards its lowermost position, and the liquid beneath the piston flows freely upward through the ball valve to the upper portion of the cylinder without offering resistance to the descent of the piston and the manual opening of the door.

As the door is released and the wound-up closing-spring 56 exerts its driving force to rotate the cylinder 14 in the direction of the arrow C, thereby swinging the lever arm 64 which carries the door toward closed position, the piston 31 begins its ascent of the double cam 22—23, but is opposed by the consequent pressure of the liquid above the piston and which now may escape only through the passages 34 from the upper side of the piston to the chamber formed beneath it as it rises. The downward flow of the

liquid through the piston is regulated by the adjustable position of the flange of the hydraulic action-adjuster 33 as has been heretofore described, and the speed of the closing door may be governed to a nicety.

As the door nears its closed position the summits of the cam surfaces approach each other, and immediately before the door closes the cam summits of the piston 31 begin to traverse the truncated areas 26 of the cam 22—23. As long as the piston 31 rises in the cylinder the piston meets the resistance of the entrapped fluid above it, but at the instant in its rotation when it reaches the truncated surfaces 26 it ceases to rise and describes rotary motion only, thus meeting no further resistance and ceasing to force liquid through the restricted passages 34. Resistance having ceased, the closing spring 56 is no longer retarded in its action and is free to exert its full power in the final closure of the door.

Having described one specific embodiment of the invention, without limiting it thereto, I claim:

1. A door closing and checking device, comprising in combination, closing mechanism, checking mechanism operatively connected therewith to retard its closing movement and automatically to terminate its retarding action prior to the conclusion of said closing movement, said checking mechanism lying within said closing mechanism.

2. A door closing and checking device, comprising in combination, closing mechanism, checking mechanism operatively connected therewith to retard its closing movement and automatically to terminate its retarding action prior to the conclusion of said closing movement, said checking mechanism lying within the outside longitudinal dimension of said closing mechanism.

3. A closing and checking device comprising in combination, closing mechanism, and retarding mechanism including a hydraulic chamber in constant but restricted communication with the outside air whereby undesirable contained air may be forced from the interior of the device by internal pressure consequent upon its operation.

4. A fluid-moving closing and checking device comprising in combination, closing mechanism, and retarding mechanism including a piston, means for retarding its operation and means for adjusting the same including a screw extending to the outside air and so threaded in position as to permit the escape of surplus air around and past the screw.

5. A door closing and checking device comprising in combination, closing mechanism, and checking mechanism operatively connected therewith including a double cam member and a cam-following member, which members in operation maintain a double contact whereby relative stability in operation is attained.

6. A door closing and checking device comprising in combination, closing mechanism, and checking mechanism operatively connected therewith including a piston operated by a double cam which maintains two simultaneous balanced contacts with the piston in operating the same.

7. A door closing and checking device comprising in combination, closing means, and checking means operatively connected therewith and including a hydraulic cylinder, a rotatable piston movable therein and a plural cam adapted to cause movement of the piston by maintaining therewith a plurality of balanced contacts.

8. A door check and closer comprising in combination a closing spring, a turning disc anchored at each end of the spring, a rotating hydraulic cylinder having each end thereof connected to the spring, means for disconnecting one end of the cylinder from the spring when the cylinder is rotated in one direction and for similarly disconnecting the other end of the cylinder when the spring is rotated in the other direction, a door closing lever, and a housing.

9. A door check and closer comprising in combination a closing spring, a winding disc disposed at each end of the spring and anchored thereto, a rotating cylinder having each end thereof connected to the spring, hydraulic retarding means in the cylinder, means for disconnecting one end of the cylinder from the spring when the cylinder is rotated in one direction and for similarly disconnecting the other end of the cylinder when the spring is rotated in the other direction, a door closing lever arm, and a housing.

10. A door check and closer comprising a housing, a shaft journaled in the housing, a lever attached to the shaft, a spring having a loose connection established between one end thereof and the shaft, a loose connection established between the other end of the spring and the housing, means for alternately rendering each loose connection fixed when the lever is rotated in opposite directions, a retarding cylinder carried by the shaft and rotated thereby.

11. A door check and closer comprising in combination a hydraulic cylinder, a lever arm fixed to the cylinder, a spring surrounding the cylinder, and a lost motion connection established between each end of the spring and the cylinder.

12. A door check and closer comprising in combination a closing spring, a disc disposed over each end of the spring and anchored thereto, a hydraulic retarding cylinder, means on the cylinder engaging one disc to rotate said disc in one direction, stop means to limit the rotation of said disc in the opposite direc-

tion, means on the cylinder to engage and rotate the other disc, stop means to limit the rotation of the last named disc in the opposite direction, and a lever arm fixed to the cylinder.

13. A door check and closer comprising in combination a casing, a hydraulic cylinder, a lever arm carried on the cylinder, a spring having lost motion connection established between it and the cylinder, and connecting means established between the spring and the casing.

14. In a door checking device and the like, the combination of a revolving cylinder containing liquid, a cam edged piston therein adapted to rotate therewith, and an opposed cam adapted to contact with said piston and anchored so that a rotation of the cylinder reciprocates the piston.

15. A door check and closer comprising a housing, a cylinder rotatable therein, a lever arm to revolve the cylinder, a cam anchored to the housing and confined within the cylinder, a cam edged piston contacting with the fixed cam, and a sliding connection established between the cylinder and piston to actuate the piston through a reciprocating movement.

16. A door check and closer comprising in combination a housing, a cylinder rotatable therein, a lever arm to rotate the cylinder, a cam fixed to the housing and confined within the cylinder, a cam edged piston contacting with the fixed cam, a sliding connection established between the cylinder and piston to actuate the piston through a reciprocating movement, and a restricted passage through the piston for the controlled movement of liquid therethrough to govern the action of the piston.

17. A door check and closer comprising in combination a housing, a cylinder therein, a lever arm to turn the cylinder, a spring to return the cylinder to normal position, a cam fixed against rotation in the cylinder, a piston confined in the cylinder, and means disposed between the cam and piston to impart longitudinal movement to the piston.

18. A door check and closer comprising in combination a housing, a cylinder in the housing, a lever arm to revolve the cylinder in one direction, a spring to revolve the cylinder in the other direction, a double edged cam fixed to the housing and in the cylinder and having opposed inclined faces of equal pitch, a double edged cam piston having opposed inclined faces of equal pitch engaging the aforesaid cam, and a spring acting on the piston to seat it against the cam.

19. A door check and closer comprising in combination a housing, a cylinder therein, a lever arm to rotate the cylinder, a spring connected to the cylinder to rotate it back to normal position, a double cam comprising a pair of telescoping parts, a piston comprising a pair of telescoping parts and engaging the cam, said piston and cam parts being arranged in opposed balanced relation.

20. A door check and closer comprising in combination a housing, a cylinder therein rotatably arranged, a lever arm fixed to the cylinder, a driving means to actuate the cylinder and swing the lever arm, a retarding means in the cyilnder, and an unretarded high speed means for imparting fast motion to the lever arm near the end of its stroke.

21. A door check and closer comprising in combination a housing, a cylinder rotatable therein and containing liquid, a lever arm to turn the cylinder to open door position, a spring to return the cylinder to closed door position, a piston working in the cylinder pumping the liquid to retard the spring closing action through a portion of the closing distance, and means cooperating with the piston to discontinue the liquid pumping to allow the spring to work unretarded for the remaining closing distance.

22. A door check and closer comprising a combination a housing, a cylinder rotatable therein and containing liquid, a lever arm to turn the cylinder to open door position, a spring to return the cylinder to closed door position, a cam in the cylinder, a cam edged piston engaging the cam and adapted to reciprocate and pump the liquid to retard the spring throughout a portion of the closing distance, and flat surfaces on the cams to arrest the longitudinal movement of the piston prior to the end of the closing action to permit powerful closing force.

23. A door closer and check comprising in combination a rotating cylinder, a spring fixed thereto, a lever arm fixed to the cylinder, a cam surfaced piston therein rotatably fixed, an opposed cam adapted to engage said piston and anchored so that a rotation of the cylinder reciprocates the piston, a liquid passage through the piston, a rotatable flange member threaded to the piston over the passage to vary the opening thereof and an adjusting screw having sliding connection with the flange member.

24. A door check and closer comprising in combination a housing, a revolving liquid-containing cylinder in the housing, a lever arm fixed to the cylinder, a spring connected to the cylinder, a cam confined in and fixed with respect to the cylinder which rotates around the cam, and a piston adapted to reciprocate in the cylinder against the fixed cam to pump liquid.

25. A door closing and checking device comprising in combination, closing means operative in both directions, and checking means associated therewith comprising a double cup cam having one of its members set within the other in such a position that its operative cam surfaces are disposed symmetrically opposite to those of the other and a piston member provided with cam-following

means to contact with and be actuated by said cam.

26. A door closing and checking device comprising in combination a casing, closing mechanism, and checking mechanism operatively connected therewith comprising a double cam having one of its members so set within the other that its operative surface is disposed symmetrically opposite to that of the other and a piston member provided with cam-following means to contact with said cam, said checking mechanism being centrally disposed as to and surrounded by said closing mechanism.

27. A door check and closer comprising in combination a spring, two winding members respectively anchored to the opposite ends thereof, a door-closing lever having connection with one of said winding members, and retarding means disposed within said spring, and comprising a double cam, having one of its members so set within the other that its operative surface is disposed symmetrically opposite to that of the other and a piston member operated by its contact with said cam.

28. A door check and closer comprising in combination a double-acting door-closing spring, winding members anchored to the ends thereof, means for connecting a door to said spring and winding members, and door-retarding means associated therewith comprising a double cam and a piston member adapted to be operated by contact with said cam.

In testimony whereof, I have signed my name to this specification this 7th day of July, 1922.

PORTER S. MORGAN.