Aug. 9, 1932. E. BOMMER 1,871,030

DOORCHECK AND CLOSER

Filed Jan. 11, 1932

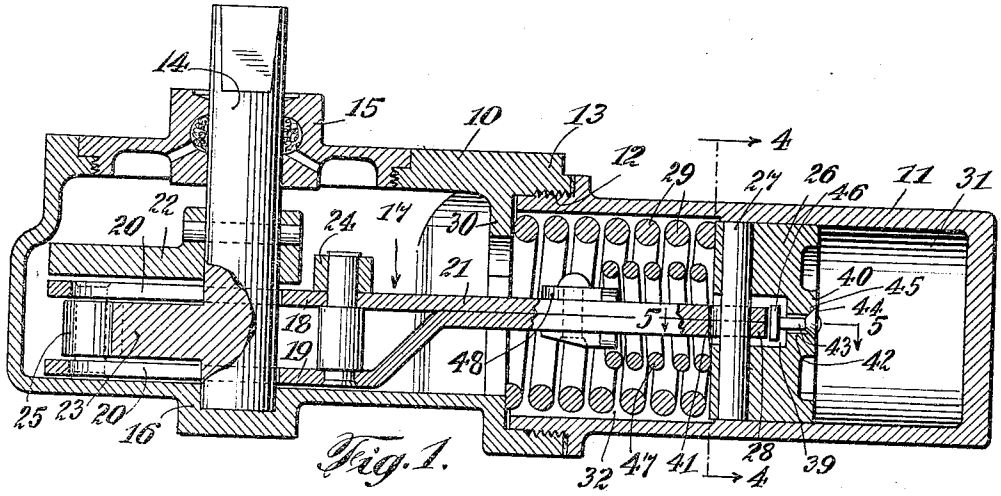


Fig. 1.

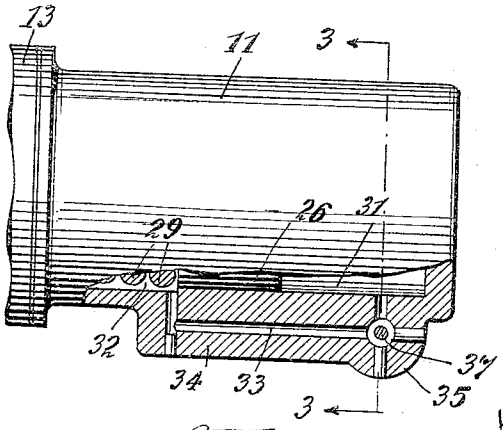


Fig. 2.

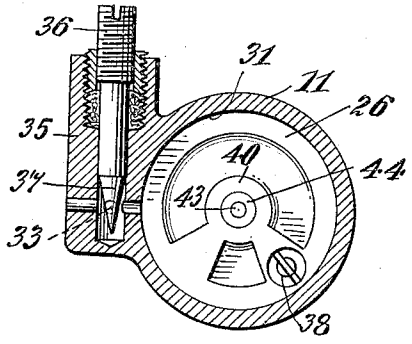


Fig. 3.

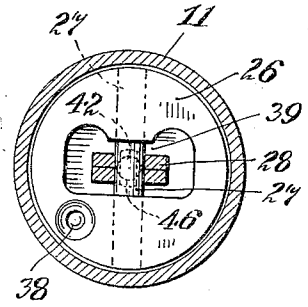


Fig. 4.

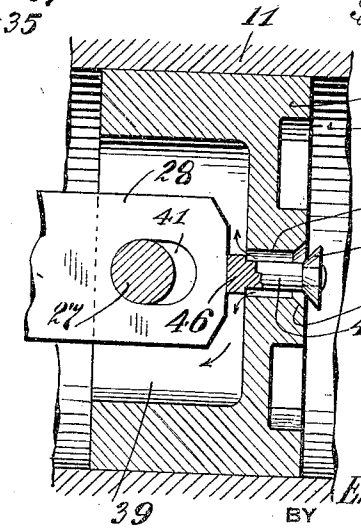


Fig. 5.

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UNITED STATES PATENT OFFICE

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DOORCHECK AND CLOSER

Application filed January 11, 1932. Serial No. 585,831.

My present invention relates to door checks and closers, the invention being more particularly related to a piston carried device for relieving the fluid pressure or resistance to the closing movement of the door.

The invention is usefully employed, for example, in connection with a door check and closer of the general construction illustrated in the accompanying drawing, although it will be recognized that other modes of applying the principle of the invention may be employed instead of the particular construction in connection with which the invention is herein illustrated and explained.

In automatically acting door-closing and checking mechanisms, it is well-known that during the closing movement of the door the force of the door-closing spring is opposed by checking medium consisting of oil or air which is forced through a restricted passageway controlled by a suitable regulating valve, and that during the opening movement of the door a freely openable one-way valve is provided for the relief of the checking medium against the door-opening movement of the piston as the door-closing spring is tensioned. The arrangement provides for a gradual relatively slow closing movement of the door and for a relatively quick opening movement thereof.

Frequently and without any necessity for such action, the attempt is made to hasten the automatic closing movement of the door by thrusting or forcing it, and occasionally there will arise a real necessity for closing the door quickly and much more rapidly than is permitted by the normal relief provided for the checking medium. Quick closing thrusts and forced closings subject the mechanisms of the door check and closer to severe strains and shocks, and the parts of the mechanisms are sometimes disarranged, damaged and broken.

The purpose and object of the present invention are to provide simple, practical and efficient means whereby to permit quick closing of the door and to attain this end without subjecting the mechanisms and parts of the door closer and check to undue strain, likelihood of damage and breakage. A further object in this connection is to attain these results without in any way interfering with the normal functioning of the mechanisms either in the opening or closing movements of the door.

More particularly, the invention consists in the provision of a yieldable connection between the piston and its connecting bar, and in the provision of a yieldable relief device in the piston arranged in such manner that when the piston yields under abnormal strain due to forced closing of the door, the relief device will be positively operated by the connecting bar to open a port for the relief of the fluid pressure in the chamber at the front side of the piston. The port commanded by the relief device is arranged to provide an outlet leading directly from the chamber at the front side of the piston to the chamber at the rear side thereof. Under my improvement, whenever the closing of the door is sharply hastened, that is to say, whenever there is exerted upon the door a closing force in excess of the normal closing force of the expansion spring means, the relief device is positively operated for instantly relieving the pressure fluid which can flow by the shortest path from the front side of the piston to the rear side thereof.

Another object of the invention is to provide a novel relief device of the character described, which will be simple in construction and economical in manufacture, while possessing the advantages of being sturdy and positive and providing for compactness.

With the foregoing and other objects in view, the invention consists in the construction and relative arrangement of parts so combined as to coact and cooperate with each other in the performance of the functions and the accomplishment of the results herein contemplated, and comprises in its evolvement the simple and practical example illustrated in the accompanying drawing, wherein similar reference characters designate corresponding parts throughout the several views, and in which:

Figure 1 represents a longitudinal sectional view through a door check and closer embody-

ing the pressure relief device of the present invention;

Fig. 2 is a top plan view of a fragmentary portion of the casing, partly broken away and in section, showing the restricted passageway for the pressure fluid;

Fig. 3 is a cross section taken on the line 3—3 of Fig. 2, showing the valve commanding the restricted passageway;

Fig. 4 is a cross section taken on the line 4—4 of Fig. 1; and

Fig. 5 is an enlarged horizontal sectional view, taken on the line 5—5 of Fig. 1, and showing the piston and associated parts in the relative positions which they occupy when the relief valve is opened for the relief of the pressure fluid.

The door closer and check selected for disclosing the purpose, utility and advantages of the present invention is of the type which is placed in a recess or cavity in the floor and which includes a vertical hinge pintle for the swinging support of the door. The illustrated type is capable of use with a single-action door, a double-action door, a right-hand door, and a left-hand door.

By referring to the drawing, it will be seen that the selected door closer and check comprises a fluid-tight casing consisting of a rear part 10 of a form suitable for accommodating the cam mechanism associated with the vertical pintle, and a front cylindrical part 11 adapted to accommodate the piston and door-closing spring means. The cylindrical part 11 is screw-threaded at 12 to an annular flange 13 provided on the rear part 10.

14 designates the vertical door-supporting pintle which is mounted for rotation in suitable upper and lower bearings 15 and 16 provided in the rear casing part 10. Arranged to reciprocate rearwardly and forwardly upon the vertical pintle is a yoke-like connecter frame designated generally by the reference character 17 and consisting of spaced upper and lower plates 18 and 19 in which are provided similar lengthwise extending slots 20 for the accommodation of the vertical pintle. At their front ends the upper and lower plates 18 and 19 are shaped and united to form a connecting bar 21 which extends well into the cylindrical part 11 and axially thereof. Fixed to the vertical pintle 14 to rotate therewith are cam devices 22 and 23 which act on suitable rollers provided on the connecter frame, there being a roller 24 operatively mounted over the plate 18 for cooperating with the cam 22, while suitable rollers 25 are operatively mounted between the plates 18 and 19 at the rear thereof for cooperating with the cam 23. This pintle and cam mechanism is such that the pintle may be rotated either clockwise or counterclockwise through a full circle of 360°, thereby accommodating the mechanism for use in connection with either single-acting doors, double-acting doors, left-hand doors or right-hand doors. This pintle and cam mechanism is more fully illustrated and described in my copending application, Serial No. 444,971, filed April 17, 1930, and also in my copending application Serial No. 585,832 filed Jan. 11, 1932, the last-mentioned application being a division of the application first mentioned.

Slidably fitting within the cylindrical part 11 is a piston 26 which is connected by a coupling pin 27 with the front end or terminal 28 of the connecting rod 21. A suitable helical door-closing spring 29 is imprisoned between the rear face of the piston 26 and an annular flange or abutment 30 provided inside the casing part 10 for such purpose. The chamber 31 in front of the piston 26 is in communication with the chamber 32 at the rear thereof through a restricted by-pass or passageway 33 which is provided in a thickened wall portion 34 of the cylindrical part. Formed in connection with the thickened wall portion 34 is a vertical cylindrical extension 35 which contains a vertically disposed regulating valve 36. By means of this valve, which is threadedly engaged for adjustment and whose lower end portion 37 is designed to operate in the restricted passageway 33, the amount of liquid moving under pressure from the chamber 31 to the chamber 32 can be readily regulated from the exterior of the casing.

The operation of a door check and closer of this type is well known. During the opening movement of the door, when the piston is drawn rearwardly and the spring 29 compressed, one or more ball valves 38 provided eccentrically in the piston are automatically opened by the fluid pressure in the chamber 32 so that the fluid can freely escape from the chamber 32 into the chamber 31. When the opened door has been released, it is automatically closed by the force of the door-closing spring 29, the forward movement of the piston being opposed by the checking medium contained in the chamber 31 which is gradually forced through the restricted passageway 33 to the chamber at the rear of the piston. This arrangement, as is well known, provides for a gradual relatively slow closing movement of the door, and whenever the attempt is made to close the door more rapidly than is permitted by the normal relief of the checking medium through the restricted passageway 33, severe strains result which are likely to injure and damage the parts of the mechanism and as well to impair the hinge connections of the door.

In carrying out my invention for providing instant and adequate relief for the checking medium in the event it is attempted to close the door too rapidly, the piston is provided with a cavity 39 which extends in-

wardly thereinto from the rear face thereof so as to leave a relatively thin head portion 40 between the front chamber 31 and the said cavity 39. The front terminal 28 of the connecting rod extends well into this cavity and the coupling pin 27 by which the piston is connected with the connecting bar, extends through a lost-motion slot 41 in the terminal of the connecting bar, as best shown in Fig. 5. By reason of the provision of the cavity 39 and of the lost-motion slot 41, the piston 26 is movable relatively and longitudinally of the connecting bar. At the axial center of the piston there is provided in the head 40 a port 42 which provides direct communication between the front chamber 31 and the cavity 39 which is in open communication with the rear chamber 32. Mounted for relative movement in the port 42 is a relief device comprising a stem 43 at the front end of which is formed a conical valve 44 adapted to fit in a correspondingly shaped seat 45 provided in the front face of the piston around the port 42. At its rear end, the stem 43 is provided with a contact piece 46 shaped to engage the opposing terminal 28 of the connecting bar. This relief device is carried by the piston and is movable relatively thereto, so that when the piston is forced rearwardly with respect to the connecting bar, owing to the provision of the lost-motion slot 41, the contact piece 46 will engage the terminal 28 of the bar with the result that when the piston has moved rearwardly to the full extent permitted by the slot 41, the valve 44 will be displaced from its seat, thereby opening direct communication between the front chamber 31 and the cavity 39, as clearly shown in Fig. 5. It will be evident that the fluid pressure in the chamber 31 will at all times keep the relief device in that position in which the valve 44 is closed against its seat 45, except when through the relative rearward movement of the piston the contact piece 46 of the relief device has been engaged with the connecting bar terminal 28, in which operation the piston moves along the relief device to the full extent permitted by the lost-motion slot 41. It will also be evident that the rearward movement of the piston will be effected by an accumulation of excessive fluid pressure in the chamber 31.

Compared with the extent of the stroke of the connecting bar, the lost-motion movement of the piston is very little and in order to insure that the relief device will close the relief port at all times during the existence of normal pressure in the chamber 31, I provide an auxiliary compression spring 47 which is coiled about the connecting bar inside the compass of the door-closing spring 29, which auxiliary spring is imprisoned between the rear face of the piston 26 and an abutment or stop 48 secured to the connecting bar. This auxiliary spring serves as an effectual means for positively maintaining the piston in the position in which the relief port is positively closed by the relief device and will remain closed until the closing force exerted on the door exceeds the force of the door-closing spring and the resistance of the auxiliary spring when the excessive pressure in the chamber will cause relative yielding of the piston and consequent opening of the relief port because of the engagement of the contact piece 46 with the terminal of the connecting rod. When the relief device is unseated, instant and adequate relief for the excessive pressure is provided, since an increased area is opened for the escape of the fluid under pressure and since the parts are arranged so that the port constitutes an extremely short relief path for the escape of fluid pressure from the front side of the piston. Every time, therefore, the attempt is made to close the door more rapidly than is permitted by the normal relief provided for the fluid pressure, the piston will yield relatively with respect to the connecting bar for instantly opening the relief port to relieve the accumulation of excessive pressure. With the device of the present invention, therefore, a forced closing of the door may be had; and such forced closing whether effected by successive thrusts or by constantly accelerated closing movement, will not result in any injurious strains to the mechanisms and parts of the door check and closer.

It will be obvious that the relief port of my present invention is capable of embodiment in many different types of door checks and closers, or environments, in which it may desirable to instantly and adequately relieve an accumulation of excessive pressure.

While the invention has been illustrated and described in considerable detail, it is realized that in practice various changes and alterations may be made therein, and further that the invention is capable of embodiment in many different constructions. It has been sought herein to illustrate only such an embodiment as will suffice to exhibit the character of the invention. Reservation is, therefore, made to the right and privilege of changing the form of the details of construction or otherwise altering the arrangement of the parts without departing from the spirit or scope of the invention or the scope of the appended claims.

I claim:

1. In a door check and closer, a cylinder, a piston and connecting bar therein, connected by a pin received in a lost-motion slot to permit relative movement of the piston with respect to the bar, and a normally closed relief device for fluid pressure, slidably disposed in the piston in position to be engaged by the end of said bar and to be opened there-

by upon the relative movement of the piston with respect to the bar.

2. In a door check and closer, a cylinder, a piston and connecting bar therein, connected to permit relative movement of the piston with respect to the bar, a normally closed relief device for fluid pressure, disposed on the piston in position to be engaged and opened by the bar upon the relative movement of the piston with respect thereto, and resilient means yieldable under an accumulation of excessive fluid pressure resisting the relative movement of the piston.

3. In a door check and closer, the combination of a cylinder, a spring-urged piston, a connecting bar connected to the piston to permit relative movement of the piston with respect to the bar, resilient means between the bar and piston resisting relative movement of the piston, a relief valve loosely disposed in the piston and normally closed by the pressure of checking fluid, said valve being positioned to be engaged and opened by the bar upon the relative movement of the piston, and said resilient means being yieldable to an accumulation of excessive fluid pressure against the piston to allow relative movement of the piston under such pressure and hence the opening of the relief valve.

4. In a door check and closer, the combination with a cylinder, a connecting member and piston adapted to move against the pressure of checking fluid in the cylinder a lost-motion connection between the connecting member and piston to allow relative movement of the latter with respect to the former, a movable relief valve carried by the piston normally closing a port therein in response to the pressure of checking fluid, said valve being adapted, on the relative movement of the piston, to be engaged by the connecting member and forced open thereby, and means for resisting relative movement of the piston until the pressure of the checking fluid rises to an excessive degree.

5. In a door check and closer, the combination with a piston provided with a head for moving in opposition to checking fluid, of an operating member for the piston connected thereto by a lost-motion connection and having a terminal portion adjacent said head, a freely movable valve normally closing a relief port in said head and constructed for engagement with said terminal portion, the piston by reason of its lost-motion connection being adapted to move relatively with respect to said member and in a direction to cause the engagement of said valve with said terminal portion, whereby automatically to unseat said valve and thereby open said port for the relief of the checking fluid.

6. In a door check and closer, a cylinder, a piston therein having a head with a port, a connecting bar having a contact end adjacent said port, means connecting said bar with said piston including a lost-motion slot in one of the parts and a pin in the other part engaging the slot, a freely movable relief device normally seated in the port and constructed for engaging the contact end of said bar, the pin and slot connection between the bar and piston permitting movement of the piston relatively with respect to the bar and providing for the engagement of the relief device with said contact end whereby automatically to unseat the relief device and thus open the port.

7. In combination with a piston and a connecting bar to one end of which the piston is attached for relative movement with respect to the bar and longitudinally thereof, a seat in the opposite side of the piston and a port leading from the same to a point adjacent said bar, a valve displaceably fitting said seat and having stem extending through said port for engaging with said bar, the relative longitudinal movement of the piston with respect to the bar providing for the engagement of the valve stem with the bar whereby to displace the valve from its seat.

In testimony that I claim the foregoing as my invention, I have signed my name hereto.

EMIL BOMMER.