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DOOR CHECK, IN PARTICULAR FLOOR-TYPE DOOR CHECK

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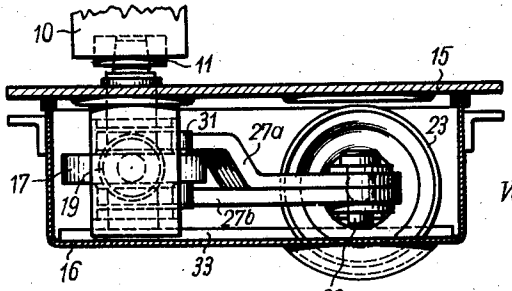
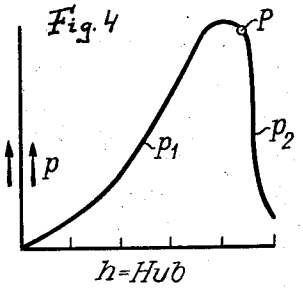


Fig. 3



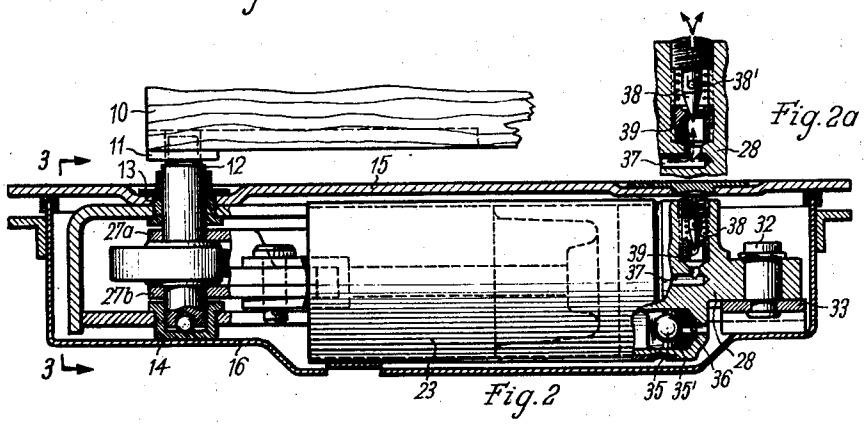


Fig. 2

Fig. 2a

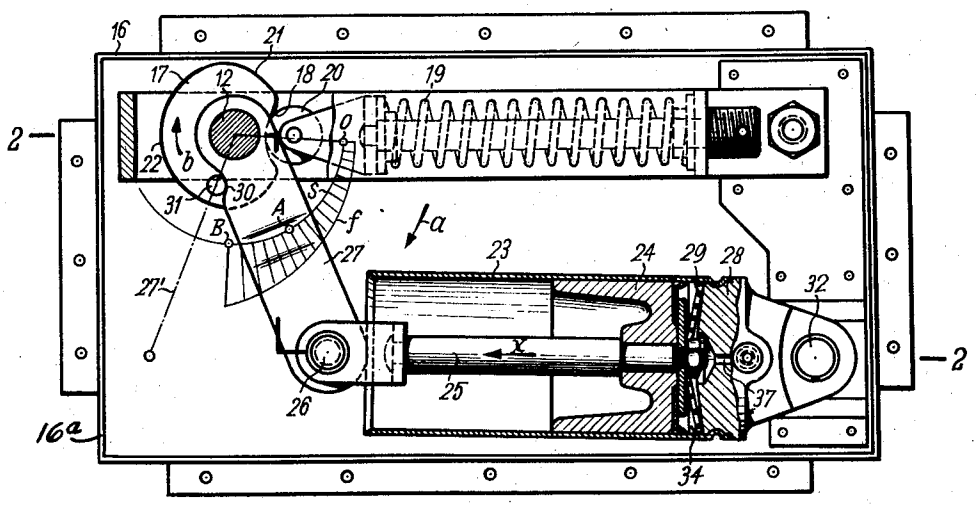


Fig. 1

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DOOR CHECK, IN PARTICULAR FLOOR-TYPE DOOR CHECK

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9 Claims. (Cl. 16—66)

This invention relates to a door check and more particularly to a floor-type door check adapted to shut an open door without slamming, the checking being preferably effected by a hydraulic or pneumatic medium under employment of a piston sliding in a cylinder in conjunction with one or more throttling bores which are in communication with the cylinder.

One important object of the present invention is to provide a door check including novel means so designed as to provide improved control of the checking action.

A further object of the present invention is to provide a door check in which the checking is effected by simplest possible means.

An important feature of the present invention therefore consists in a door check construction wherein a constant cross-sectional throttling area of such magnitude is provided for the pneumatic medium enclosed in the cylinder and passing to the outside that the closing motion of the door is opposed at first by a growing pneumatic resistance up to a maximum and thereupon by a relatively fast decreasing resistance.

Experience has proved that in using a pneumatic medium, a constant, continuously open throttling bore suffices already for effecting the damping action hitherto aimed at in a relatively complex manner and changing with the stroke. This is possible especially then when the door, in course of closing, has already reached a certain higher velocity at the moment of the beginning of the checking action.

Owing to the force acting in a closing direction, hence specifically due to the motional energy inherent in the door, a considerable acceleration of the checking piston can be obtained and thereby a relatively high compression of the enclosed, not fast enough escaping air, the air pressure within the cylinder being considerably increased at the same time. This increase in air pressure in turn causes, however, a checking of the door until a state of equilibrium between the velocity of the piston and the escaping air sets in gradually so that finally the volume of the escaping air is greater than the decrease in cylinder volume effected by the piston movement, whereby fast enclosing is effected.

According to another feature of the present invention it is suitable for the end in view that the checking piston be coupled with the door only during a portion of the door movement. Coupling between the piston and door being advantageously by non-positive means, for example, by a spring acting upon the piston and arranged within the cylinder, preferably such that the piston follows the door practically unopposed up to a certain opening stroke and is then retained by a suitable stop. The cam effecting the return movement of the door being advantageously formed in such a manner that it takes a rising course with reversing action only through a portion of the door movement, for example, through 90 degrees from the closed position thereof, but beyond that a constant course without reversing action, whilst the checking action is effective only through a first portion of the

rising course without reversing action, for example, through approximately 45 degrees.

Other objects and features of the present invention will become apparent from the following description taken in connection with the accompanying drawing which illustrates one embodiment of the invention. In the drawing:

Fig. 1 is a top plan view of the door check constructed in accordance with the present invention and showing the checking cylinder in section,

Fig. 2 is a vertical sectional view taken on line 2—2 of Fig. 1, an enlarged portion thereof being shown in Fig. 2*a*,

Fig. 3 is a sectional view taken on line 3—3 of Fig. 2, and

Fig. 4 is a checking pressure diagram.

In the drawing the numeral **10** indicates a door which is mounted by means of a fitting **11** on the door pivot **12** which simultaneously serves as the door check pivot. The latter is turnably mounted by means of bearings **13**, **14** in the door check housing comprising a top or floor plate **15** and a sheet-metal case **16**. The door check pivot **12** has an edge cam **17** preferably formed integral therewith. The cam **17** is in known manner provided with a circular notch **18** and in the closed position of the door a suitably guided cam roller **20** is urged by the action of a closing spring **19** into engagement therewith to thereby hold the door in closed position.

On either side of the notch **18** the edge cam **17** has helically curved rising portions **21** each of which extends on a perimeter of 90 degrees and then flares into a circular cam portion **22**. Above the cam is plotted in a polar diagram the effective spring pressure *f* of the closing spring **19** dependent on the angular motion *s* of the door, which increases from the point O in the rest position through A towards B and remains constant beyond the point B.

For checking the door motion there is provided a piston **24** slidingly arranged in a cylinder **23**, said piston being by means of a pitson rod **25** and a joint **26** pivotally connected to a lever **27** which, as is clearly shown in Fig. 3, comprises a bent bar **27***a* and a flat bar **27***b* turnably mounted on the door pivot **12**.

Seated within the cylinder **23** on the closure member **28** thereof is a spring **29** which urges the piston in direction *x* so that the curved notch **30** of the lever **27** engages the pin **31** arranged on the cam **17**. Spring **29** is a spiral spring wound with decreasing diameter and abutting with its largest diameter against member **28** and with its smallest diameter against piston **24**. When spring **29** is compressed, as shown in Fig. 1, the narrower turns thereof are located within the wider turns. The entire cylinder **23** with its closure member **28** is turnably mounted on a vertical fulcrum pin **32** which is rigidly secured on the housing **15**, **16** or on a reinforcement plate **33** attached thereto so that the cylinder with the piston may freely follow the turning motion of the lever **27**.

The checking space **34** formed between the closure member **28** and the piston **24** is, on the one hand, through a passage **36** controlled by a check valve **35** with a valve seat **35'** of rubber or other elastic or plastic material in communication with the open air, and on the other hand, through a bore **37** in communication with a throttle valve **38**. The threaded throttle valve **38**, which may be surrounded by a coil spring, serves for restricting the cross-sectional area of a narrow throttling opening **39** in that it is screwed in or out as occasion may require. In addition, the valve stem **38** has a bore **38'** extending both longitudinally and transversely therethrough for permitting the air passing through the space above the opening **39** to escape to the open air.

In the position shown in the drawing the door is in its closed position, the cam roller 20 is in engagement with the notch 18 and the piston 24 is in its extreme innermost position. Now, when the door is opened in the direction *a* and with it the cam 17 turned in the direction of arrow *b*, the closing spring 19 is then tensioned in conformity with the spring characteristic *f* by the movement of the cam roller 20 on the rising cam portion 21. Simultaneously therewith the checking piston 24 is moved to the left by the action of the spring 29 and non-positive engagement of the lever 27 with the stop pin 31 is effected. In this connection it is to be noted that this piston movement comes off practically unopposed, as by opening the check valve 35 the air can enter fast enough through the bore 36 into the cylinder space 34.

After a certain opening movement of the door, for example, after 45–60 degrees approximately at the point A of the curve *s*, the lever 27 is stopped in the position 27' by the wall 16*a* of the door check housing 16 or by another suitable stop, whereby the shifting motion of the checking piston 24 is ended. Disengagement of the pin 31 from the lever 27 is consequently effected on further movement of the door. After a movement of approximately 90 degrees, for example, at the point B of the curve *s*, the cam roller 20 reaches the circular cam portion 22 so that the further movement of the door can take place without resistance.

When the door is closed, the closing spring 19 becomes effective again at the point B, i.e. at the same moment in which the cam roller 20 passes to one of the cam portions 21 so that the spring 19 is extended and exerts a closing moment on the door in a direction opposite to that indicated by the arrow *b*. The door is accelerated so that at the point A it has a certain, relatively high velocity.

At this moment the pin 31 engages the notch 30 of the lever 27 and seeks thereby to shift the piston 24, which is in its left-hand end position, to the right.

In Fig. 4 the pressure *p* in dependence on the stroke *h* of the piston is diagrammatically depicted. Owing to the momentum of the door and by the action of the closing spring 19 high acceleration of the piston 24 is effected, the pressure in the cylinder space 34 rising at the same time almost adiabatically high in conformity with the curve p_1. Thereby is increased the resistance against the movement of the door as the check valve 35 has been closed by the pressure and the air enclosed in the cylinder space can escape only through the restricted opening 39 to the outside. The resistance increasing with the pressure retards the piston 24 almost to a standstill which is reached approximately at the point P (Fig. 4). Owing to the checking of the piston a further compression of the air cannot be effected and owing to the increased pressure a corresponding volume of air can escape through the restricted opening 39 to the open air, the pressure suddenly decreasing after reaching the point P conformably to the curve p_2 and thereby enables the closing spring 19 to shift the piston 24 through the cam 17 and the lever 27 rapidly to the right and thus the door into its ultimate closed position.

It will be obvious that as the details of construction may be varied from those shown in the drawing, we therefore do not limit ourselves to such details.

What we claim is:

1. A door check comprising a door check housing, a door pivot supported in said housing, a device in cooperative engagement with said door pivot and adapted for returning a door mounted on said pivot from open position to the closed position, a lever turnably supported on said door pivot, a stop for said lever connected with said door pivot, a piston connected with said lever, a cylinder for said piston in which the latter moves to and fro and forms a compression chamber in which air enclosed therein is compressed when the door is being closed, a throttling opening of constant cross-section in communication with said compression chamber and adapted for permitting the air compressed therein to escape to the open air, spring means acting to move said piston in a direction opposite to that in which the air in the compression chamber is compressed so as to effect abutting engagement of said lever with said stop, and stop means engaging said lever during the opening movement of the door to stop further movement of said piston under the influence of said spring means, and to disconnect said stop from said lever during further movement of the door in opening direction.

2. A door check according to claim 1, wherein said device for returning the door to the closed position comprises an edge cam formed integrally with said door pivot and having a notch therein, a cam follower cooperating with said cam and spring means adapted for urging said cam follower into abutting engagement with said edge cam.

3. A door check according to claim 2, wherein said edge cam is formed with a rising cam portion joining said notch and with a constant radius cam portion joining said rising cam portion.

4. A door check according to claim 3, wherein said rising cam portion is of sufficient extent so that said cam follower will not reach said constant-radius cam portion until said lever is in abutment with said stop means.

5. A door check according to claim 1 in combination with means for turnably supporting said cylinder in said door check housing for movement about an axis parallel with the axis of said door pivot, a piston rod rigidly connected with said piston, and pivot means for pivotally connecting said piston rod with said lever for movement about an axis parallel with the axis of said door pivot.

6. A door check according to claim 5, wherein said cylinder comprises a closure member adapted for receiving said means for pivotally supporting said cylinder as well as said throttling opening.

7. A door check according to claim 5 including, a further air passage in communication with said compression chamber and a check valve for controlling air displacement through said further air passage whereby movement of said piston in a direction towards said compression chamber opens said check valve and movement of said piston in opposite direction away from said compression chamber closes said check valve, wherein said cylinder comprises a closure member adapted for receiving said means for pivotally supporting said cylinder as well as said throttle opening, said further air passage and said check valve.

8. A door check comprising, in combination, a housing; a pivot supported in said housing and adapted to carry a door; closing means operatively connected to said pivot for returning a door mounted thereon from open to closed position; a lever turnably mounted adjacent one end thereof on said pivot; a stop for said lever fixedly connected to said pivot for movement therewith; a piston connected to said lever adjacent the other end thereof; a cylinder surrounding said piston and forming together with said piston a compression chamber in which gas enclosed therein is compressed when the door is moved in one direction to the closed position thereof, said compression chamber being formed with bleed means for permitting gas compressed therein to escape therefrom; spring means operatively connected to said piston for moving said piston in a direction opposite to that in which the gas in the compression chamber is compressed so as to effect abutting engagement of said lever with said stop; and stop means engaging said lever during the opening movement of the door to stop further movement of said piston under the influence of said spring means and to disconnect said stop from said lever during further movement of the door in opening direction.

9. A door check comprising, in combination, a housing; a pivot supported in said housing and adapted to

carry a door; closing means operatively connected to said pivot for returning a door mounted thereon from open to closed position; a lever turnably mounted adjacent one end thereof on said pivot; a stop for said lever fixedly connected to said pivot for movement therewith; check means including a piston member and a cylinder member surrounding said piston member, one of said members being connected to said lever adjacent the other end thereof and said members forming together a compression chamber in which gas enclosed therein is compressed when the door is moved in one direction to the closed position thereof, said compression chamber being formed with bleed means for permitting gas compressed therein to escape therefrom; spring means operatively connected to said members for moving said one member connected to said lever in a direction opposite to that in which the gas in the compression chamber is compressed so as to effect abutting engagement of said lever with said stop; and stop means engaging said lever during the opening

movement of the door to stop further movement of said one member under the influence of said spring means and to disconnect said stop from said lever during further movement of the door in opening direction.

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