Dec. 30, 1958 A. VAN DILLEN 2,866,223

DOORCLOSER AND DOORCHECK

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FIG. 1

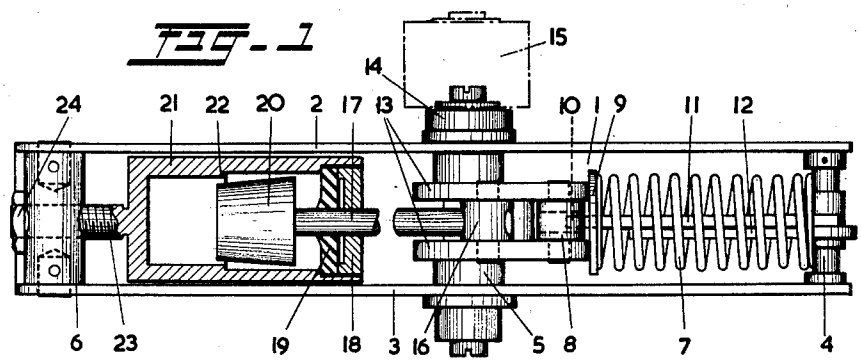


FIG. 2

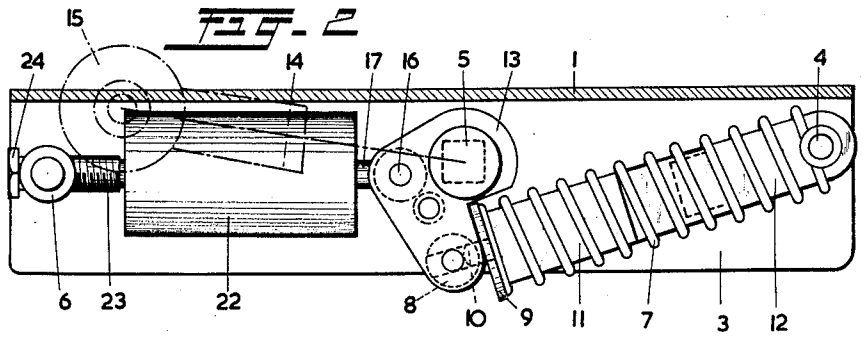


FIG. 3

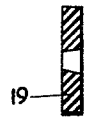
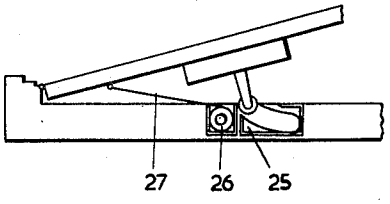


FIG. 4



INVENTOR.
ALBERT VAN DILLEN
BY
Young, Emery & Thompson
ATTYS.

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Fig. 5

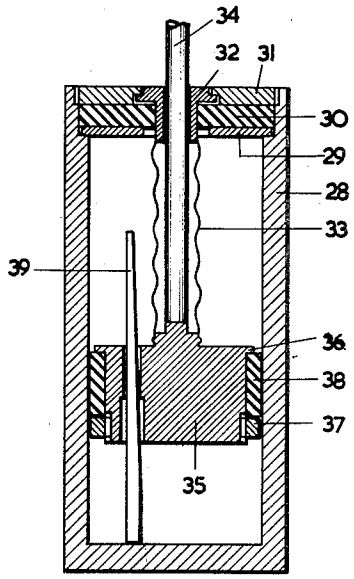


Fig. 6

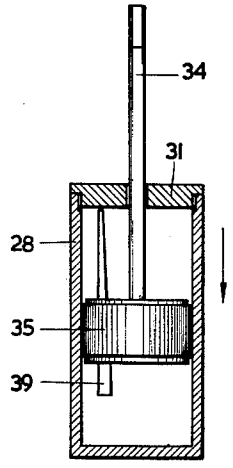
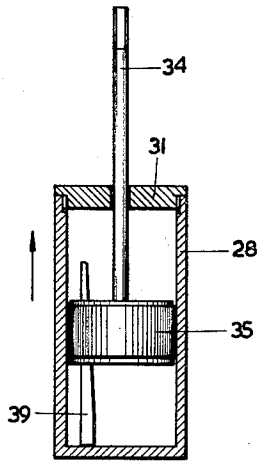


Fig. 7



INVENTOR.
ALBERT VAN DILLEN
BY
Young, Emery & Thompson
ATTYS

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DOORCLOSER AND DOORCHECK

Albert van Dillen, Blaricum, Netherlands

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2 Claims. (Cl. 16—51)

This invention relates to a hydraulic door closer and doorcheck, comprising two separate and cooperating parts to be secured to the door and to the door case respectively, one of which parts includes a lever which in its one final position is located in or slightly beyond its dead centre position and which is influenced by a spring and by a check piston operating in a check cylinder, as well as a follower determining the position of the lever, which follower is adapted to cooperate with a guide track in the other part. The drawbacks attaching to the known apparatuses of this type are connected with the mounting thereof on the door and the door case, the accurate adjustment of the dead centre and the disharmonious effect which the apparatus has on the beauty of the interior.

The dimensions of the transverse profile of doorcasings which are often kept very slight in modern building and the widely varying profiles of said cases often render it difficult to mount door closers of the known type. In order to enable the door to be closed with but slight force it is necessary to very accurately adjust the dead centre, but then again the apparatus is apt to jump out of its dead centre position owing to a shock or push, so that upon a subsequent closing of the door it will get out of order or will be deformed. A change in the vertical position of the door which is liable to occur owing to the wear and tear of hinges, the warping under the influence of moisture, the subsidence of the soil and the like, will result in the correct cooperation of the two parts being lost, which is fatal in view of the accurate adjustment of the dead centre of the door closer. Furthermore the mostly small dimensions of modern houses and the severity of modern interior decoration are not compatible with the use of a door closer of substantial dimensions owing to the disharmonious effect thereof.

Now the object of the present invention is to remove said drawbacks and this is achieved in that one of said parts is adapted to be secured against the lower side of the lintel of the door case, the follower cooperating with the guide track being carried by an arm swingable in a horizontal plane above or below the horizontally arranged check cylinder. This renders the apparatus independent of the profile of the door case and enables it to be mounted on the outside of the door. When the door is open the swinging arm is normal to the surface of the door, so that when the door is subjected to a push or shock the inertia of said arm will not have a moment about its pivot, which eliminates the danger of the apparatus jumping out of its dead centre position even in case said dead centre has been very accurately adjusted. In order to keep the apparatus narrow the spring is positioned outside the check cylinder. Said cylinder and spring being located on either side of the lever rotatable about a vertical axis.

Because the axis of the follower of the swinging arm, which follower is normally in the shape of a roller, is directly perpendicularly, a sagging of the door will not affect the cooperation between both parts of the door closer. By a simple reversal of the position of the swinging arm which is possible because the pivot of the lever protrudes from either side of the doorcloser casing, the apparatus may be used both on doors opening to the left and on doors opening to the right.

The compression spring located outside the check cylinder admits of being easily interchanged so as to adapt the apparatus to doors of different heaviness, while said compression spring is protected from collapsing—also during the assembly of the door closer—because two longitudinally overlapping rod-shaped supporting elements serve to internally guide the spring.

The horizontal arrangement of the check cylinder require a prefectly reliable sealing of the check piston rod and to this end the packing surrounding said piston rod consists in one embodiment of a disc of rubber or similar elastic material provided with a conical central aperture. The narrowest portion of said aperture has a smaller diameter than said rod and will, therefore, surround the rod in strongly elastically deformed condition so that a bulging rim is formed which engages the rod with a high degree of resilience and which scrapes the oil off the rod when same is drawn through said aperture. In order to promote the formation of said resilient bulging rim, the packing disc according to the invention only has its circumference clamped between the check cylinder and the cylinder cover, whereas its central portion has some freedom to move from its flat middle position in two axial directions. This operation of the packing disc is entirely based on the natural resilience of the material of the disc, while the packing is not pressed against the piston rod with an undue force, because the spring is provided outside the cylinder. In another embodiment the sealing of the piston rod is effected by a flexible and, if desired, bellows-like tube surrounding said rod.

The hydraulic check device may comprise a slightly conical check piston arranged in a cylinder, the internal diameter of which is locally reduced so that the braking force will gradually increase; the extent of said increase may be varied by axially displacing the cylinder for which purpose the cylinder is mounted on a screw threaded element. The spring located outside the cylinder is not tensioned or relaxed during said adjustment, which is a particular advantage of the new apparatus, while in addition the arrangement of the spring outside the cylinder gives the packing disc the freedom of movement referred to hereinbefore.

In a preferred embodiment according to the invention a ring of elastic material is so arranged about the piston between relatively adjustable collars of said piston as to admit of being compressed in an axial direction. Thus the diameter of the piston may be changed by axially adjusting said collars, so that in a cheap and simple manner each desired fit of the piston in the cylinder is obtainable, while the relative parts need not be machined with due observance of narrow tolerances.

Furthermore the invention provides a simple and efficient valve for controlling the flow of the hydraulic liquid in that in a port for letting through the hydraulic liquid, which port establishes a communication between the spaces on either side of the piston, a pin of variable cross-section is arranged, which pin is freely movable in a longitudinal direction between pre-determined final positions. Preferably said port is provided in an axial direction in the piston.

As soon as the piston moves towards one end of the cylinder, this will result in an increased liquid pressure on said end whereby the pin is suddenly displaced in the direction towards the other end of the cylinder. By suitably selecting the variable cross section of the pin, said pin will substantially obturate the port in behalf of the checking action when the piston moves in the one direction and when the piston moves in the opposite direction

the pin will leave free a wide passage for the fluid, so that the pin then serves as a return valve.

A few embodiments of the invention are shown in the accompanying drawings, in which:

Fig. 1 is a longitudinal section of a doorclosing and check device according to the invention, the closing lever being in the position it occupies when the door is open.

Fig. 2 shows a side view, one side of the casing being omitted and the closing lever being in the position it occupies when the door is closed.

Fig. 3 is a cross section showing the packing disc.

Fig. 4 is a plan view on a smaller scale showing the apparatus secured on the door case and on the door, which is about to be closed, as seen looking from the underside.

Fig. 5 shows an axial cross-section of another embodiment of the check cylinder and the piston arranged therein, while

Figs. 6 and 7 diagrammatically show two operative positions thereof.

As appears from Figures 1 and 2 the check and closing mechanism is mounted in a U-shaped casing **1**, in the side flanges **2** and **3** of which three shafts **4**, **5** and **6** are supported. The shaft **4** serves for pivotally supporting the one end of the compression spring **7** which with its other end bears against a shaft **8** via a disc **9** and a pin **10** fitting in a bore in the shaft **8**. The pin **10** passing through the disc **9** at the same time forms the end of the flat spring supporting element **11** which with little play extends into the interior of the spring and is partly overlapped within said spring by a second spring supporting element **12** pivotally secured to the shaft **4**.

The shaft **8** is rotatably supported in the double-cheeked lever **13** mounted on a square portion of the shaft **5**, at the one end of which shaft one end of the closing lever **14** carrying the rubber roller **15** is firmly secured. Also the other end of the shaft **5** extends beyond the casing and is adapted to carry the lever **14**, if necessary, so that by reversing the place of the closing lever the apparatus may be used both for doors opening to the left and for doors opening to the right. The two cheeks of lever **13** are kept spaced by a pin provided intermediate the pivots **8** and **16**, the ends of which pin have a reduced diameter and are inserted in appropriate holes in the respective cheeks, said ends being subsequently riveted.

In Figure 1 the lever **14** is in a position in which it is at right angles to the casing **1**, the shafts **4**, **5** and **8** being substantially in alignment with each other, so that the lever **13** is in its dead centre position.

At **16** the piston rod **17** of the check device has its one end pivotally connected with the other arm of the lever **13**, which piston rod passes through the cover **18** screwed onto the check cylinder **21** and through the packing disc **19**, while it carries the conical piston **20** at its other end. When said piston penetrates farther into the check cylinder **21** the passage for the oil between said piston and the rim **22** in the cylinder is narrowed, so that an increasing checking effect is obtained. The check cylinder **21** has its outer end provided with a screwthreaded stud **23**, the screwthread of which is in engagement with the internal screwthread of a transverse bore provided in the shaft **6**, so that by turning same the cylinder can be shifted to the left or to the right as seen in Figure 1 and thus the checking effect can be controlled. After the cylinder has been adjusted the stud is secured from movement by a nut **24**. The shaft **6** is secured to the flanges of the casing by means of two mounting studs.

The rubber packing disc **19** separately shown in Figure 3 has in its free condition a conical central aperture, the narrowest portion of which, as shown in Figure 1, fits about the piston rod as an elastic bulging rim, which rim scrapes the oil off the rod when said rod passes through the disc. Between the cylinder cover **18** and the packing disc **19** clamped thereby, a free space is left, so that from its middle position the disc is adapted to move along with the piston rod over a certain distance, so that the bulging rim, owing to the resilience of the disc, will engage the piston rod very firmly and will scrape off all the oil sticking to the piston rod when said rod moves outwardly.

When the piston rod moves inwardly the reverse takes place, so that there is no scraping action then. The effect of said packing disc, the action of which is solely based on the natural resilience of the material of this disc, is that the horizontally arranged oil check device functions without any loss of oil.

Figure 4 on a smaller scale shows the mounting of the apparatus on the door case and on the door, the door being shown in the position in which the follower roller **15** just leaves the guide track **25** mounted on the lower side of the lintel. In this position the axis of the pivot **8** has just passed the line of connection between the axes of the shafts **4** and **5**, so that the closing lever **14** remains in said position and will again enter the catching hook opening when the door is being closed. If the door is closed the closing lever is approximately parallel to the longitudinal direction of the casing, so that the spring keeps on exerting its force on the door, because the closing lever has not yet reached its final position which is determined by the lever **13** swinging against the web of the casing.

On the lintel there is likewise mounted a spring box **26** comprising a spiral spring, which has its inner end secured to a stationary central shaft and its outer end to a cylindrical box rotatable about said stationary shaft, at the outer circumference of which box a draw string **27** adapted to be hooked to the door is attached, so that the door is drawn shut when the follower roller and the guide track are out of engagement.

The construction of spring box **26** and string **27** is well known in the art.

In the embodiment according to Figure 5 the check cylinder **28** is provided with an internal shoulder on which a metal disc **29** bears, which disc serves to support the rubber annular disc **30** which is compressed by the cover **31** screwed into the cylinder, so that the annular disc **30** will spread in a lateral direction and be forced against the wall of the cylinder and against the bush **32**. Between the annular disc **30** and the bush **32** there is clamped one end of the sealing tube **33** made from supple oil resistant material such as synthetic rubber, which has its other end fluid-tightly secured to a collar provided on the piston rod **34**, which rod is thus sealed from the oil.

The piston **35** comprises a flange **36** while at its other end a ring **37** is screwed thereon, which ring presses a rubber sleeve **38** fitting about the piston against said flange **36**, so that screwing home of the ring **37** will cause the diameter of the sleeve **38** to increase, or conversely, so that it is possible in a simple manner to make the piston assembly fit in the cylinder with any degree of accuracy desired.

In the axial direction an opening is bored in the piston, in which opening a tapering pin **39** is freely movable between a topmost and a lowermost end position determined by the cover **31** and the opposite end wall of the cylinder respectively. If the pin is in its topmost position and the piston substantially in its lowermost position the thick end of the pin will leave free only a very slight passage in the bore in the piston, while in the opposite positions of the pin and the piston a large passage is left free in the bore. The operation of said pin is elucidated in the diagrammatic Figures 6 and 7. In Figure 6 the position is shown when the piston moves downwardly, in which case a higher pressure prevails in the lower part of the cylinder, which pressure will urge the pin and keep it in its uppermost position as long as the piston moves downwardly. As the piston moves farther downwardly the bore therein is closed to an increasing extent by the pin resulting in the required increasing checking action.

As soon as the piston moves upwardly again the higher pressure will be created in the space above the piston when the cylinder is entirely filled, which pressure will

cause the pin 39 to move downwardly and then will keep the pin pressed against the end wall of the cylinder, as shown in Fig. 7, as long as the upward movement of the piston continues.

When the tapering pin 39 is in its lowermost position a smaller cross-sectional area of the orifice through the piston at any position thereof will be obstructed than when the pin is in its uppermost position, so that the piston moving upwardly will meet with a substantially smaller checking action than when moving downwardly. The orifice through the piston has different cross-sectional areas in the upper and lower portions respectively. The upper portion of the orifice is calibrated with respect to the pin, the lower and wider portion does not participate in the checking action.

I claim:

1. A hydraulic doorcloser and doorcheck comprising two separate and cooperating devices adapted to be secured to a door and to a door case respectively, the said first device including a lever arranged pivotally about a vertical axis, a check piston connected to said lever, a horizontal cylinder pivotally arranged about a vertical axis, said piston being slidably mounted in said cylinder, a compression spring arranged outside said cylinder and operatively connected to and urging the lever about said vertical axis and a horizontally arranged follower arm connected to said lever and provided with a follower, the lever being normally located in a dead center position wherein it is maintained by the spring, the engagement of said lever with a stop surface determining its dead center position, said spring and said cylinder being located on either side of the vertical axis of said lever, the other of said devices being provided with a guide track adapted to cooperate with said follower to swing the follower arm in a horizontal plane above the horizontally arranged check cylinder, said follower arm being normal to the plane of the door when the door is closed and the lever is in its dead center position.

2. A hydraulic doorcloser and doorcheck according to claim 1, in which a port is provided in said piston for passage therethrough of the hydraulic liquid in said cylinder, the port establishing communication between the spaces on either side of the piston, and in which a pin having a varying cross-sectional area along its length is slidably mounted in the port in said piston and movable in an axial direction between two extreme positions defined by the closed ends of the cylinder at either side of said piston, axial displacement of said piston in the direction of one of said spaces creating increased hydraulic pressure in said space causing the pin to move in the opposite direction.

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