Dec. 30, 1924. 1,520,765

L. C. NORTON

DOOR CLOSING DEVICE AND DOORCHECK

Filed March 22, 1923 2 Sheets-Sheet 1

Fig. 1.

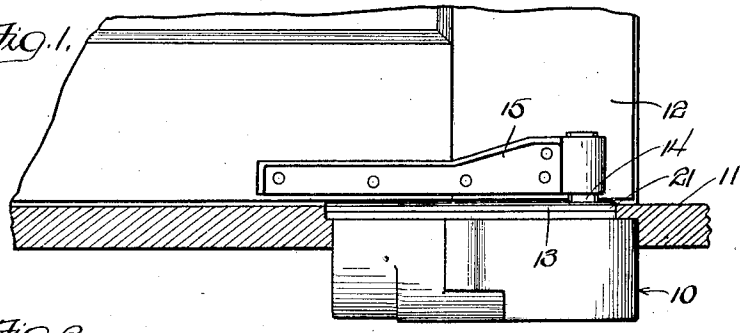


Fig. 2.

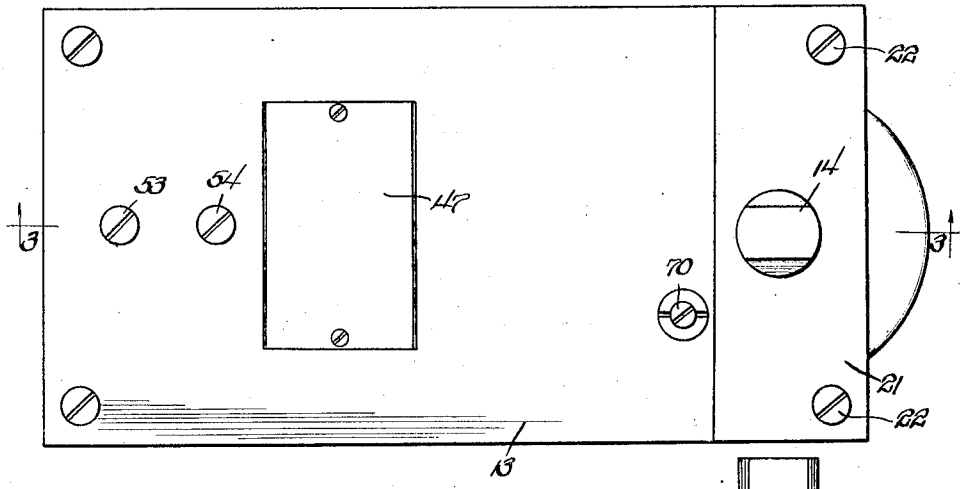
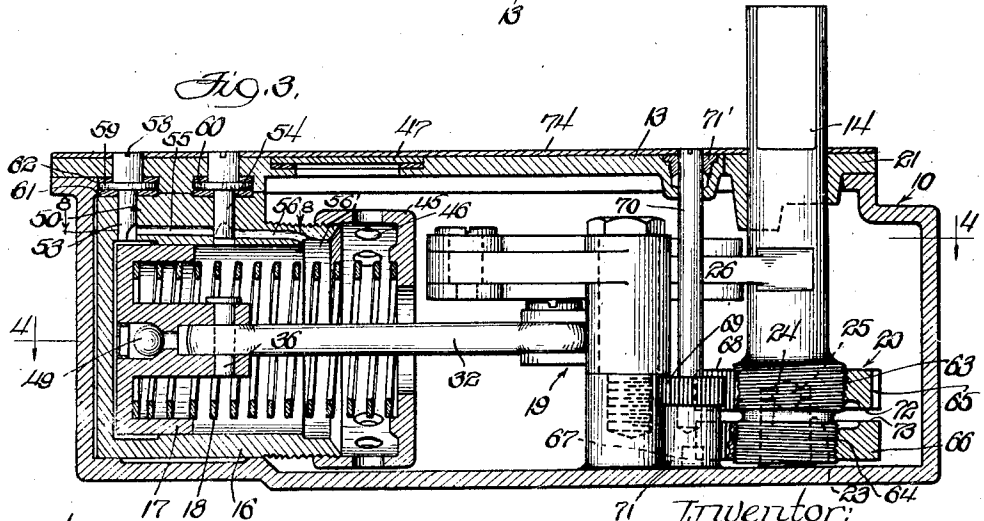


Fig. 3.



Witnesses:
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Fig. 4.

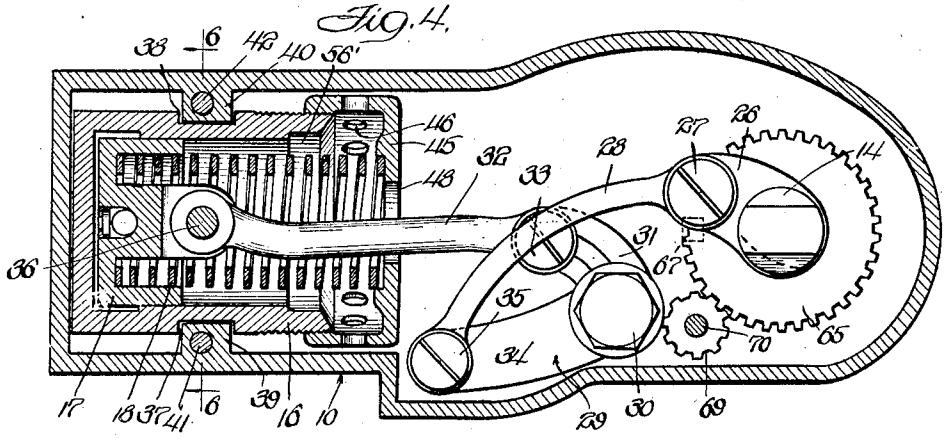


Fig. 5.

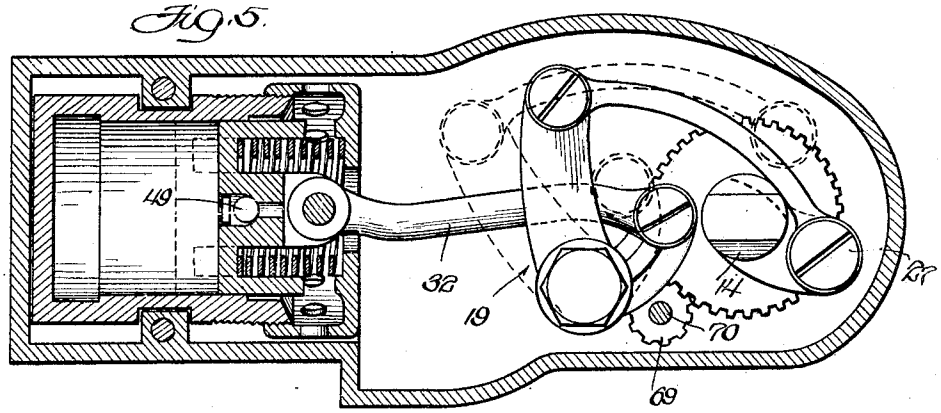


Fig. 6.

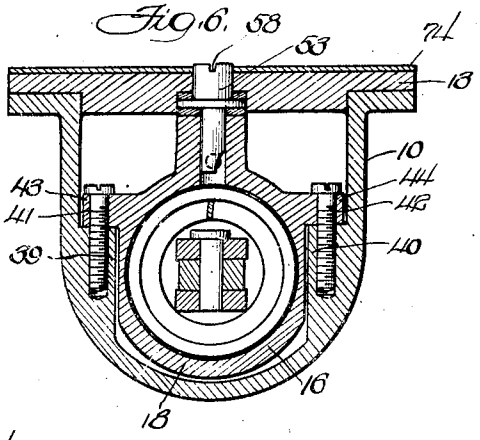
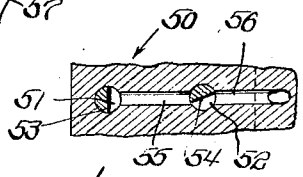


Fig. 7.



Fig. 8.



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Patented Dec. 30, 1924. 1,520,765

UNITED STATES PATENT OFFICE.

LEWIS C. NORTON, OF CHICAGO, ILLINOIS, ASSIGNOR TO NORTON DOOR CLOSER COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF WEST VIRGINIA.

DOOR-CLOSING DEVICE AND DOORCHECK.

Application filed March 22, 1923. Serial No. 626,738.

To all whom it may concern:

Be it known that I, LEWIS C. NORTON, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented new and useful Improvements in Door-Closing Devices and Doorchecks, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

This invention relates to door closing devices and door checks, and particularly though not exclusively to devices of this nature that are especially adapted to be positioned within the floor beneath the door associated therewith.

An object of this invention is the provision of a door check accompanied by spring door closing means of such construction that the increased tension of the spring upon opening the door will be more than compensated for, thus permitting the door to be opened by a gradually decreasing pull exerted upon the edge of the door.

A further aim of the structure embodying this invention is to provide a compact device possessing the above stated spring tension compensating means and which at the same time is designed to readily permit the door to be opened through an angle as great as 180 degrees.

The structure embodying this invention is further particularly designed to provide a compact and durable means for retaining the door in open position, such means being adjustable to permit the door to be retained at any particular position desired.

A further object of the invention is to provide a structure of the character indicated which may be readily installed and adjusted in connection with the door with which it is to be used and to provide such a structure which has a relatively small number of parts assembled in a very compact arrangement.

Other objects and advantages of this invention will become apparent from the following description, the accompanying illustrations and the appended claims.

For the purpose of illustration and description, one specific embodiment of this invention is shown in the accompanying drawings, in which—

Figure 1 illustrates a structure embodying my invention and installed in operative position in relation to a door;

Fig. 2 is a top plan view showing the housing of the device comprising my invention;

Fig. 3 is a sectional view taken substantially upon line 3—3 of Fig. 2;

Fig. 4 is a sectional view taken upon the line 4—4 of Fig. 3, showing parts of the mechanism in the positions which they assume when the door is closed;

Fig. 5 is a a view similar to that of Fig. 4 but showing in dotted lines parts of the mechanism in their proper positions when the door is opened through an angle of 90 degrees and showing in full lines their positions when the door is opened through an angle of 180 degrees;

Fig. 6 is a sectional view taken substantially upon line 6—6 of Fig. 4;

Fig. 7 is a detail perspective view showing the construction of a valve member; and,

Fig. 8 is a detail sectional view taken on line 8—8 of Fig. 3.

Referring especially to Figs. 1 and 3 for a general description of the essential elements of the device comprising my invention, 10 is a housing member formed preferably of cast iron or the like which may be inserted in the floor 11 beneath a door 12 in connection with which it is intended to use the door closing device. A top or cover portion 13 of the housing may be installed flush with the floor or flush with the surface of the threshold if one is used. An oscillatable pivoting shaft 14 is mounted at one end of the housing 10 and serves as the lower support for the door 12 through the medium of a hinge 15.

A dash-pot cylinder 16 is positioned at the opposite end of the housing 10. A piston 17 and a door closing spring 18 are enclosed within the cylinder 16 and are operatively connected with the oscillatable shaft 14 through a special form of link and lever mechanism 19, hereinafter described. The oscillatable shaft 14 is provided at its

lower end with an adjustable friction plate mechanism 20 for holding the door at any predetermined open position.

The various parts of the structure will now be described in further detail.

The shaft 14 is mounted at its upper end in a bearing piece 21 which is removably fixed to the housing 10 by screws 22. The lower end of the shaft 14 rests upon a bearing at 23, which comprises a cylindrical post 24 extending up from the base of the housing and provided at its upper end with an anti-friction device, such as a ball 25 upon which the weight of the shaft and the attached door rest.

The shaft 14 is provided with a crank arm 26 to which is attached a curved link 28 by a pivoting screw 27, as shown in Fig. 4. A bell crank 29 is pivotally mounted upon a post 30 at one side of the housing 10 and is provided with a short curved arm 31 for connection with the piston 17 through the medium of a piston rod 32, which is pivoted to the arm 31 by a screw 33. The bell crank 29 is also provided with a longer curved arm 34 attached to the link 28 by a pivoting screw 35. The piston rod 32 may be pivoted to the piston 17 by a pin 36. The piston rod 32 may preferably be formed in the double curve shape as illustrated which at all times insures a wide clearance with the post 30 and the various parts of the dash-pot cylinder. The fact that the two ends of the piston rod may thus be made alike greatly facilitates the rapid manufacture of this part as well as the rapid assembly of this portion of the door closer.

The dash-pot cylinder 16 may be provided at its sides with transverse slots as at 37 and 38, which are engaged by corresponding lugs 39 and 40, respectively, formed upon the housing 10, as appears in Fig. 4. After the dash-pot cylinder has been placed in position in reference to these lugs, it may be retained in this position by screws 41 and 42, which pass respectively through lugs 43 and 44, formed upon the dash-pot cylinder and then extend into threaded openings in the lugs 39 and 40. The above described structure serves as a convenient means for securely but removably fixing the dash-pot cylinder within the housing 10. Such a structure further enables the cylinder and housing to be constructed as separate units thus permitting a very accurate finishing of their various working parts.

The door closing spring 18 is shown in the form of a spiral compression spring exerting pressure between the piston 17 and a cylinder cap 45, which is threaded upon the cylinder 16. The spring 18 may preferably be formed from spring rod having a rectangular cross section, as illustrated, thus permitting the adjacent turns to be compressed very closely together. This design accordingly results in a more efficient use of the available space in the dash-pot cylinder than would a spring formed of spring rod of circular cross section. The tension within the spring 18 may be conveniently adjusted by turning the cylinder cap 45 onto or off from the cylinder 16, the cap being provided with wrench openings 46 accessible through an opening 47 formed in the cover member 13. A central opening 48 is formed in the cap member 45 to permit the free movement therethrough of the piston rod 32.

During the operation of the device, the housing 10 is adapted to be filled with a suitable fluid, such as oil, and as the door is opened and closed the cylinder 16 becomes successively filled with and emptied of the fluid. As the door is opened, the piston 17 will be drawn to the right in Fig. 3 and the liquid will be permitted to flow past the piston through a ball check valve at 49, thus filling the dash-pot cylinder. If the door is then released, the spring 18 will tend to move the piston to the left in Fig. 3, thus tending to close the door.

The speed with which the door is permitted to close will be determined by the rate at which the liquid is permitted to flow out of the dash-pot cylinder through a valve mechanism 50, shown in Figs. 3, 7 and 8. The particular valve mechanism here shown is of a type such that the door may be adjusted to partly close at one speed and to complete its closing movement at another speed since a double closing movement of this character is highly desirable in many instances, as is well known in the art. The wall of the cylinder 16 is provided with a pair of transverse openings 51 and 52 in which valve members 53 and 54 are rotatably positioned. A passageway 55 connects the openings 51 and 52. An outlet 56 from the opening 52 extends to a peripheral groove or enlarged bore 56′ at the end of the dash-pot cylinder and thus serves as a discharge opening for the fluid to pass from the front to the rear of the piston as the door becomes closed.

Valve outlets corresponding to that as shown at 56 have heretofore commonly been made to open out to a point upon or above the surface of the fluid within the door check housing. The fluid escaping from such an opening has been found to cause an excessive churning of the fluid within the container and the resulting powerful currents of fluid soon tear away the packing glands of the housing. In order to avoid this unsatisfactory design, I have located the outlet 56 in a position such that the discharge of fluid at all times will be well beneath the normal surface of the fluid within the housing. When the supply of fluid within the housing is sufficient to prop-

erly fill the dash-pot cylinder, the supply is consequently also sufficient to cover all parts of the peripheral groove 56′ thus insuring the submergence of the outlet 56.

The valve members 53 and 54 are formed with cut-out portions as at 57 at their lower ends, and may be adjusted by turning these cut-out portions into the desired relationship with the passageway 55 and the outlet 56. The valve members 53 and 54 extend upwardly through the cover 13 to the exterior of the housing 10 where they may be provided with screw slots as at 58 for receiving a screw driver or similar tool to permit making of the desired angular adjustments thereto by turning. The valve members 53 and 54 may furthermore be formed with disc shaped flanges 59 and 60 respectively, which bear between packing glands as at 61 and 62, thus rendering the cover 13 substantially liquid tight at the points where the valve members pass therethrough.

In adjusting the valve members 53 and 54, if a rapid initial closing movement of the door is desired then the opening at the valve 54 should be adjusted to cause as little restriction as possible to the flow of fluid past this point. If it is desired to make the final closing movement comparatively slow then the valve 53 should be adjusted to restrict the flow of fluid past this valve. Conversely, if it is desired to make the initial closing movement slow then the opening from the valve 54 to the outlet 56 should be made comparatively small, thus restricting the flow of fluid through the outlet 56. If it is desired then to have the final closing movement more rapid, the openings at the valve 53 and from the valve 54 to the interior of the cylinder 16 should be adjusted to offer less restriction to the flow of the fluid.

As is indicated in Fig. 5, the link mechanism 19 offers a very compact and comparatively simple means of connecting the dash-pot piston with the oscillatable shaft 14. The various parts of this mechanism are so formed and are of the proper proportions to permit the door to be opened through an angle of 180 degrees and at the same time the piston rod 32 will be drawn out very closely in direct line with the line of travel of the piston 17, thus permitting the piston 17 and the spring 18 to effectively fulfill their functions throughout the entire movement of the door. In other words, the particular position and angle at which the bell crank arm 31 is located, together with its curved shape allows the piston rod to be drawn out nearly in a straight line thereby enabling the dash-pot to check the movement of the door during its entire travel with practically the same efficiency as does the well known rack and pinion mechanism as used in door checks. The structure as shown and as above described, however, being essentially composed of a system of pivoted levers and links is much more durable and easily assembled and is more susceptible to quantity production than the rack and pinion type of mechanism.

A further important advantage of the link mechanism 19 as herein illustrated resides in the fact that as the door is opened the leverage against the effort of the spring 18 is increased sufficiently to overcome the increasing spring tension as the spring becomes more and more compressed. The effective length of the arm 34 of the bell crank which is connected with the crank arm 26 increases as the door is opened and at the same time the effective lever arm of the crank arm 26 decreases practically continually as the door is rotated from its closed position to an open position, through an angle of substantially 180 degrees. The link mechanism as shown is in fact sufficient to more than compensate for the increased spring tension and thus permits the door to be opened by a gradually decreasing pull exerted at its outer edge.

The friction plate mechanism at 20 for retaining the door in its open positions will now be described in detail.

The oscillatable shaft 14 may be provided at its lower end with two threaded portions 63 and 64, which may be provided respectively with right and left hand threads for receiving friction discs 65 and 66. The disc 66 after having been properly adjusted in place on the shaft 14 is held against further rotary movement by a lug 67 extending up from the bottom of the housing 10. The disc 66 may be provided at its periphery with gear teeth 68, as shown, for meshing with a pinion 69. The pinion 69 serves the double purpose of providing a means for rotarily adjusting the disc 65 and of retaining this disc in the desired adjusted position. The pinion 69 may be mounted upon a shaft 70 bearing within a lug 71 extending up from the base of the housing 10. The shaft 70 may furthermore extend upwardly through a stuffing box 71′ and through the cover 13 to the exterior of the housing where it may be provided with a screw slot for effecting its proper adjustment by turning.

When adjusting the friction disc mechanism to retain the door at a predetermined open position, it is merely necessary to open the door to the desired position and then rotate the shaft 70 with the attached pinion 69, which results in the turning of the disc 65. This disc should be turned until its lower face 72 firmly contacts with the upper face 73 of the disc 66. The frictional resistance between the surfaces 72 and 73 will then serve to retain the door in the desired open

position. The door may be readily closed by a slight thrust sufficient to overcome this resistance. After the disc 65 has been rotated to the desired adjustment, the pinion 69 will serve to retain it in this position since the friction of the shaft 70 within its bearings is sufficient to prevent any unintended rotation of the shaft. Accordingly, since the two discs 65 and 66 become fixed against rotation in the manner described and are threaded upon the shaft 14 by right and left hand threads respectively, when the shaft 14 is turned by opening the door the discs will longitudinally move toward each other upon the shaft and if the door is opened sufficiently the discs will come into frictional engagement preventing further opening of the door and also retaining the door in the open position.

A finishing plate 74 composed of brass or similar metal of desirable appearance can be placed over the cover 13.

It will be noted that the shaft 14 with the attached crank arm 26 and the hinge 15 are so arranged that the housing 10 may be completely installed in the floor in the proper position. Then the door may be fitted to its opening and without removing the door, the hinges may be bolted in place without further cutting or adjustments to the door. Such an arrangement of the structure permits the use of a very accurate and rapid method for installing the door closer and for hanging the door.

While I have shown and described one specific embodiment of the structure comprising my invention, it is to be understood that I do not desire to limit myself to this particular construction since many changes and modifications may be made therein without departure from the scope of the following claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent in the United States, is:—

1. A door check construction comprising a shaft on which the door is mounted, mechanism for checking the movement of the door, connections between the shaft and said mechanism, and friction means for holding the door in open position comprising a friction plate having a threaded engagement with said shaft, and provided with means to prevent it from rotating with said shaft, whereby as the shaft is oscillated, the friction plate will be moved longitudinally of the shaft.

2. A door check construction comprising an oscillatable shaft on which the door is mounted, mechanism for checking the closing movement of the door, connections between said mechanism and said shaft, and friction means for holding the door in open position, comprising a friction plate having a threaded engagement with said shaft, and means for holding said friction plate from rotating with said shaft and for adjusting said friction plate rotarily about the axis of said shaft, whereby when said shaft is oscillated said friction plate will be moved longitudinally of the shaft, and whereby said plate may be adjusted to hold the door in different open positions.

3. A door check construction comprising an oscillatable shaft on which the door is mounted, mechanism for checking the movements of the door, connections between said mechanism and said shaft, and means for holding the door in different open positions comprising a friction plate having a threaded engagement with said shaft and provided with a gear portion, and a pinion meshing with said gear portion.

4. A door check construction, comprising an oscillatable shaft on which the door is mounted, mechanism for checking the movements of the door, connections between said mechanism and said shaft, and means for holding the door in open position comprising a pair of friction plates, one of said friction plates having a right-hand threaded engagement with said oscillatable shaft, and the other plate having a left-hand threaded engagement with respect to said shaft, and means for holding said friction plates from rotating with said shaft, whereby when said shaft is oscillated said friction plates will be moved into and out of engagement with respect to each other.

5. A door check construction, comprising an oscillatable shaft on which the door is mounted, mechanism for checking the movements of the door, connections between said mechanism and said shaft, and means for holding said door in different open positions comprising a pair of friction plates, one of said friction plates having a right-hand threaded engagement with said shaft, and the other having a left-hand threaded engagement with said shaft, means for preventing said plates from turning with said shaft, and for adjusting one of said plates rotarily with respect to said shaft.

In witness whereof, I have hereunto subscribed my name.

LEWIS C. NORTON.