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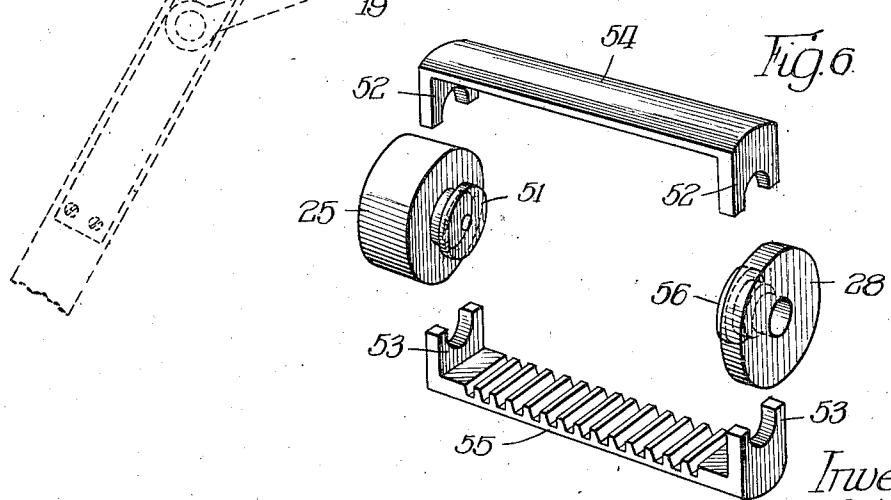
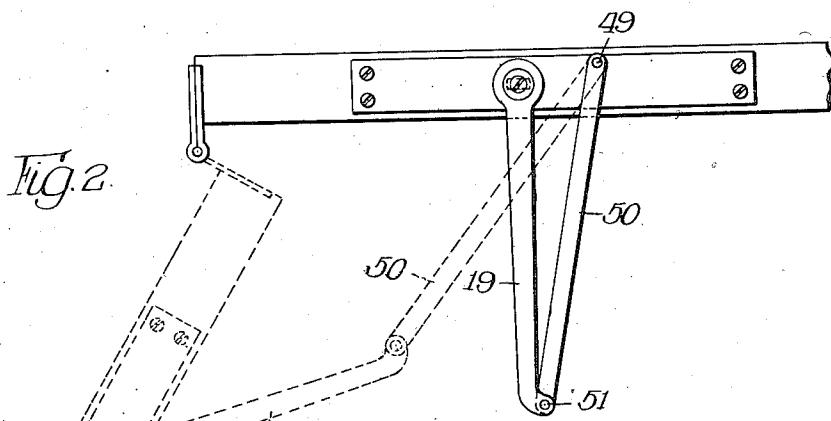
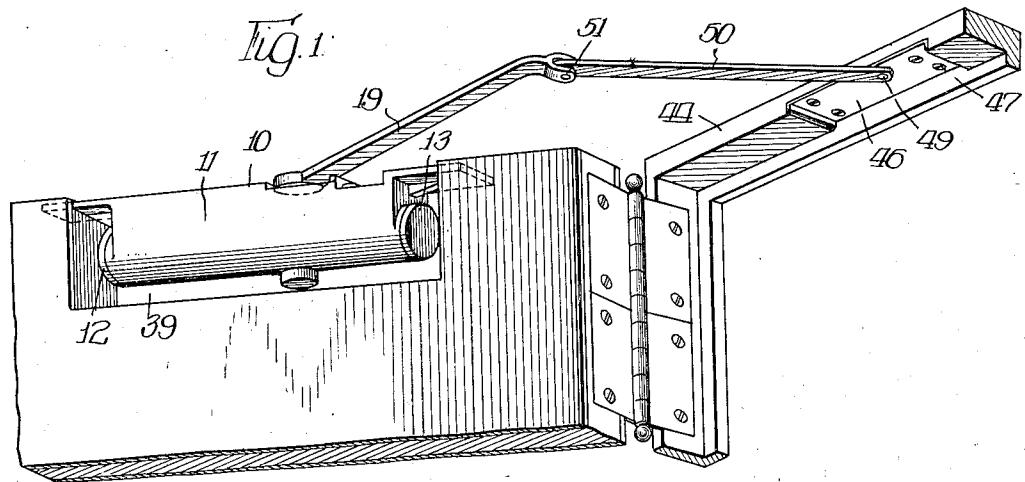
L. C. NORTON

2,024,472

DOOR CLOSING AND CHECKING DEVICE

Filed Jan. 18, 1933

2 Sheets-Sheet 1



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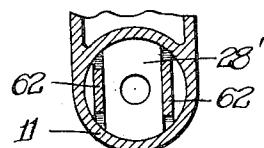
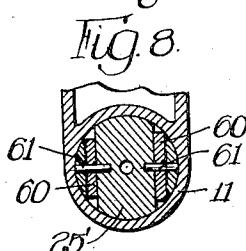
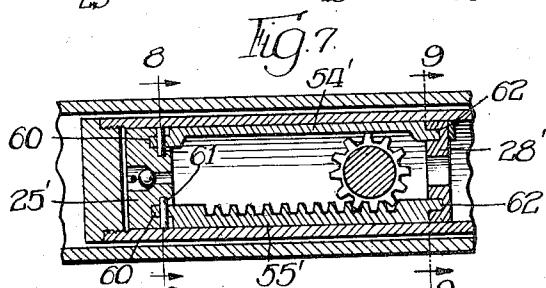
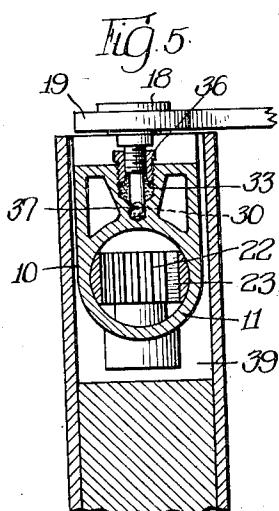
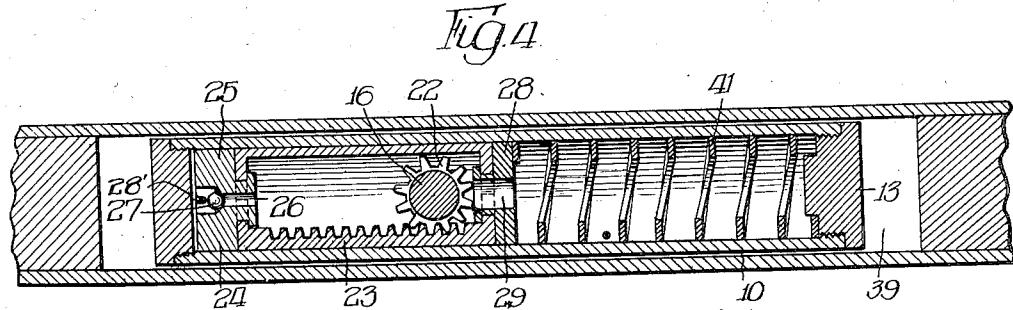
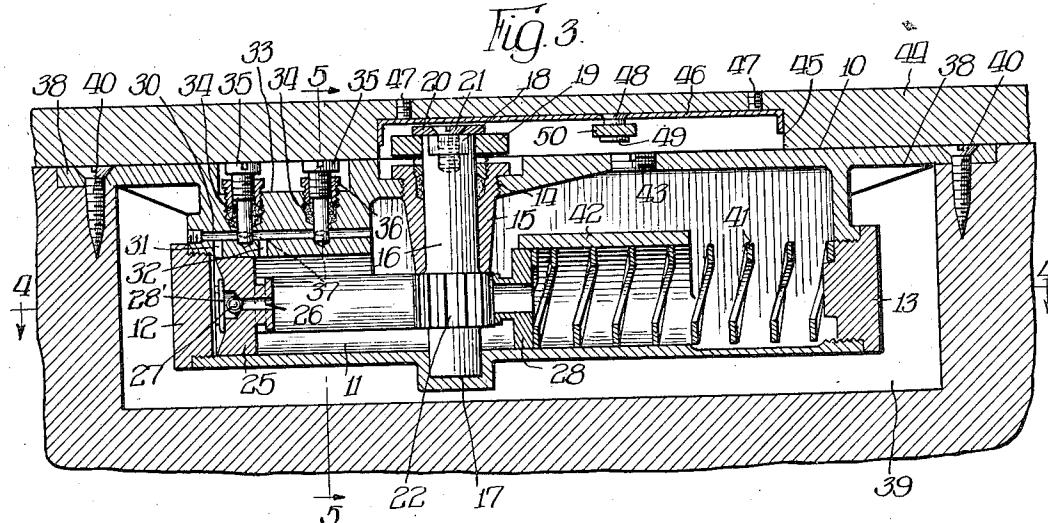
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DOOR CLOSING AND CHECKING DEVICE

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2 Sheets-Sheet 2



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## UNITED STATES PATENT OFFICE

2,024,472

## DOOR CLOSING AND CHECKING DEVICE

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Application January 18, 1933, Serial No. 652,283

## 1 Claim. (Cl. 16—49)

This invention relates to a new and improved door closing and checking device characterized in that the spring and fluid checking mechanisms are so constructed and arranged as to be adapted 5 for mounting within the door whereby the closing and checking device moves with the door for operation by connecting mechanism extending to and connected with the door frame.

In providing satisfactory door closers, several 10 factors must be taken into account and considered jointly.

First, the mechanical character and value of the elemental parts for the work to be done by each part and,

Secondly, the nature of the connecting mechanism, through which the movements of the door and door closer are imparted to each other.

In regard to the first requirement, the closing and checking device must be of satisfactory design to give the desired control to the door, with respect to the closing force, the closing movement, and the checking action of the dash pot. As door closing and checking devices of the type herein illustrated have the closing spring and 25 checking dash-pot connected for operation from the same spindle, it is obvious that both of these parts must be constructed to undergo co-related operation determined by the angular displacement of the operating spindle.

As to the second requirement, it is important to provide connecting mechanism designed to give the desired translated movement in accordance with the following mechanical principles:

First, a satisfactory movement or displacement for each of the parts of the checking and closing device for the angular displacement of the door through any particular arc of swing from the closed position to the position of maximum opening;

Secondly, proper mechanical advantage for all positions of the door so that at any and all positions of the door the spring, which possesses a predetermined energy, depending upon the degree of compression, will exert the desired force on the door;

Thirdly, in connection with the combination of a door, a door closing and checking mechanism, and connecting means therefor, collectively constituting a single machine, the selection of the 50 various parts for cooperative relationship to produce maximum results in controlling the door and in providing a practical and nice appearing installation in practice.

In addition to the above mechanical principles, 55 commercial practice demands that the installa-

tion be neat and of pleasing appearance with the avoidance of bulky, cumbersome or unsightly parts.

In view of the above considerations, it is an object of this invention to provide a door check which is mounted in the door with its operating spindle positioned in a predetermined desired relationship with respect to the hinge of the door and with respect to the connecting mechanism for the door whereby a new and improved control is provided, both as to the spring power and the checking action.

A further object of this invention is to provide a door closer which is mounted in the door and which has connecting links which project outwardly substantially perpendicularly to the face of the door with the point of attachment to the door frame disposed in predetermined relationship to the spindle of the door check and the hinge of the door and to thus provide an improved control for the door.

A further object of this invention is to provide certain new and improved structural characteristics whereby in combination with the connecting links here employed, closing and checking mechanism of the required shape and arrangement for installation within the limited space in the door, is caused to impart, by the displacement of its parts in operation, a closing and controlling movement suitable for relatively heavy doors, which, prior to this invention, could only be controlled by much larger and more powerful mechanisms unsuited for installation within the limited confines of a door.

It is another object of this invention to provide 35 door checking and closing mechanism of the above described type which provides the greatest checking power at the latch and which, due to the internal construction of the checking device, in combination with the connecting links employed and their relationship as assembled to the door and door frame, will exert a greater checking force at the latch than would devices of similar size, but of a different construction.

It is a further object of this invention to provide 45 a door closing device in combination with the connecting links which exerts a gradually diminishing closing force for successive positions of the door from closed to open position.

It is a further object of this invention to provide 50 various details in construction which make for improvement in operation of the door closer and for advantages in manufacturing, assembling and installing the apparatus.

These and other objects not specifically enu- 55

merated are contemplated for this invention as will readily appear to one skilled in the art as the following description proceeds.

The following description will be made in connection with the accompanying drawings in which—

Figure 1 is a fragmentary perspective view of a door and door frame in connection with which is mounted a door closing and checking device constructed and installed in accordance with this invention;

Figure 2 is a plan view of the upper edge of the door in which is installed a door closing and checking device of this invention and also showing in dotted lines, the position of the connecting links when the door is opened;

Figure 3 is a longitudinal, sectional view in elevation, showing the interior of the door closing and checking device of this invention;

Figure 4 is a plan view in cross section taken on the line 4—4 of Figure 3 and looking in the direction of the arrows;

Figure 5 is a vertical sectional view taken on the line 5—5 of Figure 3 and looking in the direction of the arrows;

Figure 6 is a perspective exploded view of the parts constituting the rack and piston disclosed in Figures 3 and 4.

Figure 7 is a modified form of piston construction.

Figures 8 and 9 are transverse sectional views taken on the lines 8—8 and 9—9 respectively of Figure 7 and looking in the direction of the arrows.

By referring to the drawings, it will be noted that this invention is illustrated as embodied in a door check comprising a casing 10, the bottom portion of which is constructed to form a cylinder 11, having its opposite ends closed by screw-threaded plugs 12 and 13. Centrally of the casing in the upper wall thereof is a threaded opening 14, in which is mounted the bearing part 15 for mounting the spindle 16. The bearing part extends downwardly and provides a relatively long bearing surface for the spindle. The lower end of the spindle is mounted for rotation in a bearing pocket 17, provided in the lower portion of the cylinder. The upper end of the spindle is provided with straight cut sides 18, serving to fix the main arm 19, for connection with the door frame. The arm is held on the spindle by means of a washer 20 secured by screw 21.

The spindle is provided with an integral or fixedly attached gear 22, which is disposed within the cylinder for cooperation with a rack 23 carried by the piston 24. The piston is preferably of the construction here shown wherein it has two separable piston heads 25 and 28 respectively. The head 25 is at the working end of the piston and is positioned to slide within that portion of the cylinder disposed at the left hand end as shown in the drawings. Piston head 25 is provided with an opening 26 which is closed by a check valve 27, comprising a ball held in place by a pin 128 whereby it freely passes checking fluid when moved away from the end of the cylinder as from left to right in the drawings, or in that direction in which it moves when the door is being opened. The piston head 28 has an unobstructed central opening 29 therethrough for the purpose of freely passing fluid for a purpose hereinafter described.

Casing 10 is provided with a longitudinal bore or duct 30 which communicates by means of ducts 31 and 32 respectively, with the interior of the

checking cylinder. These ducts are positioned so as to provide for the passage under control of checking fluid for imparting general and latch speeds for the door. The upper portion of the casing is provided with a recess 33 and a plurality of threaded pockets 34 in the base of said recess. These pockets communicate through their bottoms with their duct 30 and serve to accommodate the adjusting screws 35, and packing glands 36. One adjusting screw is positioned to control the escapement of checking fluid through both the ducts 31 and 32 and the other is positioned to control the escapement of checking fluid through duct 31 and it will be noted that each is provided with a V-shaped groove 37, which may be disposed longitudinally or transversely of the duct 30 in the two extreme positions of adjustment.

Casing 10 is provided with extensions of wings 38 at its ends which are adapted to extend over sections of the door to serve as a mounting for the door check in an opening 39, and provide attachment by means of screws 40 for securing the door check in place. It will be noted that the upper edge of the door checking device is flush with the upper edge of the door and that the adjusting screws are disposed with their upper edges even with or below the upper edge of the door check.

The piston head 28 is in abutment with a compression spring 41 which is preferably of a special construction and which has its opposite end abutted against the enclosing plug 13 for the cylinder. It will be noted that the cylinder 11 includes a cylinder portion 42 on the opposite side of the spindle from the piston 25 in which the piston head 28 operates. This also forms in effect, a chamber in which the spring 41 is positioned.

The interior of the cylinder is filled with the usual checking fluid which may be introduced through a plugged opening 43. The door frame 44 is provided with a cut-out portion 45 in which is mounted a plate 46 by means of screws 47. This plate is equipped with a rivet 48 and stud 49 which serves as a pivot for the forearm 50 which is pivotally attached as at 51 to the main arm of the checking device.

In this connection, it should be noted that the stud 49 is riveted to the plate 46 whereby its position cannot be altered and furthermore, that the space which the upper portion of the spindle occupies when the door is closed is defined by the plate 46 whereby the position of the spindle 16 and the stud 49 is fixed in all cases and cannot be altered by the installing mechanic.

The piston illustrated in Figures 3 and 4 respectively, is best shown in the perspective exploded view in Figure 6. In this view, it will be noted that the head 25 is provided at its back end with a flanged stud 51 adapted for interlocking cooperation with the yokes 52 and 53 of the bar and rack elements 54 and 55 respectively. The bar and rack have similar yokes 52 and 53 for cooperation with a flanged stud 56 on the piston head 28. The two heads are made to fit nicely within the cylinder but the diameter of the rack and the bar are slightly smaller than the diameter of the piston heads. By means of the stud and yokes, the heads can turn freely in the cylinder and thereby assume the proper fitting positions in operation. This diminishes frictional resistance and wear on the piston and cylinder as otherwise might occur. The construction is simple and very practical as there are no rivets or screws necessary in making up the piston. The

parts may merely be assembled as shown in Figure 6, and inserted into the cylinder.

The ball valve is of the usual construction whereas the hole in the tail end head 28 is provided for the purpose of allowing the liquid to flow freely when opening the door. Both heads are loose so as to be free to rotate on the axis of the cylinder and also to tilt or turn sidewise to relieve the tension of any frictional strains in operation. In other words, the bearing opening in the cooperating yokes 52 and 53 are slightly larger than the studs 51 and 56.

In Figure 7, a modified form of piston is shown which is more in the form of an integral piston but is assembled from separate parts. Here the head 25' is of substantially the same construction as that previously described except that no stud 51 is formed thereon. Instead, a plurality of slots 60 are provided in which projecting ends 20 of the bar 54' and rack 55' are positioned and held by means of pins 61. At the opposite end the piston head 28' is likewise provided with slots 62 in which the ends of the bar 54' and 55' are placed and secured. This forms in effect, a rigid 25 piston but simplifies its manufacturing and assembling operations, and diminishes its cost.

Attention is called to the fact that by mounting the door check in the door, the axis of the door check spindle is moved inwardly whereby the 30 effective position of the door represented by the line connecting the axis of the door hinge and the axis of the check spindle is disposed further inwardly toward the closed position than is possible with surface door checks.

In addition, pivoted connecting arms are utilized with the main arm extending substantially perpendicularly to the face of the door opening. This type of connection together with the location of the door check pivot causes the greatest 40 possible rotary movement of the spindle for a given angular movement of the door.

It is on account of this construction that such effective control over the door can be realized because for any angular displacement of the door 45 a maximum movement of the door closing and checking parts is effected. Furthermore, due to the disposition and the type of connecting links here illustrated, the rotary movement of the door check spindle is greatest throughout that portion 50 of the movement of the door approaching and receding from the latched position. This is highly important because the slightest opening movement of the door from the latch will effect a substantial displacement of the piston whereby 55 upon release, a good and effective checking action is produced.

The arrangement and construction here illustrated also provides a constantly shifting mechanical advantage so that the spring power acting on the door is diminished for successive positions from the closed to the maximum open position. For instance, by way of illustration, a preferred installation will have a spring installed under initial compression of say, one hundred 60 pounds and designed to exert only one hundred and fifty pounds under maximum compression in operation. With this type of spring the power required to open the door at the latch will be seven pounds, but from there on for successive angular 65 positions of the door to a position approaching the 180° position, the pull will be successively less, as six pounds, five pounds, and finally four pounds. In other words, though the door check is undergoing a movement of its parts acting to 70 compress the spring to increase its compression

power from one hundred to one hundred and fifty pounds, the link mechanism in combination with the leverage of the door and the mechanical relationships therebetween causes the spring power acting on the door to gradually diminish as the 5 power of compression of the spring increases. This is accomplished by the specially designed spring which is made long and slender and of relatively flexible stock and preferably of the cross sectional formation shown in the drawings. 10

It will be further noted that the forearm with the connecting links is non-adjustable wherefore it must be installed in exactly the same manner in all cases. Proper installation is also maintained by the fact that the plate 46, mounted in 15 the door frame, provides space for accommodating the upper end of the spindle wherefore the spindle and the forearm pivot must always be placed in the same relative positions. This automatically makes the installation uniform and the 20 operation of the closers correct. The connection from the forearm to the plate must be either on or in back of the dead centerline between the check spindle and the door hinge.

The two regulating screws are so formed as to 25 provide a complete adjustment for only a limited movement of the screws. When the V-cut is in line with the duct, a maximum opening is provided whereas complete stoppage is effected when the V is set across the duct. By having the open- 30 ing V-shaped, a graduated adjustment between the two extreme positions is possible.

Over the checking cylinder is a reservoir containing extra liquid to supply the cylinder as the liquid disappears in time. With the ordinary piston, when you open the door, the piston pushes the liquid with great force up through the reservoir or chamber provided for liquid, and thereby washes out any particles of foundry sand or chips that might be there, carrying them directly to 40 the regulating valves. This results in clogging and stopping the operation of the closer. This difficulty is obviated in the present invention on account of the hole 29 in the piston head 28 which allows the liquid in the cylinder to flow freely 45 through this piston head without disturbing the liquid in the reservoir. If any particles of dirt are left in the reservoir or upper chamber of the door check they will remain there and will not wash into the valves. Keeping this liquid quiet 50 prevents in a large measure, the liquid tending to go up the shaft with consequent leakage at this point.

The filling opening is provided in such position that after the closer is completely assembled it 55 can then be filled with checking fluid with the elimination of all the air without removing the piston. To illustrate the relatively quiescent condition of the fluid in the upper chamber, this check has been successfully operated with the 60 closing plug removed and without the motion of the piston tending to force the liquid out of the filling opening.

The present invention is not to be limited by the disclosure here given as the scope thereof may 65 be determined from the appended claim.

I claim:

For use with a door and a door frame, a door checking assembly comprising a door closing and checking device carried by the door and having 70 an operating spindle located substantially on the centerline of the thickness of said door, and projecting therefrom above the upper edge of said door, a pair of operating arms for said door check comprising a crank arm and a forearm, said crank 75

5 arm being fixed to said spindle so as to project substantially perpendicularly to the face of said door when said door is in closed position, and said forearm being pivotally attached at one end, to the end of said crank arm, and at its opposite end to said door frame at a point beyond the centerline of said door, and a bracket mounted in said door frame carrying the pivot for said forearm and determining a clearance space for said spindle,  
10 said bracket fixing and maintaining approximately

a predetermined relationship between the locations of said forearm pivot and the closed door position of said door check spindle in such manner as to produce substantially the maximum ratio between the rotation of the door and the consequent rotation of the door check spindle throughout that part of the movement of the door adjacent the closed position thereof.

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