June 4, 1935. R. S. POTTER 2,003,669

DOOR CLOSER

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Fig. 1.

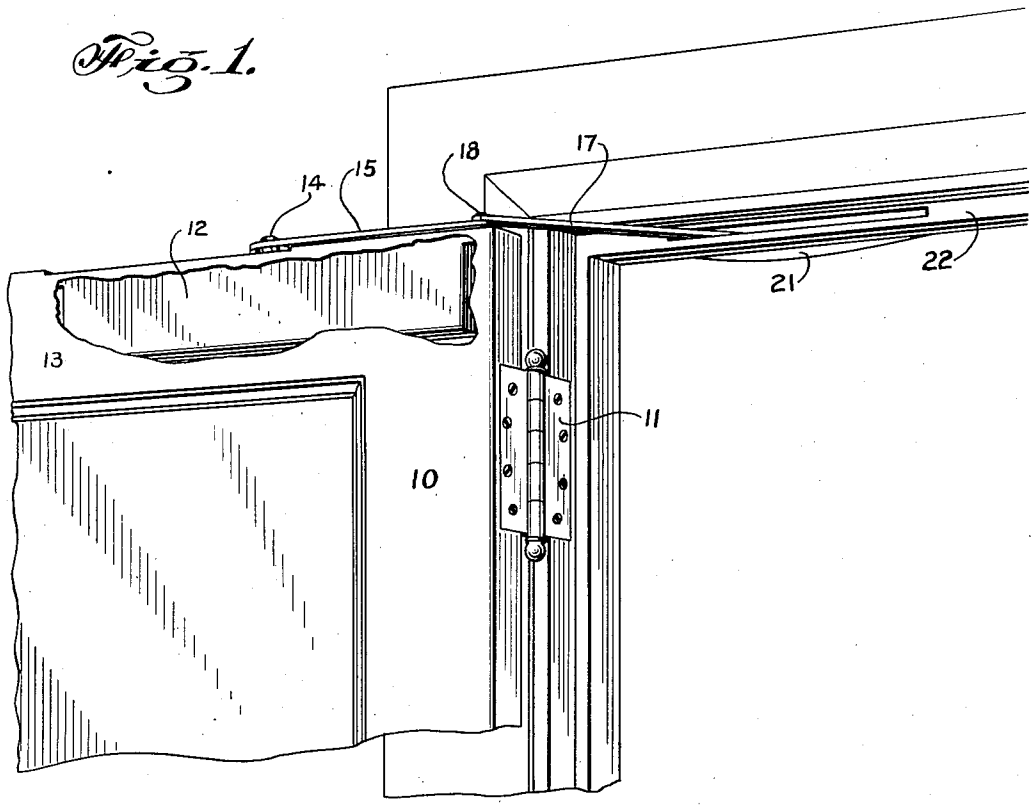
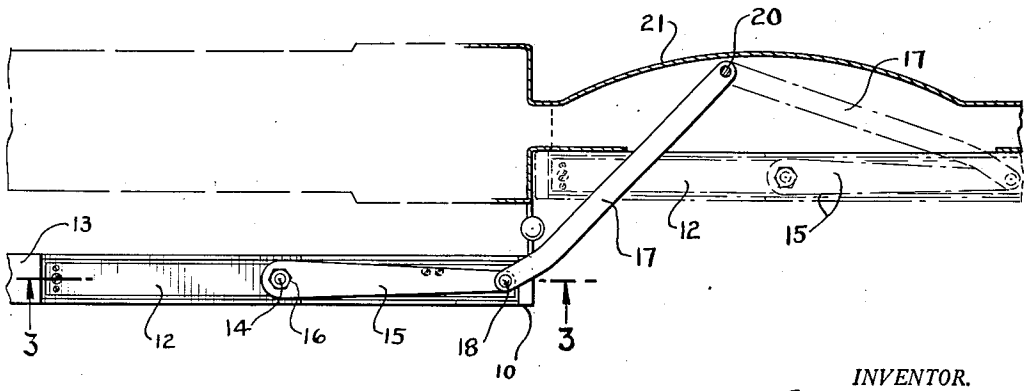


Fig. 2.



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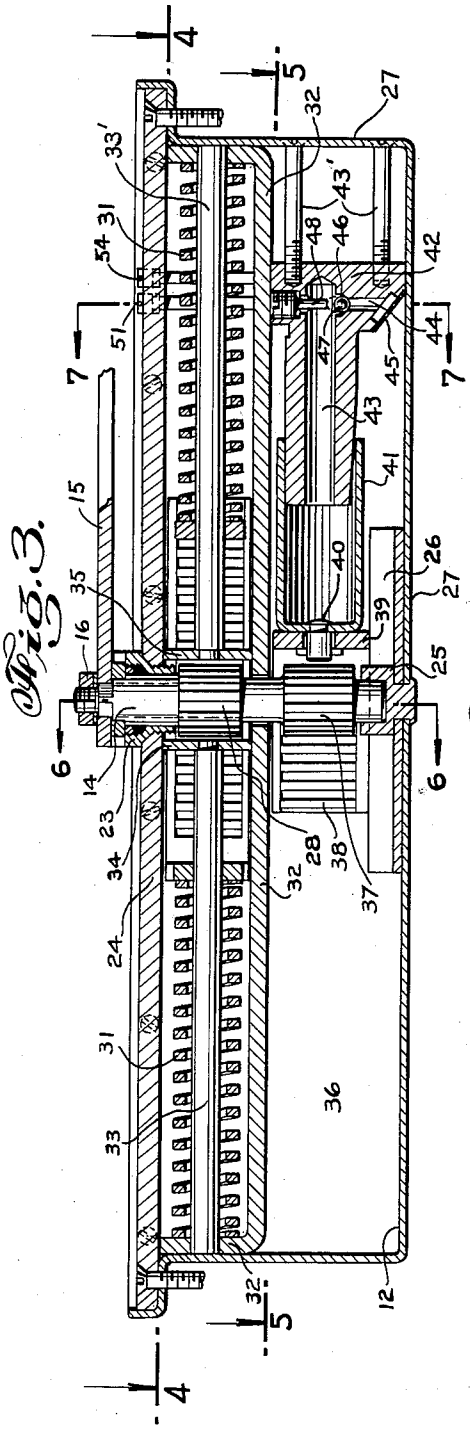

Fig. 3.

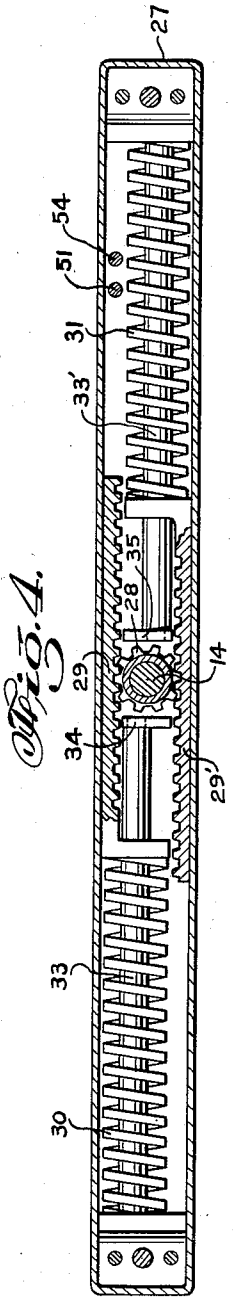

Fig. 4.

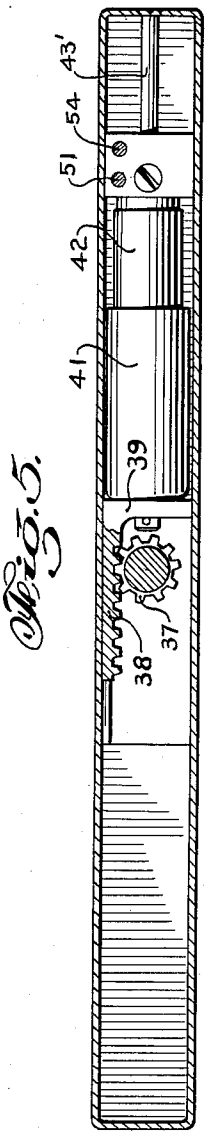

Fig. 5.

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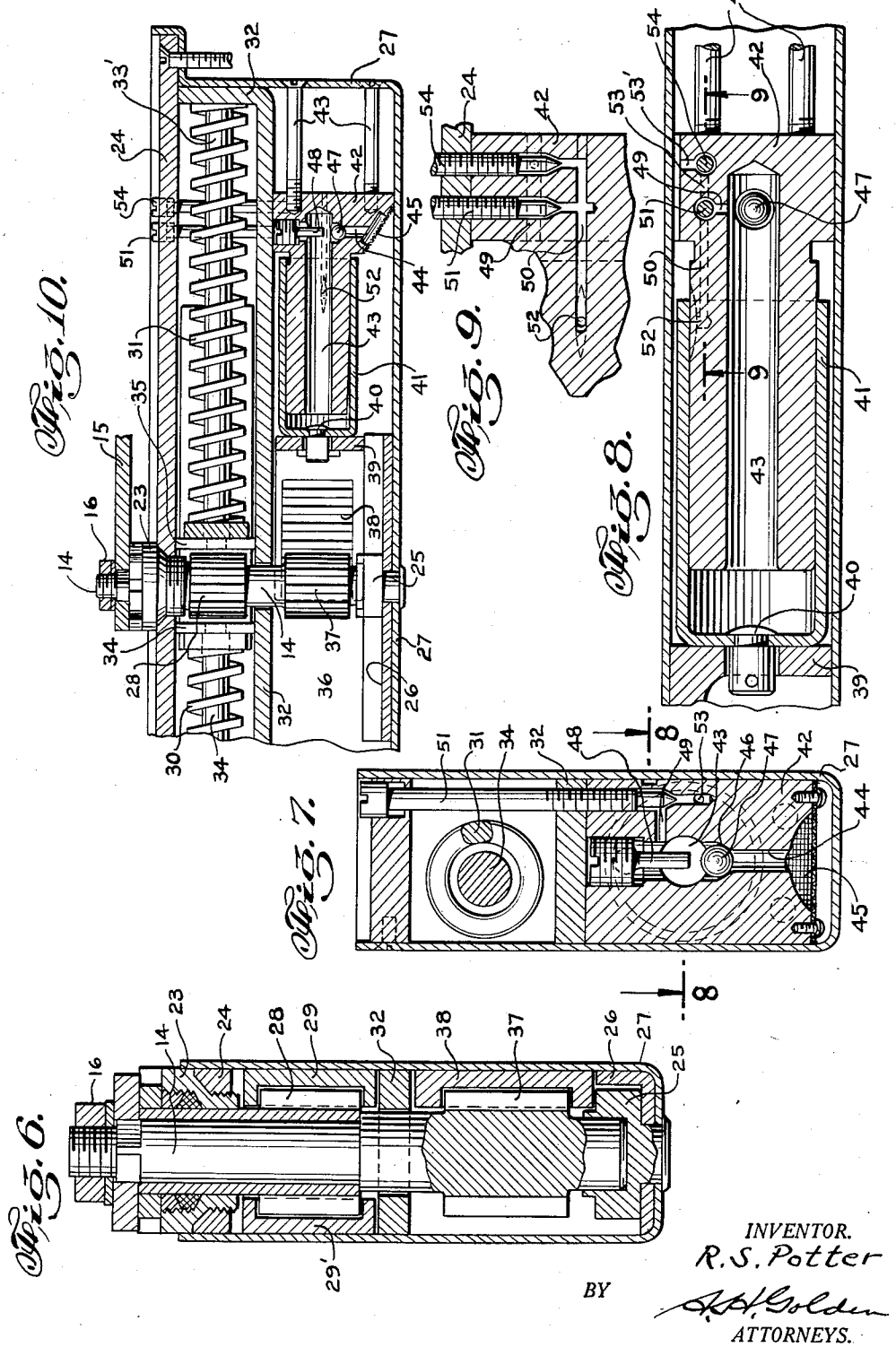

Fig. 10.

Fig. 9.

Fig. 8.

Fig. 7.

Fig. 6.

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UNITED STATES PATENT OFFICE

2,003,669

DOOR CLOSER

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Application February 4, 1932, Serial No. 590,879

4 Claims. (Cl. 16—51)

This invention relates to a door closer of the concealed type, and more especially a door closer adapted to be fitted into the top of a hollow metal door and to be entirely concealed in that door.

Concealed door closers have been known for many years, and there are numerous patents in the art illustrating mechanisms of various types. However, the average commercial hollow metal door is 1¾" thick at its upper panel, and it has been a practical impossibility to design a door closer which would operate efficiently, and at the same time could be made to occupy the upper panel of a door having such limited thickness.

My invention has for its object the design of a door closer of the above type in which a high ratio of operating efficiency will be obtained by a door closing mechanism which will have a construction of a simple type and adapted to fit into the upper panel of a relatively narrow door.

More particularly, it is the object of my invention to design a door closer of the particular type in which the necessary power for the closing action will be obtained by a pair of relatively powerful springs acting through racks on a pinion secured to the door closer operating shaft, the relation of the springs to the shaft being such that their lateral thrusts against the shaft are neutralized, while their rotating torques relatively to the pinion on the shaft are cumulative. It is through this conception of a power mechanism for the door closer, that the particular mechanism achieves its great operating efficiency and lasting qualities.

Further objects of the invention, and further meritorious improvements will be described in the following specification in which I shall particularly indicate a preferred embodiment of my invention, although it should be understood that modifications of the same within the scope of the appended claims will readily occur to those skilled in the art.

In the drawings wherein is shown a preferred modification of my invention, Fig. 1 is a perspective view showing a door equipped with my door closer, and standing in an open position. Fig. 2 shows the door in full lines in its open position, and in relation to a section of the door frame, while the door is shown in its closed position in dotted lines.

Fig. 3 is a section along the lines 3—3 of Fig. 2, while Figs. 4 and 5 are sections along the lines 4—4 and 5—5 respectively of Fig. 3.

Figs. 6 and 7 are sections along the lines 6—6 and 7—7 respectively of Fig. 3. Figs. 8 and 9 are sections respectively along the lines 8—8 of Fig. 7 and 9—9 of Fig. 8. Fig. 10 is a partial view similar to Fig. 3 showing the door closing mechanism in its closed position.

Referring now more particularly to the drawings, reference numeral 10 indicates a door hinged at 11 and equipped with a concealed door closer casing 12 in an upper hollow panel 13. The door closer is equipped with a shaft 14 to which is secured the door closing arm 15 by a threaded nut 16 as will be readily seen in the drawings. A second door closing arm 17 is pivoted at 18 to the closing arm 15 and at a point 20 in an obtruded member 21 of the door frame 22. As will be readily seen from Figs. 1 and 2, when the door is in closed position the arms 15 and 17 occupy the position shown in dotted lines in Fig. 2. As the door moves to an open position with a possible rotation approximately 180°, the arms move to the full line position illustrated in Fig. 2 as will be quite clear to those skilled in the art.

Referring now more particularly to Figs. 3, 4, and 6, the main door closing shaft 14 is held in position by a bearing 23 held in screw threaded relation to the top plate 24 of the door closer casing 12, and by a further bearing stud 25 secured to a bottom re-enforcing plate 26 and the bottom plate 27 of the door closer casing as will readily appear. Integral with the shaft is a pinion 28 which is maintained in operating relationship to a pair of spring-pressed racks 29 and 29' actuated by the compression springs 30 and 31 for rotating the shaft in a clockwise direction as will readily appear from Fig. 4.

Those skilled in the art will readily observe that the pressure of rack 29 against the pinion 28 will tend not only to rotate the pinion and shaft 14, but will also create a lateral side-pressure against the bearings of the shaft 14. The opposite thrust of the rack 29' will, however, offset this lateral thrust of the rack 29, while at the same time, the turning torque created by rack 29' relatively to the pinion 28 will be cumulative with the turning torque of rack 29. It will be readily appreciated that this construction, makes it possible to utilize the cumulative turning torques of the two springs occupying the relatively narrow door closer casing to such advantage that it is possible to obtain the very substantial turning torque necessary, while at the same time, the lateral thrusts against the bearings of shaft 14 are reduced to a practical minimum whereby to render the door closer extremely efficient.

The springs 30 and 31 are maintained in their operating positions by cooperation with the

turned-up ends of the separator plate 32 dividing the upper and lower chambers of the door closer, and by their relation to the shafts 33 and 33' secured to the plate 32 at one end and fixed at their other ends to plates 34 and 35, which in turn are held between the upper plate 24 of the door closer casing, and the separator plate 32.

As will be readily appreciated, opening movement of the door from the dotted line position illustrated in Fig. 2 to the full line illustrated in that same figure, and in Fig. 1, will rotate the door closing shaft 14, and with it the pair of racks 29 and 29', from the position of Fig. 10 to the position illustrated in Figs. 3 and 4, so as to place the springs 30 and 31 under compression. It will be obvious that when the door is released, the springs 30 and 31 will act on the racks 29 and 29' to rotate the door closing shaft 14 in a reverse direction and into door closing position. It is further obvious that unless some means are provided for slowing up the action of these springs, the door will be closed with a very fast motion bringing the same forcefully up against the door frame. For preventing this swift action, my concealed door closer is equipped with a liquid checking mechanism located entirely beneath the separator plate 32 and comprising a liquid containing chamber 36 which is intended to be filled with oil or other liquid to be used for checking the door closing movement as will be explained below:

The door closer shaft 14 is equipped with a second pinion 37 operating in the chamber 36 and cooperating with a rack 38 integral with a cross arm 39 to which is secured by a bolt 40, a cylinder 41 for movement therewith. A fixed piston 42 is securely held in the compartment 36 by a pair of screws 43' although other means may be utilized as will be readily appreciated by those skilled in the art. This piston 42 has a hollow chamber 43, and a passage 44, the entrance to which is covered by a screen 45. The passage 44 leads to a valve seat 46 which is controlled by a ball valve 47, cooperating with a screw stud 48 for limiting the movement of the ball.

Fig. 10, which illustrates the closed position of the door closing mechanism, shows the hollow cylinder 41 almost in abutting relation to the base of the stationary piston 42. As will be readily understood, rotating movement of the door closing shaft 14 to compress the closing springs 30 and 31 will act to move the cylinder 41 into the position of Fig. 3. The chamber 36 being always full of oil, such movement acts to force the oil into the passage 44 through the screen 45 and against the ball 47, which is readily lifted out of the way, and into the hollow portion 43 of the stationary piston 42, and into the hollow chamber of cylinder 41. When the door is released for closing movement by the action of the springs 30 and 31, it will be readily understood that the shaft 14 will be rotated in a direction so as to force the cylinder 41 back to its position relatively to the stationary piston 42 as illustrated in Fig. 10. It will be further obvious that such movement of the cylinder 41 will tend to force the liquid back through the chamber 43 and into the passageway 44, but that such movement will be obstructed by the ball valve 47 which will be held by the pressure of the liquid firmly against the seat 46. To provide for a slow and controlled escape of the fluid by other means than the passage 44, I employ a valve construction which is more fully illustrated in Figs. 7, 8, 9, and 10.

Referring to Figs. 8 and 9, there is shown a passageway 49 through which the fluid is forced from passage 43, upon movement of the cylinder 41 to the right from its open position illustrated in Fig. 3. A further passageway 50 communicates with the passage 49 through a valve 51 which may be readily adjusted to control the flow of the fluid through the combined passages 43, 49 and 50 and out through a port 52 in the stationary piston 42. The adjustment of the fluid flow, and therefore the door closing speed, by the valve 51, is operative for approximately 95% of the travel of the cylinder 41 incidental to the closing movement of the door. Fig. 8 illustrates the operation of the cylinder 41 whereby when the door has moved about 95% of its closing movement, the port 52 becomes closed, so that it is no longer possible for the fluid to escape through the port. There is, therefore, provided a further port 53 in the piston 42 through which the fluid will flow after it is stopped from further escape through the port 52. The escape through the port 53 is controlled by a further valve 54 which is called the latch-speed port adjusting valve because it becomes effective only at the point where the door is about to latch, and is adapted to control the speed of the door at that point only.

From the description of the invention, as it is set forth, it will be quite clear to those skilled in the art, that opening movement of the door operates to rotate the shaft 14 against the compression of the springs 30 and 31, and that when the door is released, those springs will operate to rotate the shaft in a reverse direction. It should be further understood that the opening movement of the shaft 14 will operate the rack 38 through the additional pinion 37 so as to draw the cylinder 41 from its closed position in Fig. 10 to its open position of Fig. 3. Closing movement of the cylinder back to its position of Fig. 10 will be resisted by the fluid occupying the hollow cylinder and the piston passageway 43, and the speed of approximately 95% of the closing movement will be controlled by the speed of the flow through the passageways 49, 50 and the port 52 as determined by the general speed valve 51.

The latch speed will be controlled by a port 53 through which the fluid will escape as determined by the additional valve 54 called the latch-speed port adjusting valve, once port 52 is closed by the cylinder 41.

I claim:

1. In a door closer, a vertical main shaft, a pair of horizontally spring pressed racks, a pinion on said shaft, said racks being in engagement with said pinion and spring pressed in opposite lateral directions whereby to counter-act the thrusts of each other against the shaft, said racks being at diametrically opposite sides of said pinion so as to contribute cumulative turning torques thereto, a second pinion on said shaft, and a piston connected for movement by said second pinion against fluid pressure whereby to resist the action of said spring pressed racks.

2. A door closer having upper and lower chambers separated by a plate, a shaft traversing said chambers and having a bearing in each of them, a pair of pinions on said shaft, one carried in each of said chambers, a pair of oppositely spring pressed racks cooperable with opposite sides of said upper chamber pinion, and a rack carrying a check mechanism cooperable with said lower chamber pinion.

3. In a door closer, a main door closer shaft, a

closed end sleeve secured for movement with said shaft, a second closed end sleeve in continuous telescopic relation to said first sleeve, the open ends of said sleeves being located at their meeting ends, the closed ends of said sleeves being at their opposite ends, and adapted to define the ends of a cylindrical chamber, in effect, formed by the cylindrical sides of said sleeves and by said two ends, a fluid in the variable chamber defined by said sleeves, a pair of passages in said second sleeve through both of which fluid may flow during telescopic relative movement of said sleeves, one of said passages being so located as to be covered by said first sleeve after predetermined movement thereof, whereby to force said fluid through said second passage thereafter.

4. In a door closer, a main shaft, a sleeve movable therewith to resist closing movement, a stationary sleeve continuously telescoped within the first sleeve and about which said sleeve is mounted for bearing movement, said inner sleeve having an internal passage forming with said outer movable sleeve a variable chamber, liquid in said chamber to resist telescoping relative movement of said sleeves, a pair of valve passages in said inner sleeve through which said fluid flows during said sleeve movement, said movable sleeve being operable to close one of said valve passages after a considerable closing movement of the door whereby to force the liquid through said second valve passage, and means for adjusting said valve passages.

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