March 15, 1932. C. W. BASSETT 1,849,417

DOOR OPERATING MECHANISM

Original Filed April 13, 1927 2 Sheets-Sheet 1

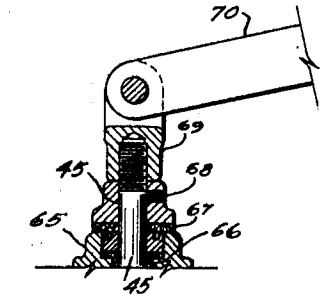


Fig. 3.

Fig. 1.

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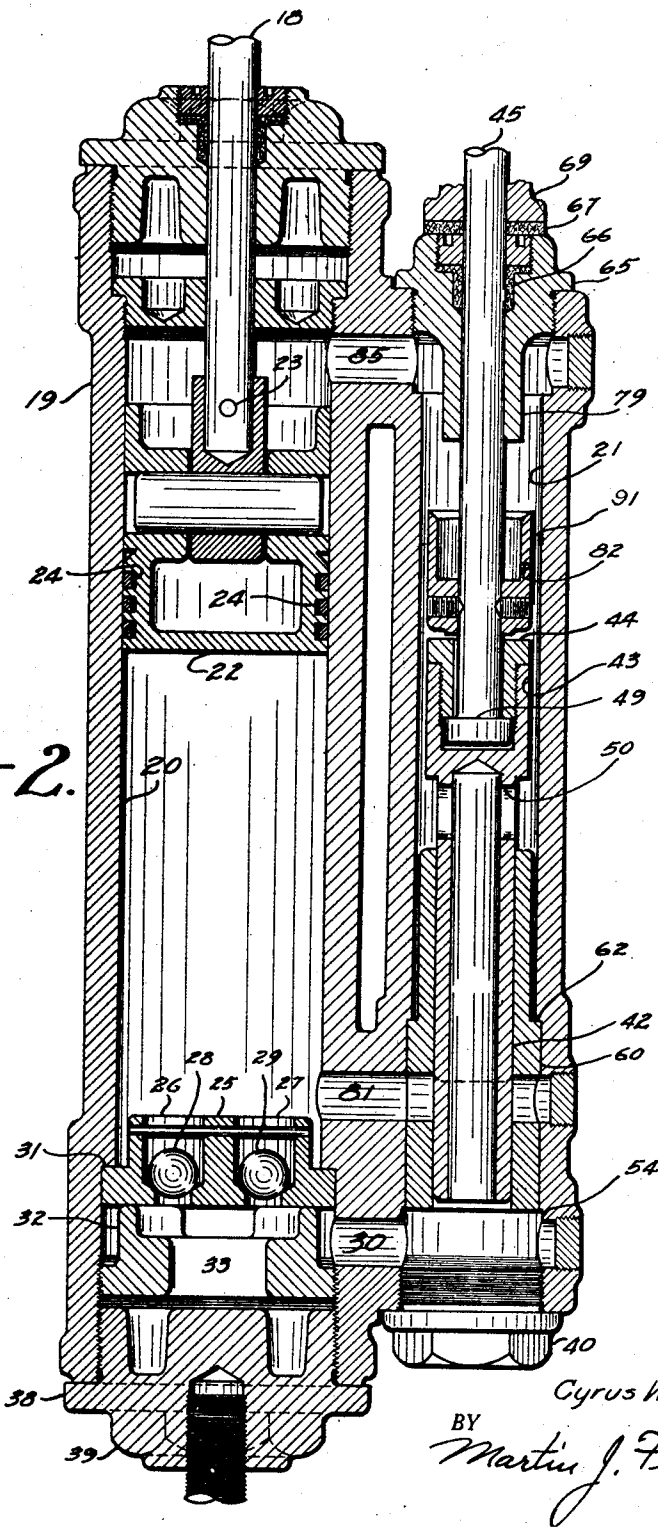


Fig. 2.

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UNITED STATES PATENT OFFICE

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DOOR OPERATING MECHANISM

Original application filed April 13, 1927, Serial No. 183,497, now Patent No. 1,709,301, dated April 16, 1929. Divided and this application filed March 30, 1928. Serial No. 266,062.

This invention relates to operating mechanisms for the doors of elevators and for other doors. While many of the features of the invention may be embodied in elevator systems such use of the invention forms the subject of my U. S. Patent #1,709,301, granted April 11, 1929, of which the present application is a division; and, therefore, the claims herein are directed to the gate operating and controlling mechanism per se, whether used with elevator gates or with gates or doors of other descriptions.

An object of this invention is to provide novel and efficient gate or door operating mechanism capable of application to various types of gates and doors; but described herein with particular reference to its use in automatically controlling the door or gate on an elevator and also, if desired, the doors at the various landings. In this connection a feature of the invention lies in the provision of novel means for rendering the operation of the doors semi-automatic and for controlling this semi-automatic operation electrically, by any suitable means, and which, in an elevator system may be controlled by means operated incidentally to the operation of the control means by the user of the elevator.

To carry out the objects of the invention I provide a self-holding device which maintains the door in any position to which it has been moved so that it is unnecessary for the person passing through to devote his attention and his strength to the task of manually holding the doors.

Heretofore doors have been provided with devices whereby the doors always tend to assume the closed position, unless physical restraint is brought to bear thereupon by the user. This puts a burden on the user of the door which is often times distressing, particularly when the user of the door is also under the necessity of carrying luggage or other articles.

With the use of the holding device described herewith such a burden is removed from the user so that he is free to pass through without paying any attention to the doors, except for the initial act of opening the doors.

Other objects and advantages to be derived from the use of the present invention or the component parts thereof lie in the specific constructions, combination and arrangement of said parts and will become more apparent from the following description when read with reference to the accompanying drawings, wherein:

Figure 1 is a view of an elevator equipped with the novel apparatus of this invention.

Figure 2 is a view, partly in section, showing some of the parts in Figure 1 on a larger scale.

Figure 3 is a view in sectional elevation of certain parts appearing on a smaller scale in Figure 1.

Referring to Figure 1, reference character 1 indicates an elevator having a gate 2 in the front thereof, this gate, as shown, being of the collapsible type. Mounted preferably on the roof of the elevator 1 is the door closing cylinder 3 having a pivotal support 4 on the mounting plate 5 suitably fixed to the roof of the elevator cab. This gate closing cylinder 3 contains a piston and a spring for influencing the piston in a direction to cause closing movement of the door, the latter part of the movement being checked by suitable means, usually liquid, in the lower part of the cylinder. Such a device is well-known in the art, a detailed description of a suitable door closer and check for this purpose being given in patent to Weeks No. 1,530,964, granted March 24, 1925. Consequently no claim is made herein to this door closing cylinder per se, which forms part of this invention only in its co-action and inter-relation with the novel parts presently to be described.

Suitable means are shown for transmitting the effect of the movement of the piston in the door closer 3 to the gate 2. As shown in Figure 1 these connections comprise the piston rod 6 suitably guided in bearings 7 and 8 in the frame 5, a crosshead 9 fixed for movement with the rod 6, and a connecting rod 10 pivoted at one end to the crosshead 9 and at the other to the bell crank 11, the latter being in turn pivotally fixed on bearing 12. Extending from the bell crank 11 is the operating arm 13 connecting by means of link 14

with the bracket 15 on the outer edge of gate 2.

Crosshead 9 in addition to being fixed to rod 6 is also fixed to a piston rod 18, which is preferably mounted in substantial parallelism with piston rod 6 and is similarly guided thru bearing 19*a*. This piston rod 18 extends downwardly into the gate holding device, designated by the reference character 19. This gate holding device, which forms one of the most essential parts of the invention, acts to positively maintain the piston rod 6, hence the gate 2, in whatever position the former is moved to. In the preferred form the holding device 19 comprises a substantially cylindrical chamber 20 and another, and preferably smaller, chamber 21, also cylindrical, the two chambers being substantially parallel to each other, as shown in Figure 2. In chamber 20 is a piston 22 to which the piston rod 18 is suitably fixed, as shown at 23. Piston 22 preferably has a substantially fluid tight fit in the cylinder 20. Such a fit may be obtained in any suitable way but as illustrated it is obtained partly by the provision of expander rings 24, which fit in the circumferential surface of the piston 22. As shown the piston is somewhat hollow in construction, not for the purpose of providing for oscillation, but merely for economy of material. Obviously other shapes and constructions could be employed.

In the lower portion of the piston chamber 20 is mounted a valve member 25 provided with a pair of vertically disposed passages 26 and 27, having suitable seats provided therein for the reception of ball check valves 28 and 29 normally preventing passage of fluid therethrough in the downward direction. In the preferred form as illustrated the valve 25 is provided with a spider-like construction in its lower portion so as to provide clear passage of fluid from the valve chamber 21 thru the underside of the valve to the piston chamber 20, the connecting passage for this purpose being shown at 30. The valve 25 is maintained against a shoulder 31 in the wall of cylinder 20 preferably by means of the externally threaded nut 32 provided with a flat-sided hole 33 serving for the insertion of a wrench or other suitable means, by which it may be threaded up into engagement with the valve 25 to push the latter against its shoulder 31 in the wall of cylinder 20. After insertion of the valve 25 and the retaining nut 32, the cylinder is closed at its bottom end by suitable means such as the externally threaded plug 38 having a head 39 to which a wrench may be applied for tightening the parts to insure against leakage.

The valve chamber portion 21 of the holding device is preferably similarly closed at the lower end by means of another plug 40 similar to plug 38 just described. In the valve chamber 21 is mounted a long tubular valve member 42 suspended on the valve rod 45 by suitable means such as an internally threaded thimble 43 adapted to engage the correspondingly threaded member 44, which serves to retain the valve stem 45 by means of the head 49 provided on the latter. As shown, the tubular valve member 42 is formed integrally with the thimble portion 43 just described and is provided with ports 50 in the upper portion of its tubular wall. These ports 50 provide free passage of the liquid or other checking fluid employed from the upper portion of the valve chamber 21 into the internal portion of the valve member 42 and thence downwardly into the lower chamber 54, from which point the liquid may pass back into the piston chamber thru the valve 25. Sufficient clearance is allowed between the valve thimble 43 and the wall of the chamber 21 to permit fairly free passage of the liquid in the course just described.

The valve member 42 is suitably guided by means of the sleeve 60, which in the preferred form as illustrated has a very tight fit against a shoulder 62 in the wall of chamber 21. Some clearance is provided between the valve stem 45 and the retaining nut 44, also between the head 49 and the inner surface of the valve thimble 43, to allow for a certain amount of angularity in the movement of the valve stem 45, which extends upwardly thru the cap 65, stuffing box 66 and rubber bumper 67, to be fixedly secured by means of a suitable thread or otherwise, (Figure 3) to the lug 69, to which is pivoted a rocker arm 70 fulcrumed on bearing 71 and having attached to its other end suitable means for effecting operation of the valve stem 45. In the preferred form, as illustrated, this operating means comprises a solenoid 75 suitably mounted in the framework 5 and provided with a plunger normally held in the upward position, in which position it is maintained by means of suitable connections, such as pin 76, with the lug 77 pivoted on rocker arm 70.

Suitable means, such as spring 80, serves to retain the rocker arm 70 and the plunger pin 76 in the extreme upward position, as shown, and energization of the solenoid 75 causes an attaction of the plunger and hence a downward movement of the plunger pin 76 against the force of spring 80.

With this construction it will be apparent that (assuming the holding device to be completely filled with a liquid, preferably a viscous liquid such as oil or glycerine) a movement of the crosshead 9 in the upward direction (corresponding to a movement of the gate 2 toward open position) will cause upward movement of the piston in the door closing cylinder 3 and will also cause upward movement of the piston 22 in the chamber 20 of the holding device, the movement of these two pistons being effected, as is obvious, by

means of the connecting piston rods 6 and 18. Now, since the holding device is completely (or substantially so) filled with liquid, and also since the valve is in its normal (downward) position as shown in the drawings, the upward movement of the piston 22 will create a very low pressure approaching a vacuum on the under side of the piston so that the liquid will flow thru passage 85 into the upper portion of the valve chamber 21, thence downwardly in said chamber and thru the ports 50 in the wall of the tubular valve member to the lower portion of the chamber 21, thence thru passage 30 and vertical passages 26 and 27 of the valve 25 back to the chamber 20 on the under side of the piston 22.

Now due to the construction of the valve 25 and the provision of the ball check valves 28 and 29 therein, it is obvious that the liquid which flows in an upward direction thru said valve in the manner just described and by reason of pressure exerted thru the liquid by virtue of the upward movement of the piston 22, cannot flow back again but is trapped in the lower portion of the piston chamber 20, completely filling the entire chamber up as far as the lower end of the piston. Consequently it is obvious that as soon as the upward movement of the crosshead 9 ceases, irrespective of the distance it has traveled, whether a full stroke or only a portion thereof, a return, that is, downward movement of the piston will be impossible to any appreciable extent with the tubular valve member 42 in the position shown in the drawings and with the ball check valves resting on their seats as shown, in which positions they will of course remain since the force holding them in such position is greater than the force tending to push them upward. It is then obvious that despite the tendency of the spring in the door closing cylinder 3 to return the piston rod 6 to its lowermost position such a return will be impossible, hence movement of the gate 2 in a direction to close will be impossible, while and so long as the valve remains in the position shown, in which position the solenoid 75 is de-energized.

Upon energization of the solenoid 75, however, the rocker arm is tilted about its fulcrum against the force of spring 80 and the valve stem 45 is thereby raised carrying with it the tubular valve member 42 which rises to the position indicated in dash lines, Figure 2. In this raised position of the valve member it will be apparent that the liquid in chamber 20, below the piston 22, has a means of escape as the piston 22, together with the piston in the door closing cylinder 3, descends, this free passage being thru the horizontal channel 81, around the lower end of the tubular member, thence up thru the tubular member and the lateral ports 50 up thru the chamber 21 and back into the free space in the upper portion of the chamber 20 above the piston 22, the flow taking place along the course just described by reason of the difference in pressure produced in the two chambers by virtue of the downward movement of the piston 22, which downward movement is produced, it will be remembered, by reason of the spring or other equivalent means in the door closing cylinder 3 which is now free, due to the removal of the liquid resistance to cause the descent of the two connected pistons.

It is to be noted that cushioning means are provided to prevent too sudden or too noisy operation upon the energization of the solenoid 75. This means, as illustrated, comprises a cup-like member 91*a* secured by suitable means, such as set screws, to the valve stem 45 and movable therewith to envelop the downwardly extending projection 79 on the cap member 65 as the valve stem ascends in response to movement of the rocker arm 70. A suitable vent or outlet port 82 is provided in this cup member 91 to allow gradual escape of the liquid imprisoned in the cup member as the latter envelops the projection 79. Obviously the size of this outlet will govern the degree of retardation and cushioning obtained as the solenoid operates.

It is to be understood that any other form of power, or control means may be employed in place of the solenoid 75 for producing operation of the valve stem 45. Similarly other changes may be made in the construction and interrelation of the parts without departing from the scope of this invention as defined in the claims.

I claim:

1. In a device of the class described, a door closer and liquid check forming a single unit, normally acting means in said single unit having a tendency to move the door to closed position, and means operable at any stage of the opening movement for preventing such a closing movement of the door comprising an auxiliary fluid checking device and means for controlling said auxiliary fluid checking device to render the said normally acting means ineffective.

2. In a spring impelled door closer, a liquid containing chamber, means for confining the liquid in said chamber to prevent movement of the door by the closing spring, means comprising an electro-magnet for permitting the release of the fluid thus confined to permit closure of the door by said spring.

3. A door controlling mechanism comprising a fluid containing chamber, a piston in said chamber, means of escape for the fluid on one side of said piston, means normally closing said means of escape, thereby preventing movement of said piston in one direction, and means for permitting the piston to make a full stroke in the opposite direction at any time, said last-named means compris-

ing a constantly available path of escape for the fluid on the other side of said piston.

4. A door controlling mechanism comprising a fluid containing chamber, a piston in said chamber, means of escape for the fluid on one side of said piston, means normally closing said means of escape, thereby preventing movement of said piston in one direction, means for permitting the piston to make a full stroke in the opposite direction at any time, said last-named means comprising a constantly available path of escape for the fluid on the other side of said piston, and means external to said chamber for withdrawing said closing means.

5. A door controlling mechanism comprising a fluid containing chamber, a piston in said chamber, means of escape for the fluid on one side of said piston, means normally closing said means of escape, thereby preventing movement of said piston in one direction, means for permitting the piston to make a full stroke in the opposite direction at any time, said last-named means comprising a constantly available path of escape for the fluid on the other side of said piston, and electro-magnetic means for withdrawing said closing means.

6. In a door closer, a fluid containing chamber, a piston in said chamber, means tending to move said piston in the door closing direction, means normally nullifying said last-named means comprising two paths for the fluid on one side of said piston and valves normally closing said paths, and means for permitting the piston to make a full stroke in the opposite direction at any time, said last-named means comprising a constantly available path of escape for the fluid from one side of said piston to the other.

7. In a door closer, a fluid containing chamber, a piston in said chamber, means tending to move said piston in the door closing direction, means normally nullifying said last-named means comprising a path of escape for the fluid on one side of said piston and a valve normally closing said path, means for permitting the piston to make a full stroke in the opposite direction at any time, said last-named means comprising a constantly available path of escape for the fluid from one side of said piston to the other, and electro-magnetic means for withdrawing said valve.

8. In a door closer provided with means tending to effect closure of the door, means for nullifying said force comprising a plunger operatively connected with said device, a liquid containing chamber on one side of said plunger, a passage leading from said chamber, and a valve normally completely closing said passage and preventing escape of fluid from the path of said plunger whereby the fluid in said chamber prevents movement of either said plunger or said device.

9. A door controlling mechanism comprising fluid means for holding the door in a partially open position, said fluid means comprising a piston and means operatively connecting said piston to the door whereby it moves when the door moves and displaces fluid by its movement, and means for stopping the displacement of fluid by said piston at a position corresponding to a partially open position of the door to thereby stop the movement of said door and hold the door open in said partially open position.

10. Apparatus according to claim 9, wherein said fluid means further comprises a chamber containing a fluid and a passage connecting the parts of said chambers on opposite side of said piston.

11. Apparatus according to claim 9, wherein said fluid means further comprises a chamber containing a fluid and a passage connecting the parts of said chamber on opposite sides of said piston and wherein said stopping means comprises a valve having a normal position in which movement of said piston in one direction is free.

12. A door controlling mechanism comprising fluid means for holding the door in a partially open position, said fluid means comprising a cylinder containing a fluid, a piston, means operatively connecting said piston to the door whereby it moves when the door moves and displaces fluid by its movement, communication means connecting the parts of said cylinder on opposite sides of said piston, said means having separate inlets into at least one end of said cylinder, and means for stopping the displacement of fluid by said piston at a position corresponding to a partially open position of the door to thereby stop the movement of said door and hold the door open in said partially open position said stopping means comprising a one-way valve controlling one of said separate inlets to the cylinder, the two ends of said cylinder being constantly connected through said one-way opening valve, whereby said piston and the door controlled thereby may be freely moved in one direction.

13. A door controlling mechanism comprising fluid means for holding the door in a partially open position, said fluid means comprising a cylinder containing a fluid, a piston, means operatively connecting said piston to the door whereby it moves when the door moves and displaces fluid by its movement, a passage connecting the parts of said cylinder on opposite sides of said piston, said passage having two branches to said cylinder at one end, and means for stopping the displacement of fluid by said piston at a position corresponding to a partially open position of the door to thereby stop the movement of said door and hold the door open in said partially open position, said stopping means comprising a one-way valve in one of said branches,

the two ends of said cylinder being constantly connected through said one-way valve whereby said piston and the door controlled thereby may be freely moved in one direction.

14. A door operating device comprising a fluid containing casing, means for permitting circulation of the fluid in said casing during the opening movement of the associated door, means for preventing any circulation of the fluid in said casing after the opening movement of the door has ceased, a plunger in said casing operatively connected with the door, said plunger being incapable of movement in the door closing direction except upon the re-establishment of circulation of the fluid in said casing, and means for withdrawing said circulation preventing means to permit movement of said plunger in the door-closing direction.

15. In a device of the class described, a main closing and checking unit and an auxiliary checking unit, means connecting said auxiliary checking unit with said main closing and checking unit to permit the passage of fluid from one of said units to the other, and means normally preventing the passage of fluid thru said connecting means.

16. In a device of the class described, a main closing and checking unit and an auxiliary checking unit, means connecting said auxiliary checking unit with said main closing and checking unit to permit the passage of fluid from one of said units to the other, means normally preventing the passage of fluid thru said connecting means, and means for releasing said preventing means.

17. In a device of the class described, in combination a main closing and checking unit and an auxiliary checking unit, means connecting said auxiliary checking unit with said main closing and checking unit to permit the passage of fluid from one of said units to the other, means normally preventing the passage of fluid thru said connecting means, and means for releasing said preventing means, said last-named means comprising a valve in said auxiliary checking unit and electromagnetic means for operating said valve.

Signed at Hoboken, in the county of Hudson and State of New Jersey, this 29th day of March, A. D. 1928.

CYRUS W. BASSETT.