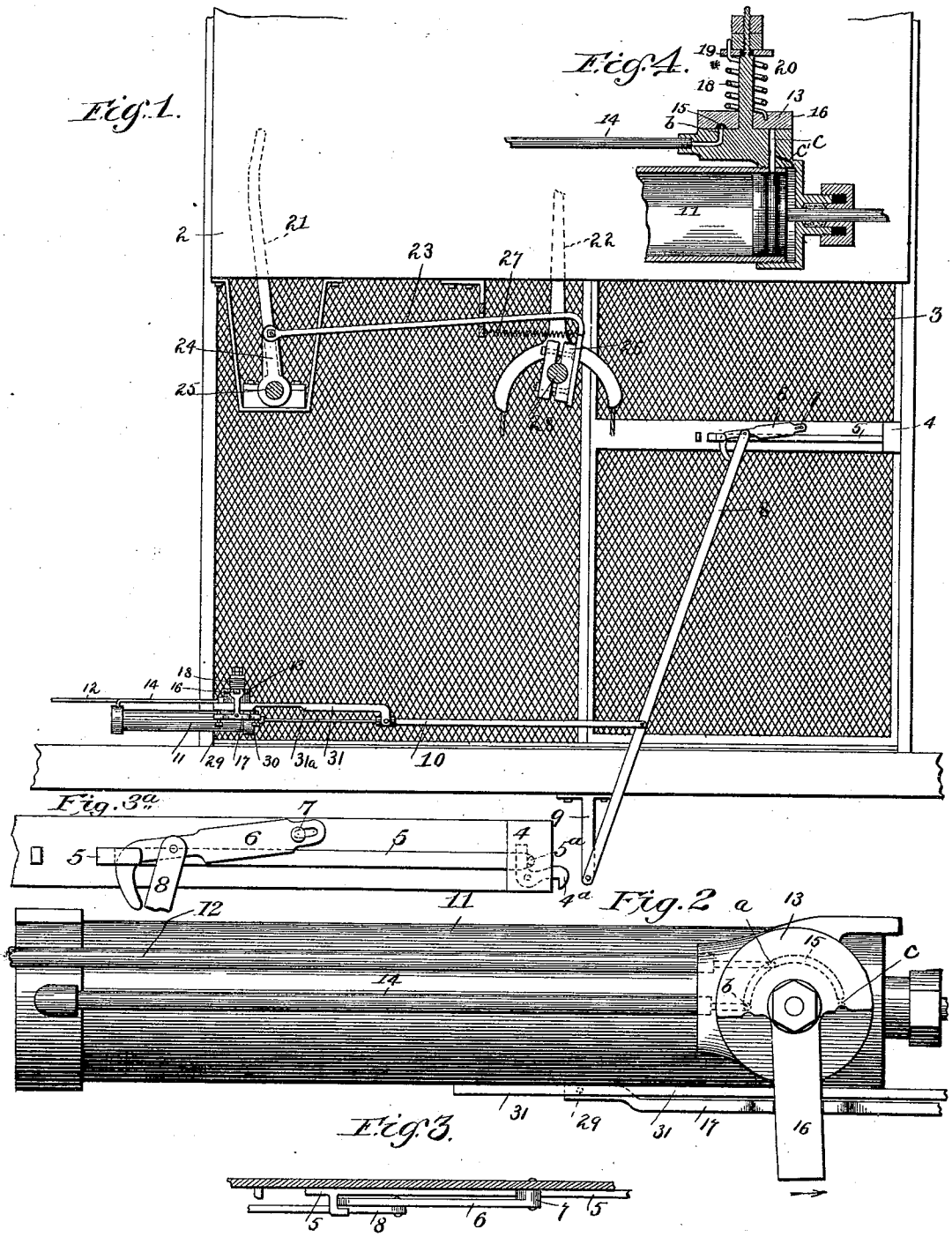
(No Model.) 2 Sheets—Sheet 1

H. ROWNTREE.

DEVICE FOR OPERATING ELEVATOR DOORS.

No. 520,833. Patented June 5, 1894.



Witnesses
Wm. M. Rheem.
Elsie Hewett.

Inventor:
Harold Rowntree
By Raymond & Veeder
Atty's.

THE NATIONAL LITHOGRAPHING COMPANY
WASHINGTON, D. C.

(No Model.)

2 Sheets—Sheet 2.

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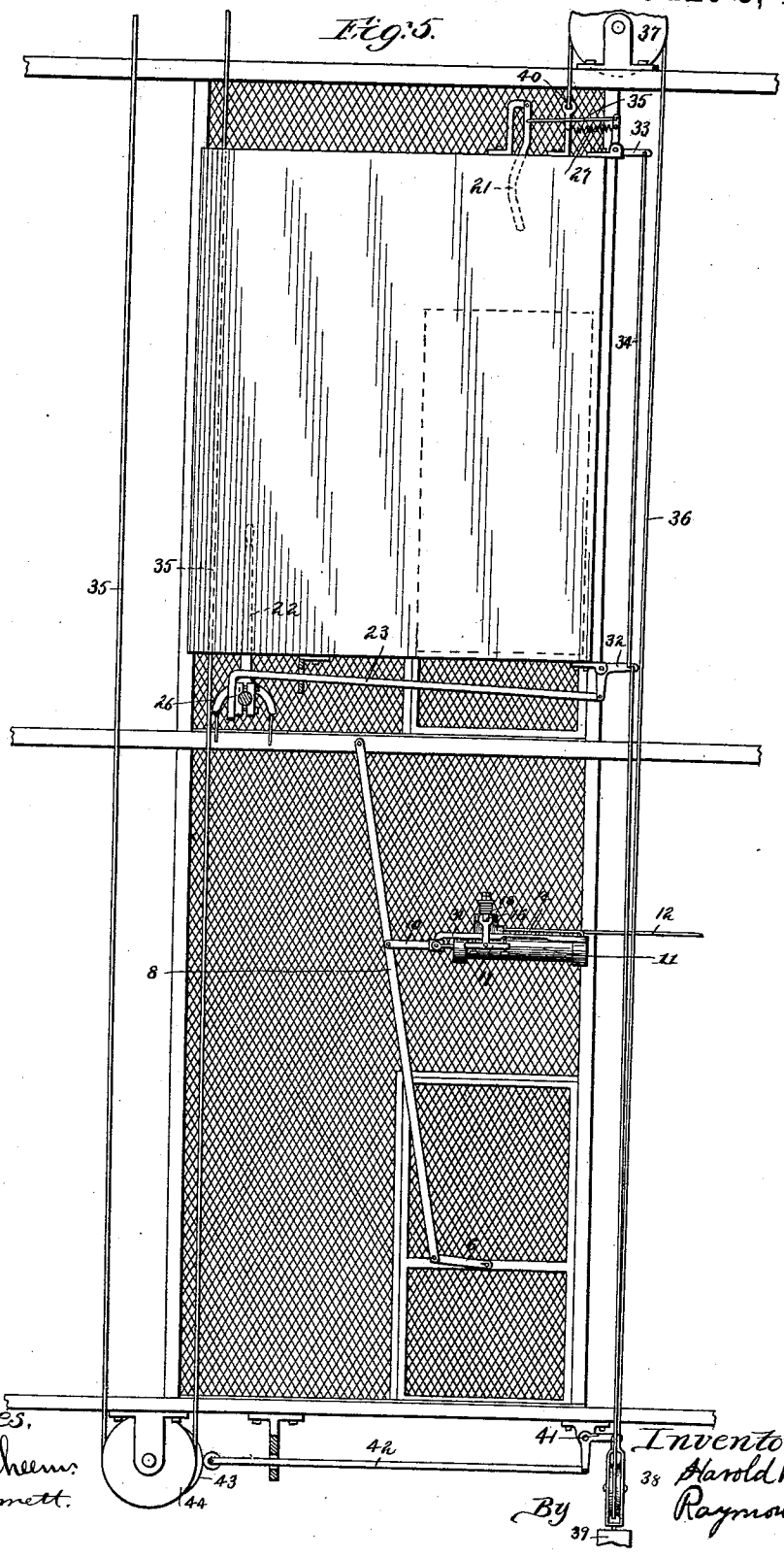
Fig. 5.



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THE NATIONAL LITHOGRAPHING COMPANY
WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

HAROLD ROWNTREE, OF KANSAS CITY, MISSOURI, ASSIGNOR OF ONE-HALF TO J. B. BURDETT, OF SAME PLACE.

DEVICE FOR OPERATING ELEVATOR-DOORS.

SPECIFICATION forming part of Letters Patent No. 520,833, dated June 5, 1894.

Application filed October 5, 1891. Serial No. 407,763. (No model.)

To all whom it may concern:

Be it known that I, HAROLD ROWNTREE, of Kansas City, in the county of Jackson and State of Missouri, have invented certain new and useful Improvements in Devices for Operating Elevator-Doors, of which the following is a specification.

My invention relates to devices for operating the doors at the several landings of an elevator shaft or well, the said devices being so arranged as to automatically open the door when the car is stopped at the landing and to close the same as the car is started away from the landing.

The purpose of my invention may be stated in a general way to be the provision of means whereby the opening and closing of the door is effected automatically without special attention on the part of the operator, it being only necessary that he should manipulate the ordinary stopping and starting gear by which the movements of the car are controlled from within it. In carrying out this general purpose, the special purposes had in view are the provision of devices by which fluid pressure, either steam, air or water, may be employed to actuate the door and whereby the door operating mechanism will be put into action and the door may be entirely closed before the starting of the car.

A further object of my invention is to secure the rapid opening and closing of the door without undue noise or jar.

In the accompanying drawings: Figure 1 is a side elevation of the landing and a portion of the car having my improved devices attached. Fig. 2 is a top view of the cylinder by which the door is operated. Fig. 3 is a top view of the latch upon the elevator door and a portion of the operating lever which is attached thereto. Fig. 3ª is a side view of the same. Fig. 4 is a vertical section of the operating valve and the end of the cylinder to which it is attached. Fig. 5 is a side view of the elevator-car and one of the landing-doors showing the operating cylinder located above the door instead of at the bottom as in Fig. 1, and also showing the connection of the operating-cylinder with a different control-gear from that shown in Fig. 1.

2 (Fig. 1) is the lower part of the elevator-car.

3 is the landing-door upon which is a latch 4 operated by a slide 5 in the usual way. The slide 5 is connected to a tripping device 6, attached to the door by a pin 7, passing through a slot in the end of the tripping-device. To the tripping device is fastened the end of a lever 8 which is pivoted at its other end to a fixed support 9, either upon the landing-floor, as shown in Figs. 1 and 5, or in any other convenient position. To the lever 8 is attached a rod 10 connected to the piston within the cylinder 11. The movement of the piston is thus multiplied and communicated to the door through the lever 8 and its attached tripping-device 6. By the connection of the lever 8 to the door through the tripping-piece 6, the retraction of the slide 5 and the release of the latch 4 is automatically effected by the power applied to open the door; the slot 7 in the end of the tripping-piece 6 allowing a limited movement sufficient to effect the release of the latch. The operation will be clearly understood by reference to Figs. 3 and 3ª. The slot in the end of the tripping device 6 permits a limited movement of the latter under the action of the lever 8. When an impulse is communicated to said lever in the direction to open the door, the tripping device 6 first moves and its curved end pressing against the slide 5 retracts the slide and the catch 4ª connected therewith, which is shown in dotted outline in Fig. 3ª. The curved end of the tripping device 6 affords a sufficient surface to maintain the engagement of the slide 5 and the tripping device 6, notwithstanding the vertical movement imparted to the tripping device 6 by the end of the lever 8 moving in the arc of a circle. The connection between the latch 4 and the slide 5 may be made in any desired manner as my invention is not concerned especially therewith. As shown in dotted outlines in Fig. 3ª, the end of the slide has a projection 5ª which engages one arm of the elbow lever 4ª. The other arm of the elbow lever forms a catch by which the door is secured.

Fluid under pressure is supplied to the cylinder 11 through the pipe 12 connected

with any convenient air-compressing apparatus, if air be the fluid employed, or with a water tank if hydraulic power is used. The admission and exhaust of the motor-fluid to and from the cylinder 11 is controlled by the valve 13, best seen in Fig. 4. In the valve-seat there are three ports—*a*, *b*, and *c*,—the port, *a*, communicating with the supply-pipe 12 and the ports, *b* and *c*, with the forward and back ends, respectively, of the cylinder. The connection of the port *b* is through the pipe 14 (Fig. 2). On the lower face of the valve 13 is a groove 15 by which the port *a* may be put in communication with either the port *b* or *c*. The valve 13 is shifted by an arm 16 projecting over one side of the cylinder. The valve 13 is held to its seat by the spring 18 which bears at one end against the top of the valve and at the other against the lower side of a collar 19 adjustable upon the stud 20 projecting from the valve-seat and upon which the valve revolves. The spring 18 is secured at its ends in the collar 19 and the valve 13, respectively, so as to exert a torsional force upon the valve, tending to turn the valve-arm 16 to the right, as denoted by the arrow in Fig. 2. In this position the motor-fluid is admitted to the outer end of the cylinder 11 so as to close the door. To shift the valve 13 so as to open the door a movable contact-piece 21 is attached to the cage in such a position as to make contact with the valve-arm 16 when the car is in position at the landing floor. Movement is communicated to said contact-piece from the control-gear upon the cage by which the movement of the car is governed. Said control-gear may be of any well known sort, the connection between the control-gear and the contact-piece being varied to suit the special construction of the former. Such connection between the control-gear and the contact-piece is not broadly claimed herein, it forming the subject-matter of a patent granted to me August 2, 1892, No. 479,956.

In Fig. 1 I have illustrated the movable contact-piece as connected to a handling gear which operates the control-valve through a lever upon the car to which are connected cables whose bight may be lengthened and shortened by moving the control-lever 22 in the car, this being a well-known species of handling-gear in extensive use. The connection between the control-lever 22 and the contact-piece 21 consists of a rod 23 pivoted to an arm 24 on the rock-shaft 25, to which the contact-piece 21 is attached. The other end of the rod 23 is bent approximately at right angles to the body of the rod and this bent end bears against a flat face of a cam 26 secured to the rock-shaft 28 of the hand-lever 22. A spring 27 maintains the rod 23 in contact with the face of cam 26.

By the construction just described the contact-piece 21 is projected when the handling-lever is in its middle position said position causing the car to be brought to a state of rest, and the contact piece is retracted whenever the lever is shifted on either side of its central position in order to start the car either up or down. When the control-lever 22 is brought to its central position, in order to stop the car the contact-piece 21 will, on being projected, act upon the arm 16 of the valve 13 and cause the door to be opened as soon as the car reaches the landing. Immediately upon the shifting of the lever 22 to start the car either up or down the shaft, the simultaneous retraction of the contact-piece 21 will permit the valve 13 to shift to its original position, thereby closing the elevator door. The retraction of the contact-piece 21 can be effected by an amount of movement of the hand-lever which is not sufficient to open the valve controlling the movement of the car, and thus the door may be closed before the car is started, and the door can be opened or closed any number of times by movements of the control-lever too slight to affect the starting of the car. In order to effect the noiseless opening and closure of the door, I provide for the cushioning of the door-operating piston within the cylinder 11 by the partial shifting of the valve 13 as soon as the piston approaches the end of its stroke. This method gives perfect control of the movement of the piston at each end of the stroke, so that there will be no rebound, but, instead, a gradual and certain closure.

Connected to the arm 16 of the valve 13 is a T-shaped lever 17 (*vide* Figs. 1 and 4), the middle arm of the lever which forms the stem of the T having a fork through which the arm 13 passes. The said lever is pivoted at the junction of the stem with the top of the T and each of the side arms is provided with a screw 29, 30 which abuts against a slide 31 connected to move with the piston-rod 10. Said slide 31 is hollowed at its central portion so that the screws 29 and 30 can make contact only with the end portions. The movement of the arm 16 by the contact-piece 21 tilts the inverted T-lever 17 so that the screw 30 projects into the hollowed out space of the slide 31. In this position the valve 13 is fully open so as to permit a free escape from the outer end of the cylinder 11 and a like inlet into the inner end of the same. The door is thus quickly opened until, by the travel of the piston-rod the slide 31 is moved so that the screw 30 strikes against the beveled-cam face 31ª, of the slide 31. The depth of this bevel and the amount of projection of the screw 30 is so regulated that the T-lever 17 will be shifted just sufficiently to nearly but not quite close the valve 13, thus reducing the speed of travel of the piston and consequently of the door to any desired rate, the complete opening of the door being insured by the slight opening of the valve remaining. Upon the shifting of the valve to close the door, the T-lever is tilted in the opposite direction and the screw 29 acts in a similar manner to partially close the valve before the

door reaches the end of its travel. The speed of the door is thus diminished so as to avoid noise and rebound when it strikes the jamb and its latching is thus insured. The adjustment of the contact-screws 29 and 30 may be regulated so as to produce any desired amount of cushioning and speed of closure.

In Fig. 5 is illustrated a different control-gear to which the contact-piece of the door-operating mechanism is connected and also a different location of the door-operating devices. It is sometimes inconvenient, owing to the narrowness of the elevator well, to place the door-operating devices as shown in Fig. 1. The arrangement shown in Fig. 5 is adapted to such narrow elevator wells. In said figure the lever 8 conveying the multiplied motion of the piston to the door of the elevator-well is hung from above and the operating cylinder 11 is placed over the door. The connection of this lever 8 with the door is shown without a tripping device, as the presence or absence of such a device has nothing to do with the modification shown in this figure. It may be employed or not, as desired. This necessitates that the contact-piece 21 shall be hung from the top or upper part of the car instead of the bottom as in Fig. 1. To make connection between the rock-shaft of the handling lever 22 I employ a series of bell-cranks 32, 33, and rods or cables 34, 35. The rod 23 bearing upon the cam-face 26 and connected to the bell-crank 32 operates in the same manner as in Fig. 1.

In some constructions of handling-gear the lever (22) upon the car is only moved from its central position when in the act of shifting the elevator control valve either to open or close it, the lever occupying a central position at all other times. In such devices it is customary to attach to the main control-valve the ordinary hand-rope as illustrated in Fig. 5, in addition to having the lever upon the car. The handling-gear used upon the Hale elevator is an example of this class. Whether the hand-rope be used or not, however, it becomes necessary, where the hand-lever upon the car may occupy a central position while the car is moving, to make a connection between the movable contact-piece and the valve or other device operated by the lever upon the car and forming a part of the control-gear. In such cases I combine, with the connections already described between the hand lever 22 and the contact-piece 21, devices illustrated and forming the subject-matter of claims in my application hereinabove named. Said devices consist of a cable 36 passing over a fixed sheave 37 at the top of the elevator-well and a movable sheave 38 at the bottom to which a weight 39 is attached. The cable is connected directly or indirectly to the car so as to travel therewith. As shown herein, one end is attached to a fixed eye-bolt 40 in the top of the car and the other end is attached to the bell-crank 32 carried by the car; the housing of the sheave 38 is connected to one end of the bell-crank 41 pivoted to a fixed support at the bottom of the well and the other end of the bell-crank 41 is connected to a slide 42 operated by a cam 43 fastened upon or connected to the pulley 44, around which the hand-rope 35 passes. In the device just described and illustrated for controlling the movement of the car the shifting of the hand-lever 22 results in the movement of the pulley 44 connected to the control-valve and also the hand-rope 35 which is attached to said pulley 44. When the hand-lever is in its central position after closing the main valve so as to bring the car to rest, the pulley 44 is in the position shown, cam 43 being then in position to move the slide 42 outward and thereby to raise the housing of pulley 38. The slacking of the cable 36 which results therefrom permits the contact-piece 21 to be projected by the operation of its spring 27, so that it acts upon the door operating mechanism and causes the door to be opened. The shifting of the hand-lever to either side of its central position withdraws the contact-piece in the manner already described so as to cause the door of the elevator well to close and the consequent moving of the pulley 44 and its connected hand-rope 35 also permits the weight 39 to come into action and through the cable 36 to assist in the retraction of the contact-piece 21. Thus, in order to permit the contact-piece 21 to come into operation and open the door, it becomes necessary, not only that the hand-lever 22 be shifted to its central position but, also, that the valve-gear operated by said hand-lever be closed, so that there is no possibility of the door opening unless the elevator car is in a state of rest. Further, in case of derangement of the hand-lever mechanism, and the use of the hand-rope 35 for starting and stopping the car, there is still a connection between the contact-piece of the handling-gear which enables the door-operating mechanism to be controlled as before.

Without confining myself to the precise devices herein shown and described, I claim—

1. The combination of a cylinder and piston actuated by fluid pressure; an elevator well-door; connections between said piston and door; a movable contact-piece carried by the car; devices operated from the car to control its movements; and connections from said devices to said movable contact-piece, substantially as described.

2. The combination of a cylinder and piston actuated by fluid pressure; an elevator well-door; connections between the said piston and door, said connections consisting of a slotted tripping-piece attached to the door and a lever pivoted at one end to said tripping piece and at the other to a fixed support in the elevator well connected at an intermediate point to the piston-rod; a movable contact-piece carried by the car; devices operated from the car to control its movements; and connections from said devices to said

movable contact-piece, substantially as described.

3. The combination of a cylinder and piston actuated by fluid pressure; an elevator well door; connections between said piston and door; a movable contact-piece carried by the car; devices operated from the car to control its movements; connections from said devices to said movable contact-piece, said connections comprising a cam operated by the hand-lever which controls the movement of the car; and a rod connected to said movable contact-piece and held in contact with said cam-face by spring pressure; substantially as described.

4. The combination of a cylinder and piston actuated by fluid pressure; an elevator well door; connections between said piston and door; a valve controlling the admission and exhaust of fluid to and from said cylinder; and devices connected to said valve and piston and adapted to partially close the valve before the piston reaches the end of its stroke, substantially as described.

5. The combination of a cylinder and piston actuated by fluid pressure; an elevator well door; connections between said piston and door; a valve controlling the admission and exhaust of fluid to and from the said cylinder; a slide having beveled cam-faces connected to the piston-rod; a T-shaped lever connected to said valve provided with contact-points, adapted to cooperate with the said beveled cam-faces and partially close said valve as the piston nears the end of its stroke, substantially as specified.

6. The combination of a cylinder and piston actuated by fluid pressure; an elevator well door; connections between said piston and door; a rotary-valve controlling the admission and exhaust of fluid to and from said cylinder provided with a laterally projecting arm and impelled in one direction by spring pressure and in the other by a movable contact-piece upon the car; a T-shaped lever having its middle arm forked and connected to said laterally projecting valve-arm; adjustable contacts at the extremities of the side arms of said inverted T-lever and the slide connected to the piston-rod having beveled cam-faces co-acting with said adjustable contacts; substantially as described.

7. The combination with the landing-door of an elevator well, of devices connected thereto and adapted to open and close it; a movable contact-piece carried by the car adapted to put said door-operating devices into action; handling-gear carried by the car, and connected to said movable contact-piece; a cable passing over sheaves at the top and bottom of the elevator well and running with the car and having one or both of its ends connected with the movable contact-piece upon the car; and connections between the control devices governing the movement of the car and the lower sheave to slacken or tighten said cable, whereby said contact-piece is operated by the joint action of said handling gear on the car and said connections to the control devices, substantially as described.

8. The combination with an elevator well door of a cylinder and piston actuated by a fluid pressure; connections between said piston and door; devices operated from the car to control the movements of said piston, and means adapted to automatically confine a portion of the fluid contained in said cylinder as the door nears the end of its movement, substantially as described.

HAROLD ROWNTREE.

Witnesses:
IRWIN VEEDER,
J. B. BURDETT.