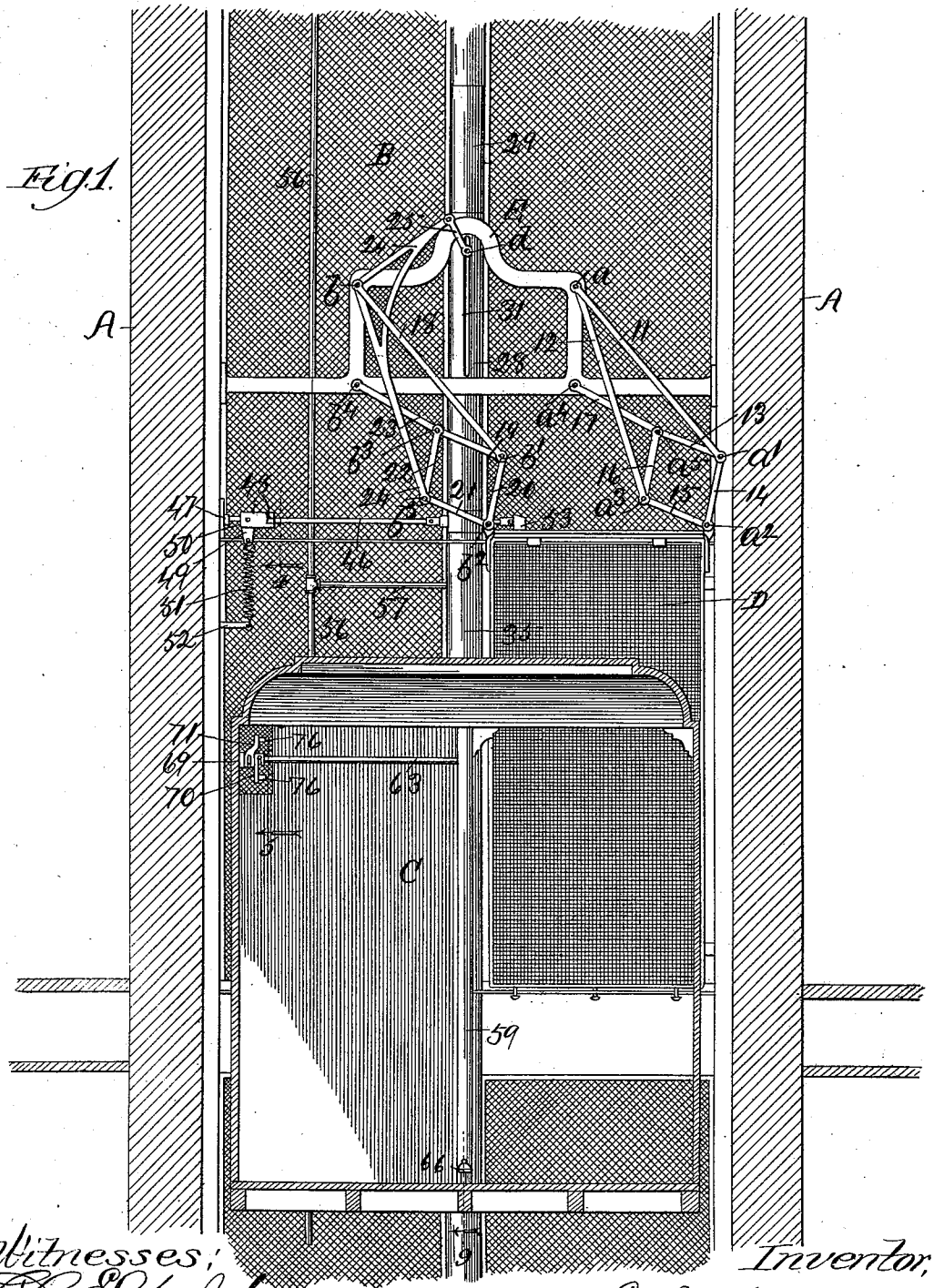
(No Model.) 2 Sheets—Sheet 1.

E. A. HALDEMAN.

DEVICE FOR AUTOMATICALLY OPERATING ELEVATOR DOORS.

No. 561,164. Patented June 2, 1896.

Fig. 1.



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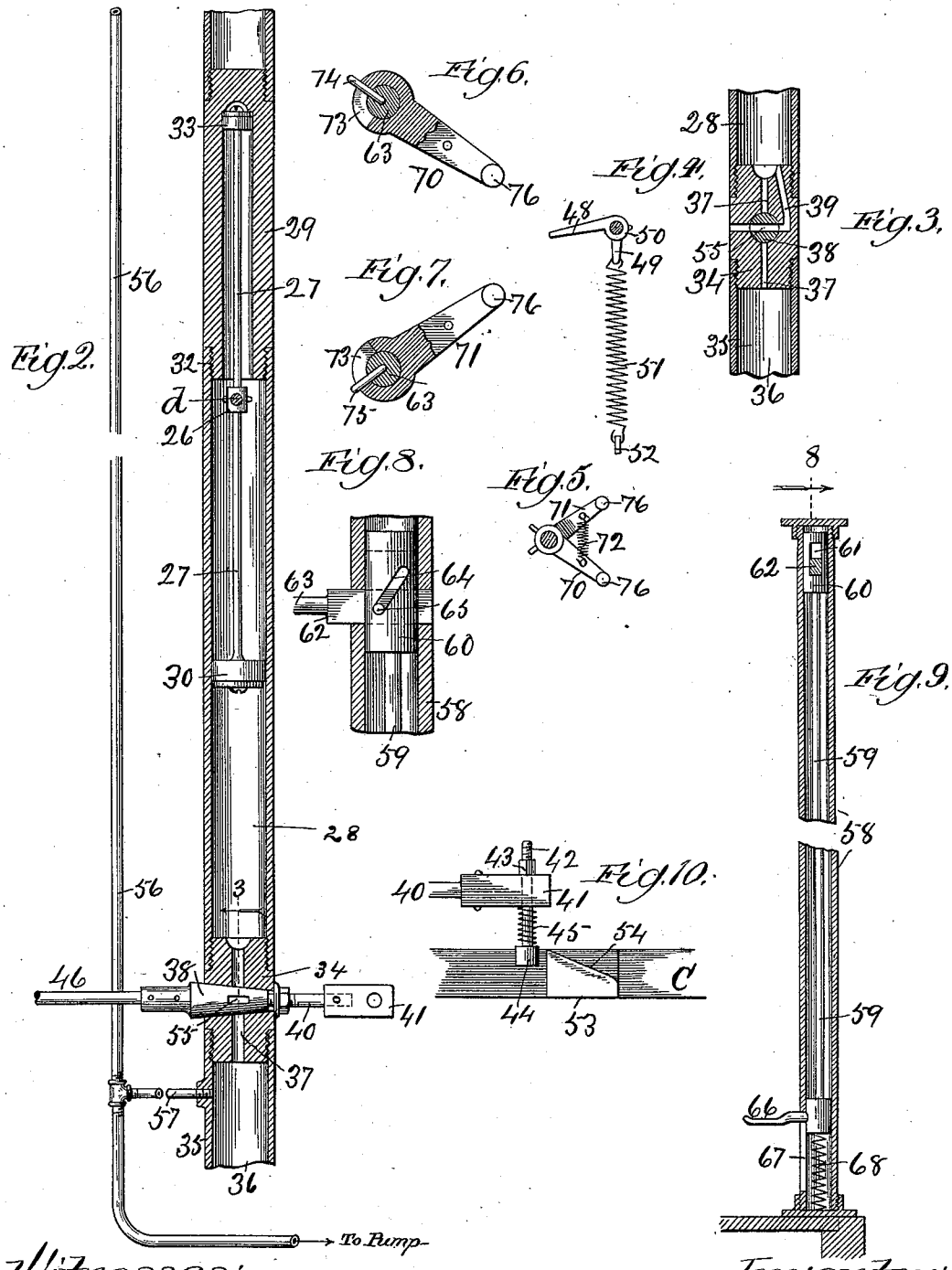

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UNITED STATES PATENT OFFICE.

EPHRAIM A. HALDEMAN, OF CHICAGO, ILLINOIS.

DEVICE FOR AUTOMATICALLY OPERATING ELEVATOR-DOORS.

SPECIFICATION forming part of Letters Patent No. 561,164, dated June 2, 1896.

Application filed July 3, 1895. Serial No. 554,874. (No model.)

To all whom it may concern:

Be it known that I, EPHRAIM A. HALDEMAN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Devices for Automatically Operating Elevator-Doors; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to improvements in that class of elevators used in office, apartment, and other buildings, and has for its object to provide an attachment for automatically opening and closing the elevator-doors, as will be hereinafter set forth.

In the drawings, Figure 1 is a broken-away sectional elevation looking outwardly from the shaft, the car being shown in position between landings; Fig. 2, a broken-away sectional elevation of an operating-cylinder system, the vacuum-exhaust pipe being shown in elevation; Fig. 3, a broken-away vertical section on line 3, Fig. 2, looking in the direction indicated by the arrow; Fig. 4, a detail sectional elevation on line 4, Fig. 1; Fig. 5, a detail sectional elevation on line 5, Fig. 1; Figs. 6 and 7, detached details of the companion shifting-arms; Fig. 8, a broken-away sectional elevation on line 8, Fig. 9; Fig. 9, a broken-away sectional elevation on line 9, Fig. 1; and Fig. 10, a broken-away plan of the top of the door and the locking mechanism.

A may represent the side walls inclosing an elevator-shaft, B the front wall, C the car, and D the landing-door in the front wall and controlling the usual passage-way therethrough.

The door is supported in a suspended position from the inside of the front wall and is adapted to have a sliding movement edgewise across the door-opening therein.

A bracket E, Fig. 1, is rigidly secured to the inner side of the front wall above the door and is connected therewith by a system of compound levers and links having pivotal joints or connections which provide for the sliding movement of the door and which will next be described.

The upper ends of companion levers 11 and 12 are pivoted to the upper part and one end of the supporting-bracket, as at a. The lower end of lever 11 is connected to the joining ends of links 13 and 14 by a common pivot-pin a'. The lower joining ends of links 14 and 15 are connected to one corner of the door by a pivot-pin a^2. The lower end of lever 12 is connected with the joining ends of links 15 and 16 by a pivot-pin a^3. One end of a link 17 is pivoted, as at a^4, to the supporting-bracket, the opposite end being connected to the joining ends of links 13 and 16 by a pivot-pin a^5. This comprises one of a pair of hangers supporting and moving the door.

The upper end of lever 18 of the companion hanger is secured to the opposite end of the supporting-bracket by a pivot-pin b. The lower end of lever 18 is connected to the joining ends of links 19 and 20 by a pivot-pin b'. The lower ends of links 20 and 21 are connected to the opposite upper corner of the door from that of the companion hanger by a pivot-pin b^2. The joining ends of links 19, 22, and 23 are connected by a pivot-pin b^3, the upper end of link 23 being pivoted to the supporting-bracket, as at b^4. An angular or bell-crank lever 24 is connected at its pivotal point to the supporting-bracket by the same pivot-pin b, inserted through the joining end of lever 18. The lower end of angular lever 24 is connected to the joining ends of links 21 and 22 by a pivot b^5. The upper end of angular lever 24 is pivoted to one end of a link 25, the opposite end of which is in turn connected to a pin d, Figs. 1 and 2, secured in a collar 26, mounted on a piston-rod 27, located in cylinders 28 and 29. The cylinders 28 and 29 form what may be termed "combined air and vacuum" cylinders, joined together, atmospheric air being admitted to cylinder 28, but not to cylinder 29. The companion hangers are exact duplicates with the exception of the angular lever, the only difference from that of the corresponding lever in the first hanger being that of the extension to connect with the operating-pistons.

The series of levers and links entering into the construction of the hangers is so arranged as to exert a powerful leverage, thus requiring but little power to move them and therewith the object supported therefrom. The landing-door is shown in its closed position,

and when open the levers and links will assume the opposite position from that shown.

A piston 30 is mounted on the lower end of rod 27 and is adapted to have a reciprocating movement in cylinder 28. This cylinder is provided with a slot-opening 31, Fig. 1, which allows for the traversing movement of stud *d*, fixed in collar 26, projecting through the slot and having an operative connection with one of the hangers. This slot does not extend into that part of the cylinder traversed by the working piston so as to communicate with the vacuum side thereof.

The second cylinder 29 is connected to the upper end of the first cylinder 28, as at 32. This cylinder is of a less diameter than cylinder 28, as shown in Fig. 2, and is provided with a piston 33, mounted on the upper end of rod 27. This piston is of a correspondingly less area with reference to the piston in the first cylinder. These cylinders open into each other, as shown, and form a differential vacuum system for moving the doors in opposite directions. One end of a threaded connection 34, Fig. 2, engages with the lower end of cylinder 28. A tubular extension 35 engages with the lower end of connection 34 and provides a vacuum-chamber 36. Connection 34 is provided with a passage 37, extending longitudinally therethrough and opening into cylinder 28 and vacuum-chamber 36. A valve 38 is seated in connection 34 and controls the passage therethrough. The connection 34 is also provided with an angular passage 39, which leads downwardly from the lower end of cylinder 28 and opens out through the side, as shown in Fig. 3.

One end of a rod 40 has a suitable connection with the inner end of valve 38. A head extension 41 is mounted on the outer end of rod 40 and has a locking-pin 42 loosely inserted therethrough and adapted to have an endwise movement, which is limited in one direction by a nut 43 and in the other by a head 44. A spring 45 returns and retains this pin in the normal position. (Shown in Fig. 10.) One end of a valve-rod 46 is secured to the outer end of valve 38, Figs. 1 and 2, the opposite end resting loosely in a socket-bearing 47, secured rigidly in place. An arm 48, Fig. 1, is rigidly mounted on the valve-rod. A lug 49 is formed on the hub part 50 of arm 48 and has one end of a spring 51 connected thereto, the opposite end of which is attached to a fixed lug 52. This spring returns arm 48 and the valve-rod to their normal position when rocked. A catch 53 is fixed on the top of the landing-door, Figs. 1 and 10, and is provided with a beveled edge 54. The door is shown closed. The locking-pin 42 and the catch (shown in their relative locking positions) prevent the door from being opened until the valve is rotated far enough to throw the locking-pin out of the pathway of the catch. The corresponding normal position of the valve is shown in Fig. 3, the port 55 therethrough registering with passage 39 and providing a communication between cylinder 28 and the atmosphere. It will be understood that the arrangement of double cylinders and the operative connection between the same and the doors will be provided at each landing. The stand-pipe 56, connecting with a vacuum-pump (not shown) and with each vacuum-chamber by the tube 57, is, however, continuous to the last landing.

A tube 58, Figs. 1 and 9, is rigidly secured to the elevator-car C. A rod 59 is located inside of this tube and is adapted to have a vertical movement. A slide 60, rigidly secured to the upper end of rod 59 and provided with an enlarged opening 61, is loosely mounted on the flattened end 62 of a rod 63, extending into tube 58, as shown in Fig. 8. This slide is also provided with a diagonal slot 64, in which rides a pin 65, Fig. 8, that is rigidly inserted in the flattened end of rod 63. A foot-pedal piece 66 is secured to the lower end of rod 59 and projects out through an elongated slot 67 in tube 58. A spring 68 returns these parts to their normal positions when the pressure on the foot-piece is relaxed.

The opposite end of rod 63 is loosely inserted in a socket-bearing 69, providing for an endwise movement. On this end of rod 63 are loosely mounted, Figs. 5, 6, and 7, companion arms 70 and 71, the relative normal positions of which are illustrated in Fig. 5 and are retained in those positions by a spring 72. The hub parts of these arms are each provided with a segmental slot 73, through which is inserted locking-keys 74 and 75, fixed in rod 63. This arrangement adapts the arms to have a limited rocking or rotary movement. The end of each of the arms is provided with a projecting finger 76.

The door is shown closed and the different parts of the operating mechanism in a corresponding position.

When the elevator is on the up movement and the landing is reached, the operator presses down on the foot-pedal, which has the effect of imparting a slight endwise movement to rod 63 and brings arm 70 into position to come in contact with arm 48 on the valve, and moves the valve one-quarter of a turn and opening the passage from the larger cylinder communicating with the vacuum-chamber, which has the effect of drawing down the piston and automatically opening the door. When the foot-pressure of the operator is relaxed, the spring underneath returns these parts to their normal positions, so that the atmospheric air will rush into the larger cylinder, which, together with the action of the smaller vacuum-cylinder, has the effect of closing the door. It will be readily seen and understood that the larger cylinder overcomes the area of the lesser cylinder and so opens the door.

On the down movement of the car the companion arm comes in contact with the arm on the valve-rod and rotates the valve and opens one passage and closes the other in the same

manner as when the car is on the up movement, so that the operation of opening and closing the door is precisely the same no matter in which direction the car is traveling.

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

1. The combination with a landing-door, of a vacuum-cylinder system, comprising cylinders of different diameters opening into each other and having a piston-rod common to each of said cylinders and pistons mounted on the respective ends thereof, an operative connection between said door and the cylinder system, the elevator-car, and the operating mechanism, for opening and closing the door, substantially as described.

2. In an elevator system, the combination with a landing-door, of a combined vacuum and air cylinder, a vacuum-cylinder of a less area and opening into the larger cylinder, a piston-rod, running from one cylinder to the other and having pistons mounted on the respective ends thereof, a vacuum-chamber, a connection, having passages and joining the larger cylinder and said vacuum-chamber, a valve, seated in said connection and adapted to control the passages therethrough, the elevator-car, means for operating said valve by the movement of the car, and the operative connection between the landing-door and piston-rod, substantially as described.

3. In a device for automatically operating elevator-doors, the combination with combined vacuum and air cylinders, a piston-rod, common to both of said cylinders and having pistons mounted on the respective ends thereof, the elevator-door, a hanger, forming an operative connection between said door and piston-rod, and means, for imparting the required movement to said pistons, substantially as described.

4. In a device for automatically operating elevator-doors, the combination with a vacuum-cylinder system, of the elevator-door, a hanger, comprising a series of compound levers, and links connecting said vacuum system and door, a rocking rod, a movable locking-bolt, inserted in the inner end of said rod, a catch, mounted on the top of the elevator-door and adapted to lock the same against opening when said rod is in its normal position, a projecting arm, mounted on the outer end of said rod and adapted to have an intermittent contact with a corresponding arm on the car, whereby said rod is rotated out of its locking position to permit of the door being opened, substantially as described.

5. The combination with an air and vacuum cylinder, a vacuum-cylinder connected thereto and opening therein, a piston-rod, common to both of said cylinders and inclosed thereby, the pistons mounted on the respective ends of said rod, a vacuum-chamber, a connection, joining one end of the air and vacuum cylinder, said connection being provided with two ports or passages therethrough, one forming a communication between said cylinder and vacuum-chamber and the other leading outwardly from said cylinder into the atmosphere, a valve, seated in said connection, and means for rotating said valve to alternately open and close the passages through said connection, substantially as described.

6. The combination with an elevator-car, of a vertical rod, a foot-pedal mounted on the lower end of said rod, a spring, adapted to return said rod to its normal position when the pressure on the pedal is relaxed, a slide, mounted on the upper end of said rod and provided with a diagonal groove, a horizontal rod, a pin, inserted in the inner end thereof and engaging with said slot for the purpose of imparting an endwise movement to said rod coincident with the endwise movement of the vertical rod, companion arms mounted on the outer end of said horizontal rod and adapted to have a limited rotary movement and contact with a shifting arm controlling the movement of the elevator-door, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

EPHRAIM A. HALDEMAN.

Witnesses:
L. M. FREEMAN,
L. B. COUPLAND.