

May 26, 1931.

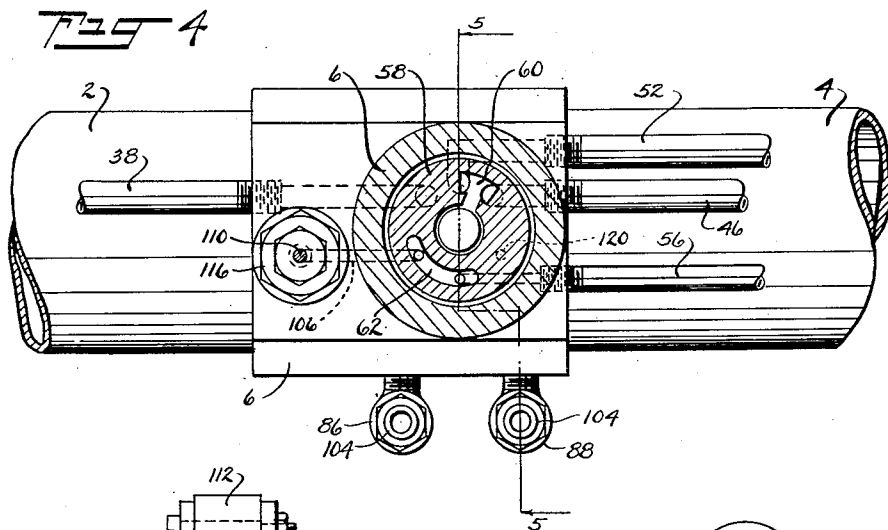
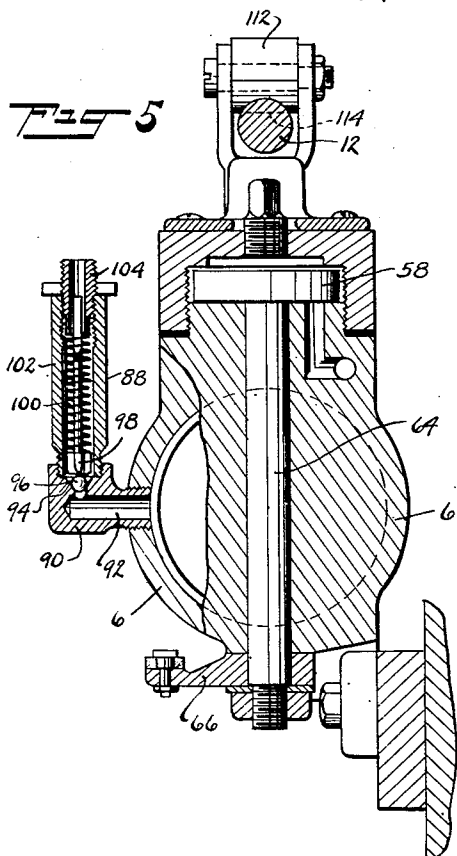
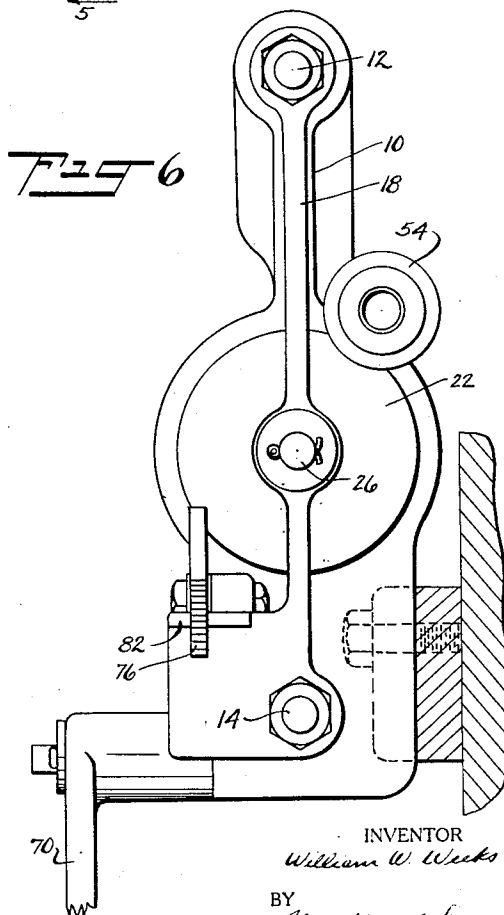
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ELEVATOR DOOR OPERATING MECHANISM

Filed Nov. 15, 1923

4 Sheets-Sheet 3



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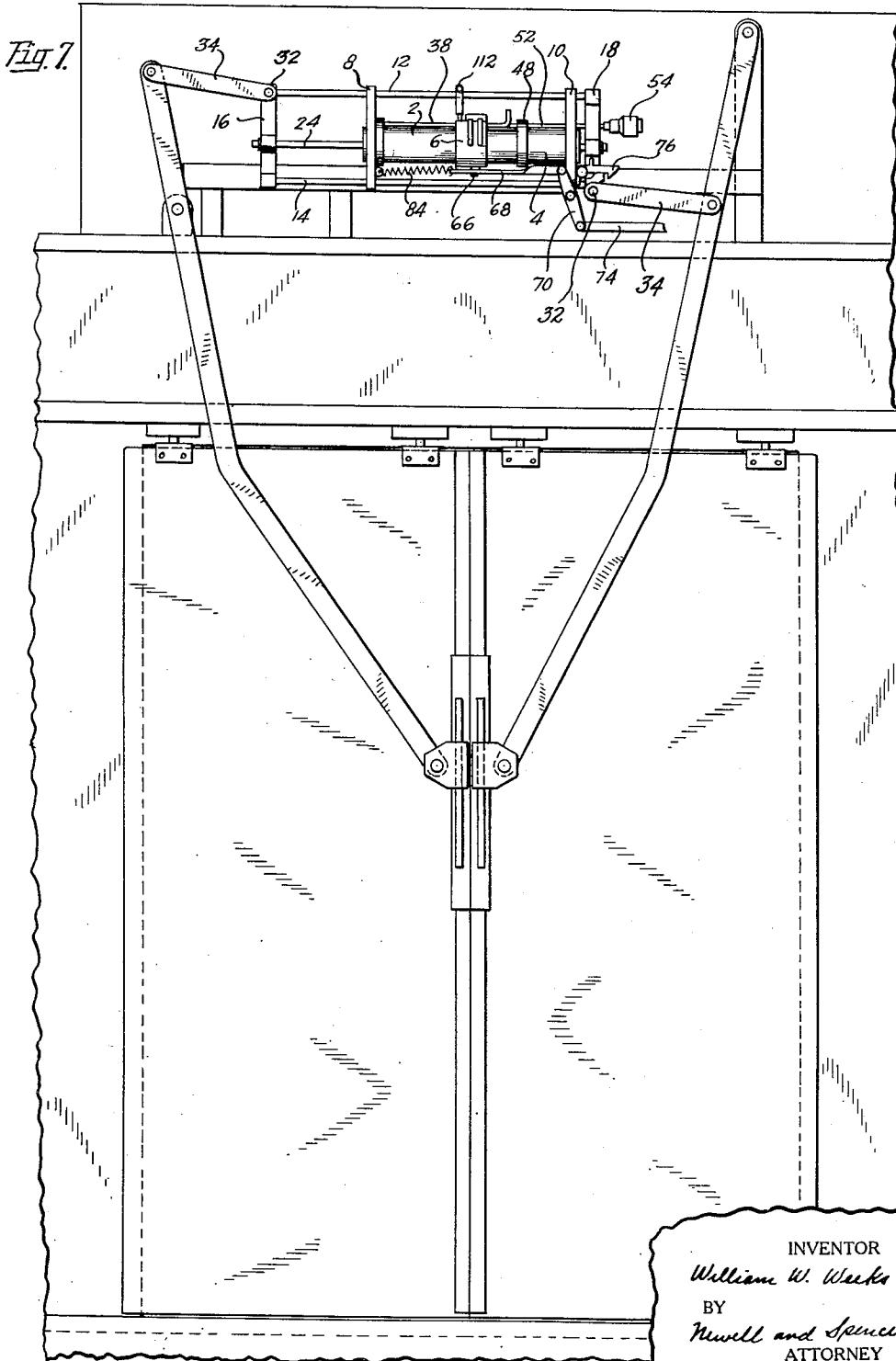
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UNITED STATES PATENT OFFICE

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ELEVATOR DOOR OPERATING MECHANISM

Application filed November 15, 1923. Serial No. 674,848.

The present invention relates to improvements in elevator door operating mechanisms and more particularly to improvements in pneumatically operated devices for operating the toggle levers of elevator doors, in which the opening and closing of the doors is under control of the operator by the manipulation of a valve or valves to admit pressure fluid to, and exhaust pressure fluid from, the operating cylinders.

In devices for operating elevator doors, in which the movement of the device is pneumatically cushioned to cushion the movements of the elevator door during the opening and closing thereof, considerable difficulty has been experienced when it has been attempted to speed up operation. It has been found that with the use of increased pressure of the operating fluid to operate the elevator doors, more rapidly, a jarring or reciprocating movement of the door takes place, or a rebounding of the door occurs in a portion of its movement, because of excessive pressure built up in the cushioning fluid. It appears that the excessive pressure is built up during cushioning, because of the momentum gained by the door in the opening or closing movement, which results in a building up of pressure in excess of the operating pressure.

One object of the present invention is to overcome the above defects and improve the construction of elevator door operating mechanisms in such a manner as to permit a rapid operation of the mechanism without causing rebounding or oscillating movement of the elevator door.

In the form of elevator door operating mechanisms in which two operating cylinders are employed, a considerable loss of power occurs due to leakage of compressed air while the door is in closed position, due to the fact that the full pressure of air or other operating fluid is on the pistons in the door closing cylinder, and leakage of the pressure fluid takes place around the piston and around the piston rod. It is a further object of the present invention to provide a mechanism in which the leakage of air or other operating fluid is prevented during the

time the door is in inoperative or closed position. Another object of the present invention is to provide a mechanism in which the above and other improvements are combined to attain an efficient and rapidly operating elevator door operating device. With these and other objects in view, the invention comprises the features hereinafter described and more particularly defined in the claims.

The preferred embodiment of the invention is illustrated in the accompanying drawings, in which:

Fig. 1 is a view in elevation of the improved door operating mechanism, shown in the position corresponding to that in which the elevator door, to which it is adapted to be connected, is closed;

Fig. 2 is a view similar to that of Fig. 1, showing the apparatus in the position corresponding to the open position of the elevator door;

Fig. 3 is an enlarged vertical section of the mechanism in which the parts are in the relative positions corresponding to the closed position of the elevator door, showing the operating valve controlling admission and exhaust to and from the operating cylinders, and also the shut-off valve and mechanism connected therewith which serve to cut off communication of pressure fluid with the door closing cylinder when the door is in closed position;

Fig. 4 is a detail plan view of the operating valve, taken on the line 4—4, Fig. 3;

Fig. 5 is a sectional view taken on the line 5—5, Fig. 4;

Fig. 6 is an enlarged end view of the device taken from the right in Fig. 1; and

Figure 7 is a view illustrating how the device may be mounted for the operation of elevator doors.

In elevator door operating mechanisms in which compressed air is employed to operate a mechanism of the general form shown in the drawings, it is preferable to connect the piston rods, or parts movable therewith, to swinging arms or the toggle levers of the elevator doors and to mount the cylinder or cylinders by suitable means to a part of the elevator shaft, preferably over the elevator

shaft doors when it is to be used for operating the elevator shaft doors as shown in Fig. 7, or over the elevator car when it is to be employed for operating the car door or doors.

The preferred form of the invention comprises two cylinder casings 2, 4, which are screwed into or otherwise attached to a valve block or coupling member 6, which is preferably adapted to contain an operating valve to control the admission and exhaust to and from the cylinders. The outer ends of the cylinders are supported on suitable frames 8, 10, which are preferably constructed so as to contain openings in which guide rods 12, 14 are adapted to slide during the operation of the device. The guide rods 12, 14 are preferably connected by means of transverse connecting members 16, 18 to piston rods 24, 26, the piston rods being connected to pistons 28, 30 adapted to slide in cylinders 2, 4, respectively. The ends of the cylinders are preferably covered by means of cylinder heads or caps 20, 22, having openings therein through which piston rods 24, 26 pass. The pistons, piston rods, and guide rods are preferably connected to the swinging arms or toggle levers of the elevator door or doors to be operated by means of a link or links 34 which may be connected thereto at any suitable point, such as at 32, at which the transverse members 16, 18 are connected to the guide rods 12 and 14 respectively. In the cylinder casing 2 is an exhaust port or ports 36 through which air or other operating fluid may be exhausted during a portion of the piston stroke, as will be hereinafter explained. The port is suitably connected to an exhaust pipe 38 by means of a casing 40 having a passageway or port 42 therein. In the cylinder 4 is a similar exhaust port 44 which communicates with an exhaust pipe 46 through an opening or port 50 in a housing or casing 48 by means of which pressure fluid may be exhausted from the cylinder 4 during the closing movement of the elevator door. From the exhaust pipes 38 and 46 pressure fluid is conducted through suitable ports in the valve housing or coupling member 6, as will be hereinafter described, and passes to an exhaust pipe 52 preferably into the atmosphere through an exhaust muffler 54, shown more particularly in Figs. 1 and 2.

In order to admit pressure fluid to the cylinders to operate the pistons and the mechanism connected therewith, a pipe 56 leading from the source of pressure fluid supply is connected to suitable passageways in the housing 6 containing the operating valve. It is preferable to control both admission to and the main exhaust from the cylinders by means of a single valve, and in order to accomplish this a valve 58, in which are two separate passages or passageways 60, 62 is

provided, by means of which the exhaust pipe and admission pipe may be alternately connected with the cylinders 2 and 4 to attain admission of pressure fluid to and exhaust of pressure fluid from the cylinders. The valve 58 is suitably mounted in the coupling member or valve housing 6 so as to be under the control of a valve stem 64, as shown in Figs. 3 and 5, to which may be connected an arm or link member 66 (Fig. 2) which may be connected through linkages to an operating handle of any desired form. The arm 66 is preferably connected to a connecting rod or arm 68 which is in turn connected to a lever 70 pivoted at a fulcrum or pivot 72, attached preferably to a stationary part of the frame. To the lever 70 is connected an arm 74 which may be directly connected to the operating handle, by means of which the operation of the valve 58 is controlled.

In order to lock the door and mechanism when the door is in closed position, a latch 76 is provided which is adapted to lock when the door is closed and to be opened when the operating handle is moved so as to admit pressure fluid to open the door. A lug or projection 78 is provided on the lever 70, which is adapted to contact with a projection or lug 80 on the latch 76 when the operating lever is moved into position to admit air or operating fluid to open the door or doors to which the mechanism is connected, the lever 70 is turned causing the latch to raise out of contact with the holding means 82. The locking means 82 for the latch is preferably mounted on the transverse member 18, so as to move with the guide rods when the mechanism is operated. A spring 84 may be connected at one end to the link member 68, and at the other end to the frame member 8 by means of which the operating lever will be brought back to the position corresponding to the closed position of the elevator after operation of the lever to admit pressure fluid to one of the cylinders.

Connected to the coupling member or valve housing 6, so as to communicate with the ends of the operating cylinders 2 and 4, are relief valves 86, 88 by means of which the fluid pressure in the cylinders during the cushioning of the pistons and the parts connected thereto may be maintained below a predetermined value. By this means, cushioning fluid at the ends of the cylinders will be exhausted to the atmosphere at the ends of the strokes of the pistons in the respective cylinders, and will prevent jarring, rebounding, or oscillating movement of the pistons and parts connected therewith. The relief valves preferably comprise a valve casing 90 (Fig. 5) which may be screwed into or otherwise attached to the coupling member 6, and a spring casing 102 adapted to hold a regulating spring 100 for the valve. In the part 90 is a passageway 92 which is en-

larged in the upper portion of the casing 90 to form a conical seat 94 in which a ball 96 is adapted to seat and which may be held in place by means of a cage or holding member 98. The valve holding member 98 is forced downwardly against the ball by means of the spring member 100, which may be adjustably held in place in the casing 102 by means of a hollow screw 104, by means of which the tension in the spring may be regulated so as to hold the ball 96 to its seat with any desired amount of pressure and by means of which also any desired fluid pressure may be attained during the cushioning action. If during the cushioning, which takes place through the trapping of a residual amount of pressure fluid, the pressure exceeds that corresponding to the set of the spring 100, then the ball 96 will be raised from its seat and permit exhaust fluid from the end of the cylinder until the pressure corresponding to that determined by the pressure of the spring 100 is attained in the cylinder.

In order to provide means whereby, when the pressure fluid has been admitted to the cylinder 2 to return the piston and parts connected thereto to the position corresponding to closed position of the elevator door, the pressure of the fluid may not be maintained in the cylinder until the door is again operated, passage 106 is provided in which is a valve 108, preferably conical in form, which is so mounted as to be closed when the door is in closed position. By this means communication of pressure fluid with the cylinder 2 in closed position of the elevator door, is entirely prevented. The valve 108 is preferably connected by means of a valve stem 110 with a roller 112, which is mounted so as to roll upon the guide rod 12. In the guide rod 12 at a point corresponding to the position of the roller, when the door is in closed position, is a depression 114 into which the roller 112 falls when in contact with the corresponding part of the guide rod. The valve stem 110 is adapted to pass through a bushing 116, serving as a guide for the valve stem, and serving also as a seat for a spring 118 by means of which the valve is forced to its seat when the roller 112 passes into the depression 114. The tension of the spring 118 may be regulated by suitably adjusting the position of the bushing 116, which is suitably fastened in a part of the casing or coupling 6, preferably by means of screw-threaded connections.

The valve passages through which operating fluid passes to and from the cylinders may be best described in connection with the operation of the mechanism, which will now be described.

When the elevator door or doors are to be opened from the closed position, illustrated in Figs. 1, 3 and 7, the operating handle con-

nected to the rod 74 is turned, by means of which the lower end of the link 70 is moved to the left into the position shown in Fig. 2. By this movement, the upper portion of the lever 70 is swung to the right, by means of which the latch 76 is lifted so as to be disengaged from the holding means 82, and by which the link 68 is also moved to the right, putting the spring 84, connected to the end of the member 68, in tension. By the opening movement of the operating handle, the link arm 66, connected to the link 68, is turned to the right or in a clockwise direction, Fig. 1, by means of which the valve 58 will be swung in a counter clockwise direction from the positions shown in Fig. 4 of the drawings to a position in which the pressure fluid pipe 56 communicates through the passage 62 in the valve 58 with the admission port 120 leading to the end of the cylinder 4, and the exhaust pipe 52 communicates through the passage 60 in the valve 58 with the exhaust pipe 38, communicating with the exhaust port 36 at the end of the cylinder 2. Pressure fluid acting on the piston 30 in the cylinder 4 moves the piston and piston rod 26 to the right, by means of which the guide rod 12, which is connected to the piston rod 26 through the transverse member 18, moves to the right, and the roller 112 moves out of the depression 114. The valve 108 is raised with the movement of the roller away from its seat 122, by means of which the passage 106 communicates through the opening at the seat 122 with the interior of the cylinder casing 2. As the valve 58 is now in the position in which pressure fluid is admitted to the cylinder 4, the passage 62 in the valve 58 is in a position to the right of that shown in Fig. 4, in which the passage 106 is cut off from communication therewith. During the movement of the piston 30 in the cylinder 4 to the right, air or other pressure fluid to the right of the piston may be exhausted into the atmosphere through the clearance between the piston rod 26 and the opening in the cylinder head 22. In the cylinder casing 2, during the movement of the piston 28 to the right, the air or pressure fluid in the cylinder at the right of the piston is compressed and at the end of the stroke serves to cushion the movement of the piston and the elevator door mechanism. When the pressure of the cushioning fluid, during the compressing action by the piston, exceeds a predetermined amount determined by the set of the spring 100 in the relief valve 86, the ball 96 will be raised from its seat against the force of the spring, whereby the pressure fluid passes through the openings in the valve and exhausts to the atmosphere, until the pressure is reduced to that determined by the set of the spring 100. By this means a sudden peak or excess of pressure is released, and the rebounding or vibration of the ele-

vator door or doors due to the sudden back pressure is entirely overcome, thereby attaining smooth operation at both rapid and slow speeds.

When it is desired to close the elevator door, the operating handle is released or turned, assisted by the spring 84, so that the valve 58 is brought into the position shown in Fig. 4 of the drawings. By this movement of the valve, the passage 120 leading to the cylinder 4 is brought out of communication with the passageway 62 in the valve, and the air pipe or fluid pressure pipe 56 is brought into communication through the passage 62 in the valve with the passageway 106, by means of which air passes from the pipe 56 through the passageway 62 in the valve and through the passageway 106 into the end of the cylinder 2, the valve 108 being still in a raised position. By the passage of pressure fluid through the port or opening of the valve seat 122 into the cylinder 2, the piston 28, which is now in the end of the cylinder in proximity to the valve casing or coupling member 6, is forced to the left until the apparatus is in the position corresponding to the closed position of the elevator door. In the passage of the piston 28 to the left, the air or pressure fluid in the cylinder to the left of the piston is exhausted mainly through the space between the opening in the cylinder head 20 and the piston rod 24, but also through an auxiliary port 124 in the cylinder which communicates with an opening 126 in the casing 8 connected to the end of the cylinder 2. It is apparent that the exhaust through the ports 36 and pipe 38 remains cut off by the valve 58 during closing movement of the elevator door, and the exhaust pipe 52 communicates during the closing movement through the port opening 60 in the valve 58 with the exhaust pipe 46, which permits exhaust through the ports 44 from the cylinder 4 during the return of the piston 30 toward the left of the cylinder until the port 44 is passed by the piston. During the further movement of the piston in the cylinder 4 beyond the port 44, the air in the cylinder is compressed and serves to cushion the piston 30 and the closing movement of the elevator door. If during the closing movement the pressure in the end of the cylinder 4 should be raised too high, caused by the momentum of the door, which would ordinarily result in a rebound or chattering of the door, the relief valve 88 will open to release the excessive pressure and cause a smooth and continuous closing movement of the door. Should the valve 58 be suddenly turned so as to admit pressure fluid to the cylinder 4 before the end of the return stroke is reached, at a point where the port 36 has been uncovered by the piston, but the port 124 in the cylinder has not been reached, the pressure in the cylinder will be released by

the passage of fluid through the port 36 into the pipe 38, and through the passageway 60 in the valve 58 to the pipe 52 and from thence to the atmosphere through the muffler 54.

While the invention has been described in connection with the preferred form of the invention as illustrated in the drawings, it is to be understood that various changes and modifications may be made as may be apparent to those skilled in the art without departing from the spirit or scope of the invention as defined in the claims.

Having described the invention, what I claim and desire to secure by Letters Patent is:

1. In an elevator door operating mechanism, a cylinder, a piston in the cylinder, means for operatively connecting the mechanism to an elevator door, a valve, a passageway in said valve, a passageway connecting said valve with one end of said cylinder, means for operating said valve to control communication of said passageway in said valve with said passageway between said valve and said cylinder, a guide rod, a roller adapted to move on said guide rod, a second valve adapted to open an close communication between the first-named valve and said cylinder, means for adjustably connecting said second valve to said roller, a depression in said guide rod adapted to permit transverse movement of said roller to seat said second valve, whereby communication between said pressure fluid and said cylinder will be cut off in the closed position of said door.

2. In an elevator door operating mechanism, a cylinder, a piston in the cylinder, means for operatively connecting the mechanism to an elevator door, a valve having admission and exhaust passageways therein, means for connecting said valve with a source of pressure fluid supply, a pressure conduit connecting said valve with said cylinder, means for connecting said valve to an exhaust conduit connecting the end of said cylinder with said valve, means for operating said valve to alternatively connect and disconnect said conduits with said source of pressure fluid supply and said exhaust, a valve in said pressure conduit, spring means for holding the last-named valve in closed position when said door is closed, and cam means operatively connected to said door whereby the last-named valve will be opened when said door is opened.

3. In an elevator door operating mechanism, a cylinder, a piston in said cylinder, means for operatively connecting said mechanism to an elevator door, a second cylinder, a piston in said second cylinder, means for operatively connecting the piston of the first cylinder to the piston of the second cylinder, means for admitting air to the first cylinder to open said elevator door, means for com-

pressing air in the second cylinder during the opening movement of said door to cushion the movements thereof, means for exhausting air from said second cylinder when the pressure therein during the cushioning action exceeds a predetermined amount, thereby preventing jar and rebound of the door during the opening movement thereof, means for cutting off the supply of pressure fluid to said first cylinder, means for admitting pressure fluid to said second cylinder to operate the piston therein and thereby close said door, means for simultaneously exhausting air from the first cylinder during a portion of the stroke, and means for thereafter compressing air to cushion the movements of said mechanism during the closing movement of said door, and means for relieving excess pressure during the cushioning action in the closing movement of said door, whereby a smooth operation of said door is attained.

4. In an elevator door operating mechanism, a cylinder, a piston in said cylinder, means for operatively connecting the said mechanism to an elevator door, a second cylinder, a piston in said second cylinder, means for operatively connecting the piston of the first cylinder with the piston of the second cylinder, means for admitting air to the first cylinder to open said elevator door, means for compressing air in the second cylinder during the opening movement of said door to cushion the movements thereof, means for exhausting air from said second cylinder when the pressure therein during the cushioning action exceeds a predetermined amount, thereby preventing jar and rebound of the door during the opening movement thereof, means for cutting off the supply of pressure fluid to said first cylinder, means for admitting pressure fluid to said second cylinder to operate the piston therein, and thereby close said door, means for simultaneously exhausting air from the first cylinder during a portion of the stroke, means for thereafter compressing air to cushion the movements of said mechanism during the closing movement of said door, means for relieving excess pressure during the cushioning action in the closing movement of said door whereby a smooth operation of said door is attained, and means for automatically cutting off communication between said pressure fluid supply and said second cylinder when said door is closed, thereby preventing leakage of pressure fluid through the said second cylinder when said door is in closed position.

5. In an elevator door operating mechanism, a door-opening piston cylinder unit, a door-closing piston cylinder unit, a valve block having fluid pressure passages connecting said units, a valve in said valve block adapted for manual control, a passageway in said valve communicating with a pressure

fluid supply to operate said units, passageways in said valve block communicating with said piston-cylinder units, means for alternately connecting said passageways with the passageway in said valve communicating with said pressure fluid supply, exhaust ports in said piston cylinder units, passageways from said exhaust ports to said valve, a passageway in said valve communicating with the atmosphere, said passageways and said valve being so positioned that when pressure fluid is admitted to said door opening cylinder unit the exhaust passageway in said valve will be in communication with the exhaust passageway from said door closing unit, and when the admission passageway is in communication with said door closing unit, said exhaust passageway is in communication with the exhaust passageway from the said door opening unit, and means, in the passageway for conducting pressure fluid to said door closing unit, for cutting off communication of pressure fluid therewith when said door is in closed position, whereby leakage from said unit is prevented in closed position of the door.

Signed at New York city, New York, this 13th day of November, 1923.

WILLIAM WALLACE WEEKS.