Nov. 17, 1925. 1,561,810

W. W. WEEKS

ELEVATOR DOOR OPERATING MECHANISM

Filed Oct. 18, 1923

Fig 1

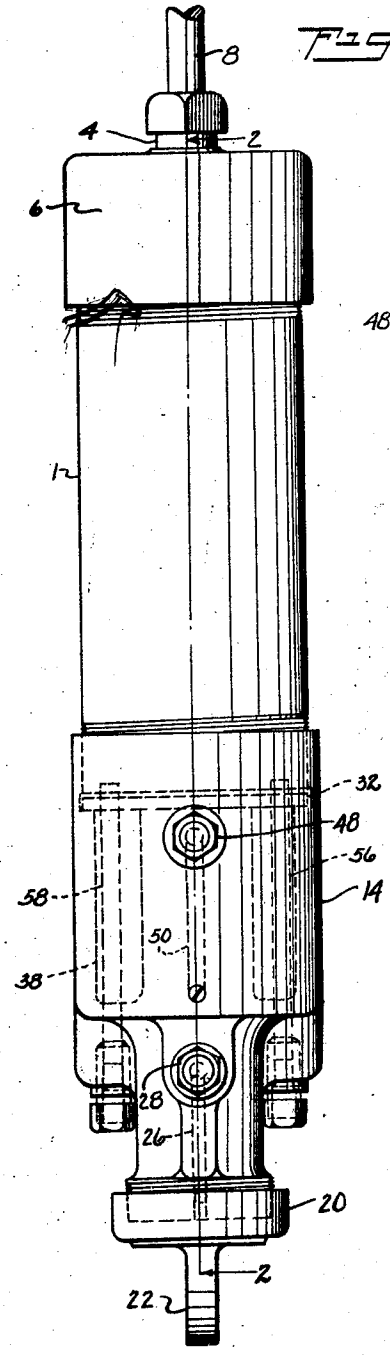


Fig 2

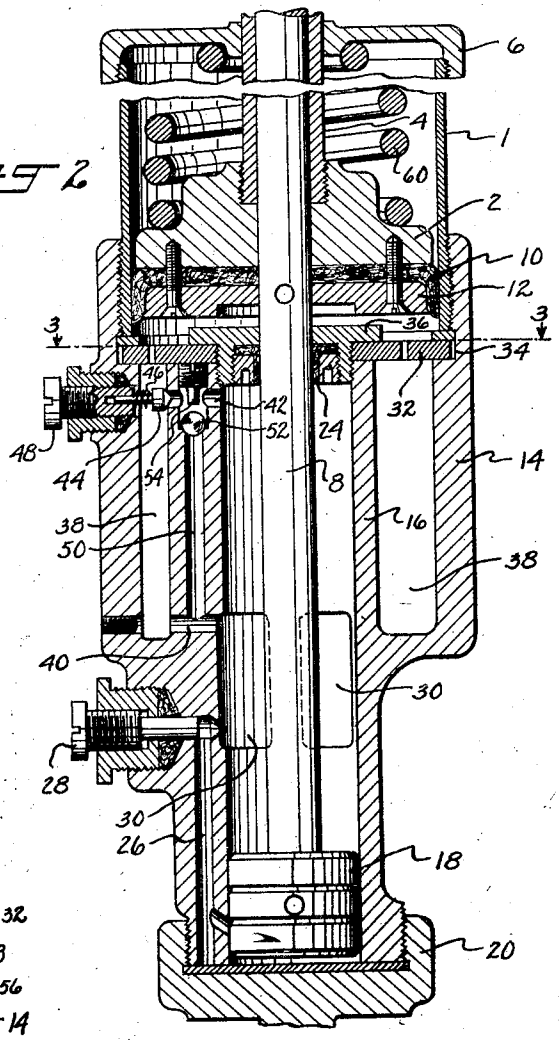
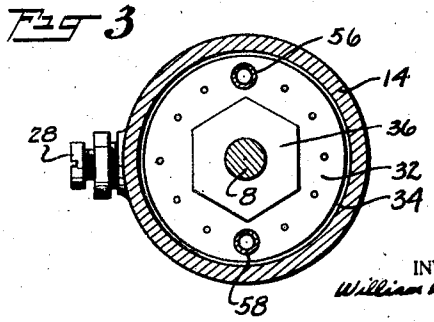


Fig 3



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WILLIAM WALLACE WEEKS, OF BROOKLYN, NEW YORK, ASSIGNOR TO ELEVATOR SUPPLIES COMPANY, INC., A CORPORATION OF NEW JERSEY.

ELEVATOR-DOOR-OPERATING MECHANISM.

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To all whom it may concern:

Be it known that I, WILLIAM WALLACE WEEKS, a citizen of the United States, residing at 366 Fourth St., Brooklyn, N. Y., have invented a certain new and useful Improvement in Elevator-Door-Operating Mechanism, of which the folowing is a clear, full, and exact description.

The present invention relates to improvements in elevator door operators, and more particularly to improvements in cushioning means for elevator door operating devices. The invention is particularly adapted to be applied to fluid pressure operated means in which cushioning action is attained on both the up and down stroke of the piston in the cylinder. The invention may also be applied to dash-pots or other cushioning devices in general wherever a similar action is desired.

In fluid pressure operated devices heretofore employed for operating elevator doors, cushioning action is satisfactorily accomplished during normal operation of elevator doors, that is, when the elevator door is opened or closed in one continuous stroke. When, however, the door has been opened and the return stroke has been initiated, there is no oil or cushioning fluid behind the plunger in the plunger cylinder, and if the door is then returned to the full open position after partial closing as, for example, when another passenger is to be taken on before closing the door, there is no oil in the upper part of the plunger to cushion the partial return stroke, and consequently the door returns to the full open position with a slam.

It is the primary object of the present invention to provide a means in an apparatus of the kind above referred to whereby the slamming or jarring effect is obviated when an elevator door, or similar device to be operated, is returned to the full open position after a partial closing thereof.

Another object of the invention is to improve the normal operation of an elevator door opening and closing means so as to avoid all jar and to attain a smooth operation throughout the opening and closing strokes of the mechanism.

With these and other objects in view, the invention comprises the device hereinafter fully described and more particularly defined in the claims.

In the drawings illustrating a preferred embodiment of the invention—

Fig. 1 is a view in elevation of the device;

Fig. 2 is a part sectional view taken on the line 2—2 of Fig. 1;

Fig. 3 is a cross sectional view taken on the line 3—3 of Fig. 2.

Referring more particularly to the drawings, 1 designates a cylinder casing in which is a piston 2 which is attached to a sleeve 4 which passes upwardly through the head 6 of the cylinder. The sleeve 4 is attached to a plunger rod 8 which may be directly connected to mechanism to be operated, such as the toggle levers attached to an elevator door. To the piston 2 is connected a leather washer 10 which is outwardly expanded by means of a follower 12 which is attached to the piston 2 by suitable means such as set screws, for example, as shown in the drawing.

In order to provide for cushioning the movements of the piston and parts attached thereto, a suitable dash-pot or dampening means is operatively connected to the device. The cushioning means could be made entirely separate from the pneumatic cylinder, but I prefer to embody the cushioning means in one unit to attain a construction which may be manufactured at a low cost and which may be easily installed. The dampening means comprises a casing 14, preferably attached to the cylinder 1 by screw threaded connections, to which is attached an inner wall 16 which is connected at its base to the casing 14 and extends or projects downwardly from the point of connection thereto to provide a cylinder in which a plunger 18, attached to the plunger rod 8, may operate. To the lower end of the wall 16 is attached a cap or head 20 having a lug 22 thereon which may be attached to a bracket or other suitable means when the cylinder is mounted. The plunger rod 8 passes upwardly through a bushing 24 by means of which the oil or other cushioning liquid is retained in the plunger cylinder.

In substantially the mid-portion of the cushioning cylinder or wall 16 is an enlarged portion having a length preferably slightly greater than the length of the plunger 18, by means of which oil or other liquid may pass around the plunger in its movement through this section of the cylinder. The enlarged portion 30 of the cylin-

der is connected by means of a passageway 26 in the walls of the cylinder 16 to the lower portion of the cylinder, by means of which liquid may pass forward and backward between said sections of the cylinder during the movements of the plunger 18 therein. In order to regulate the movements of the plunger and the parts attached thereto, a regulating screw 28 is provided, by means of which the passage 26 is restricted so as to attain any desired amount of resistance to the passage of the liquid therethrough. At the point of connection between the casing 14 and the cylinder wall 1 is preferably placed a perforated diaphragm 32 by means of which upward passage of liquid, or splashing of liquid into the cylinder casing 1, is prevented. The diaphragm 32 is preferably placed in a recess 34 in the wall 14 and is held in position by means of a plate 36 having a downwardly extending wall on which is a threaded portion adapted to screw into a corresponding thread in the interior portion of the wall 16 and to thereby rigidly hold the diaphragm in place. The bushing 24 may be conveniently held in place by means of the downwardly extending walls from the plate 36, as shown in the drawing. Between the walls 16 and 14 is a reservoir 38 which communicates with the enlarged portion 30 by means of a passageway 40 in the wall 16. The upper portion of the interior of the cylinder 16 communicates with the reservoir 38 by means of a horizontal passageway 42. The opening of the passage leading to the reservoir 38 is restricted by means of a valve 44 adapted to serve the same function as the regulating screw 28 to regulate the passage of liquid therethrough, but which is adapted to yield when the pressure of the liquid in the upper portion of the cylinder 16 exceeds a predetermined amount. To attain this object, the valve is held in position by means of a spring 46, the tension of which may be regulated by the regulating screw 48. During the operation of the apparatus, any sudden pressure of liquid passing through the passageway 42 to the reservoir 38 will cause the valve 44 to open, whereby the pressure in excess of that supplied by the spring 46 will be relieved and will thus prevent any sudden jar in the movements of the plunger 18 in the upper portion of the plunger cylinder.

In order that liquid may be supplied above the plunger in the plunger cylinder as soon as the plunger 18 moves downwardly from the top of the cylinder, corresponding to a partial return of the elevator door from full open position, so as to provide for immediate cushioning action should the door be returned to full open position before closing, a by-pass 50 is provided in the walls of the plunger cylinder 16, leading from the passageway 40 to the passageway 42. In this by-pass is a ball check valve 52 which may be held in position by means of a suitable retaining means 54 extending downwardly into the upper portion of the passageway to retain the ball 52 in proximity to its seat. The check valve serves to prevent the passage of liquid downwardly through the by-pass 50 but permits flow upwardly therethrough to supply liquid from the reservoir 38 or the portion 30 of the cylinder to the upper part thereof when the plunger moves downwardly therefrom.

In order to automatically operate the piston and parts attached thereto, air or other pressure fluid is supplied to the cylinder by means of one or more pipes 56, 58, as indicated more particularly in Fig. 1. If only one pipe is to be employed for supplying pressure fluid to the cylinder, the pipe not in use may be closed by means of a valve or set screw, or other equivalent means.

The operation of the device is as follows:

When the elevator door is in closed position the piston 2 is at the lower end of the cylinder 1 and the plunger 18 is at the lower end of the plunger cylinder 16. When the elevator door is to be opened, pressure fluid is admitted from one or both of the pipes 56, 58 through a suitable regulating valve, and the piston is forced upwardly against pressure of a spring 60 causing operation of the toggle levers and the opening of the elevator door. During the upward movement of the piston 2 the plunger 18, operatively attached to the piston moves upwardly in the cylinder 16 and causes oil, or other liquid therein, to flow at first from the enlarged portion 30 through the restricted passage 26 to the bottom of the plunger cylinder, and then after the plunger passes the mid-portion or enlarged portion 30 and reaches the upper portion of the plunger cylinder, oil which is entrapped above the plunger is forced through the passage 42 by the valve 44 into the reservoir 38. By the passage of oil through the passageway 42, the ball 52 is forced to its seat in the passageway 50, and prevents passage of oil therethrough. By the passage of oil through the restricted passageway 42, the movement of the plunger and parts attached thereto is cushioned, whereby the movement of the elevator door is properly slowed up at the end of its opening movement, and jarring or slamming is thus avoided.

The valve controlling the supply of fluid pressure to the operating cylinder is held open until it is desired to close the elevator door. The valve is then turned to exhaust position, whereby exhaust of pressure fluid from the cylinder will take place either to an exhaust pipe or directly into the atmosphere, if desired. The piston 2 and the plunger 18 are then forced downwardly by

a compression spring 60 operating on the upper surface of the piston. During the downward movement of the plunger 18 from the top of the plunger cylinder, a reduction in pressure above the plunger takes place, and oil passes upwardly through the passageway 50 by the ball 52, and through the passage 42 into the plunger cylinder above the plunger 18. If, before the completion of the return stroke of the plunger 18, the valve controlling the admission of pressure fluid to the cylinder 1 is turned to again admit pressure fluid to the cylinder so as to return the elevator door to its full open position, the fluid pressure acting through the perforations in the diaphragm 32 to the top of the liquid in the reservoir 38 assists in forcing the oil upwardly through the passage 50 to the portion of the plunger cylinder above the plunger 18. The liquid above the plunger then allows the door to be opened with proper cushioning, so that no jarring in the movements of the piston and the parts attached thereto takes place. Any sudden excess pressure of oil above the plunger will be relieved by means of the valve 44, which will operate to allow passage of oil through the passage 42 to the reservoir 38, as has been explained.

By regulating the position of the regulating screws 28 and 48, the flow of oil through the passageways 26 and 42 may be controlled to any desired extent and any desired amount of cushioning action may be thus attained. Furthermore, any pressure of the operating fluid within certain limits may be used whereby any desired speed of action of the mechanism may be attained. It is to be understood, however, that the size and force of the spring 60 must be proportioned to correspond substantially with the pressure of fluid supplied to the cylinder 1 so that the apparatus may be operated against the spring pressure with the particular fluid pressure used, and the spring must be designed to operate so as to return the piston and parts thereto to the closed position of the elevator door within a predetermined time.

It is to be understood that various changes and modifications may be made in the details of the device to attain substantially the same results, without departing from the spirit or scope of the invention. I do not desire to be limited, therefore, to the form of the invention described, except as hereinafter defined in the claims.

Having thus described the invention, what is claimed as new is:

1. In a cushioning device adapted for cushioning the movements of elevator door operating mechanisms, a cylinder, a plunger in said cylinder, a passageway communicating between the upper portion of said cylinder and a lower portion thereof, and a by-pass connecting said passageway with a lower portion of the cylinder, permitting the passage of fluid to the upper portion of said cylinder to attain cushioning action of said mechanism when said plunger is returned to the upper portion of said cylinder after a limited movement toward the lower portion thereof.

2. In a cushioning device, a cylinder, a plunger in said cylinder, a passageway in the walls of said cylinder, a reservoir communicating with said passageway, means for regulating the flow from the cylinder through said passageway to said reservoir, means for relieving pressure in said cylinder and said passageway, and means for supplying oil to the said cylinder from said reservoir when said plunger initiates movement from one end of said cylinder.

3. In a cushioning device, a cylinder, a plunger in said cylinder, a passageway leading from one end of said cylinder to an intermediate portion thereof, a relief valve in said passageway, a valve seat in said passageway, a spring mounted on said valve to hold the valve under pressure against said seat, and means for regulating the tension of said spring to maintain a liquid in said cylinder under a predetermined pressure.

4. In a cushioning device, a cylinder, a plunger in said cylinder, a passageway in the walls of said cylinder communicating with one end thereof, a reservoir external to the said cylinder and communicating with said passageway, a relief valve in said passageway to limit the pressure of fluid in said cylinder, means for regulating the relief pressure of said valve, a by-pass connecting said reservoir with said passageway at a point therein intermediate said relief valve and said end of the cylinder, and a valve in said by-pass to permit flow therethrough only in the direction of said cylinder end.

5. In a cushioning device for elevator door operating mechanisms, a cylinder, a plunger in said cylinder, a passageway communicating between the upper portion of said cylinder and a lower portion thereof, means for regulating the passage of fluid through said passageway, a by-pass communicating between a lower portion of said cylinder and a point in said passageway intermediate said regulating means and said upper portion of the cylinder, and means for attaining unidirectional flow in said by-pass to the upper portion of said cylinder whereby fluid may rapidly pass to the upper portion of said cylinder when suddenly required to attain cushioning action.

6. In a cushioning device for elevator operating mechanisms, a cylinder, a plunger in said cylinder, passageways communicating between the upper and lower portions of said cylinder and a portion intermediate

between said portions, means for regulating the passage of fluid through said passageways, a by-pass connecting an intermediate portion of the cylinder with the upper portion thereof, a check valve in said by-pass to permit flow of fluid therethrough to the upper portion of said cylinder during downward movement of said plunger, and to prevent passage of fluid therethrough during the upward movement of said plunger.

7. In a cushioning device, a cylinder, a plunger in said cylinder, a passage leading from the lower end of said cylinder to a mid-portion thereof, a second passage leading from the upper end of said cylinder to a mid-portion thereof, regulating screws in said passages to regulate the passage of fluid therethrough, a third passage communicating between a mid-portion of said cylinder and the upper portion of said cylinder to permit passage of fluid to said upper portion when the plunger moves downwardly from the upper portion of the cylinder, whereby cushioning action may be attained should the plunger, in its downward stroke, be returned to the upper portion of the cylinder before reaching the intermediate portion thereof.

8. In a cushioning device, a cylinder, a plunger in said cylinder, a passage leading from the lower end of said cylinder to an intermediate portion thereof, means for regulating the passage of fluid therethrough, a second passage leading from the upper end of said cylinder to an intermediate portion thereof, means for regulating the passage of fluid through the last-named passage whereby cushioning of said plunger is attained during the normal upward and downward strokes from the intermediate portion of said cylinder, an auxiliary passageway communicating with the upper portion of said cylinder, to supply cushioning fluid at the beginning of the return stroke of said plunger from the upper portion of said cylinder, means for preventing return flow through said passageway, whereby cushioning of said plunger may be attained should the plunger be again moved toward the upper end of said cylinder before reaching the mid-portion thereof, at which point fluid would normally pass above said plunger to supply cushioning fluid for the upward movement thereof.

9. In a device of the class described, a cylinder, a piston in said cylinder, means for connecting one of said parts to a mechanism to be operated, cushioning means operatively connected to said mechanism to be operated, comprising a casing, a plunger in said casing, a passageway in said casing for the passage of fluid from one portion thereof to another, means for regulating the passage of fluid therein, and a by-pass connecting said passageway to another portion of said casing to permit passage of fluid through said passageway when said plunger is moved in said casing away from said passageway.

10. In a device of the class described, a cylinder, a piston in said cylinder, means for connecting one of said parts to a mechanism to be operated, cushioning means operatively connected to said mechanism to be operated, comprising a casing, a plunger in the casing, oil passages leading from the ends of said casing to an intermediate portion thereof, means for regulating the passage of fluid through said passages, a by-pass from said intermediate portion of the cylinder to one of said passages leading to the upper portion of said casing, means for causing unidirectional flow of fluid therein to the upper portion of said casing, whereby cushioning fluid may be maintained at both ends of said casing irrespective of the movements of said plunger therein.

11. In a device of the class described, a cylinder, a piston in the cylinder, means for attaching one of the parts to a mechanism to be operated, cushioning means comprising a plunger cylinder having a liquid therein, a plunger in said plunger cylinder, restricted passageways in said plunger cylinder to control the passage of liquid from one portion of the plunger cylinder to another and to thereby cushion the movements of said mechanism, a reservoir, a passageway communicating between the upper portion of said plunger cylinder and said reservoir, a check valve in the last-named passageway to attain unidirectional flow therein to the upper portion of said plunger cylinder.

12. In a device of the class described, a cylinder, a piston in the cylinder, means for attaching one of the parts to a mechanism to be operated, cushioning means comprising a plunger cylinder having a liquid therein, a plunger adapted to operate in said plunger cylinder, restricted passageways in said plunger cylinder to control the passage of liquid from one portion thereof to another, to cushion the movements of said mechanism, a reservoir, a passageway communicating between the upper portion of said plunger cylinder and said reservoir, a check valve therein permitting flow of liquid to the upper portion of said plunger cylinder and preventing flow therein opposite thereto, means to prevent passage of liquid in aggregate from said reservoir to said cylinder, and a conduit connected to said cylinder for supplying pressure fluid thereto above said last-named means.

13. In a device of the class described, a cylinder, a piston in the cylinder, means for connecting one of said parts to a mechanism to be operated, means for admitting pressure fluid below said piston to cause move-

ment thereof, spring means in said cylinder above said piston adapted to resist upward movement of said piston and to return said piston when said fluid pressure under the piston is released, a liquid-containing chamber operatively connected to said mechanism to be operated, a plunger in said chamber, passageways communicating between the upper and lower portions of said chamber and a portion intermediate thereof, means for regulating the passage of fluid through said passageways, a by-pass connecting an intermediate portion of the chamber with the upper portion thereof, a check valve in said by-pass permitting flow of fluid therethrough to the upper portion of said chamber when said plunger is moved downwardly therefrom, and to prevent the passage of fluid therethrough during the upward movement of said plunger, whereby cushioning action is attained by the flow of fluid through one of said passageways.

Signed at New York, N. Y., this 15th day of October, 1923.

WILLIAM WALLACE WEEKS.