Feb. 4, 1930. W. B. CROWELL 1,745,357

ELEVATOR DOOR OPERATING MECHANISM

Filed Aug. 8, 1923 2 Sheets-Sheet 1

Fig 1

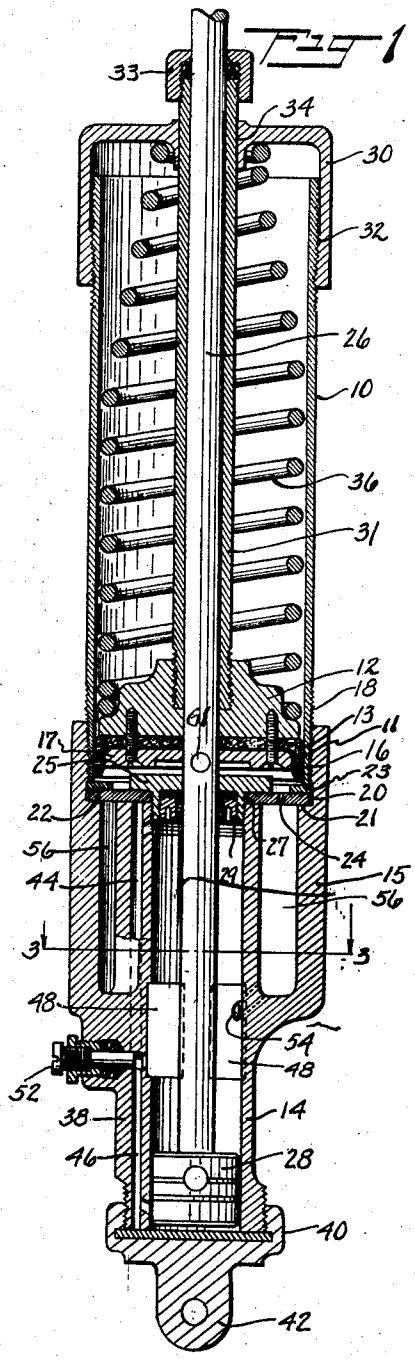
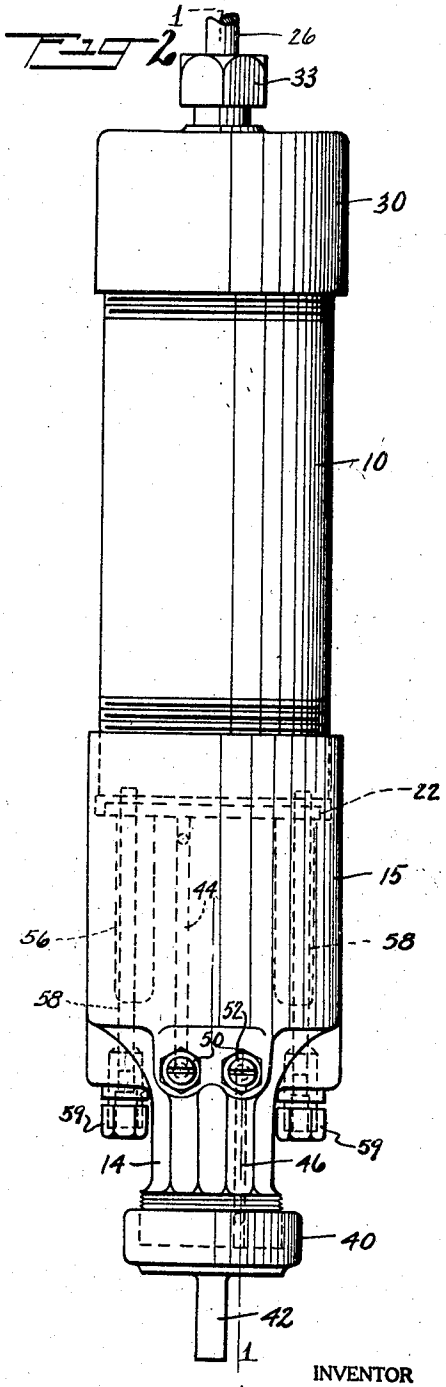


Fig 2



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Fig 3

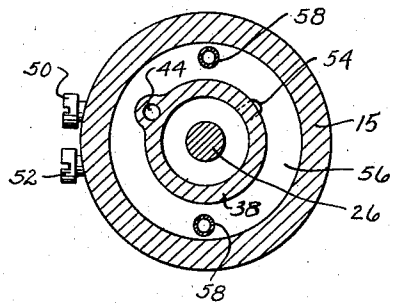


Fig 4

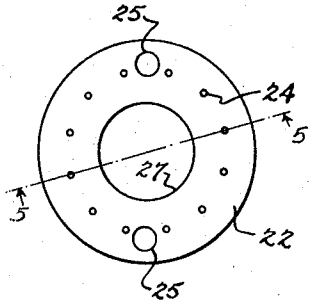


Fig 6

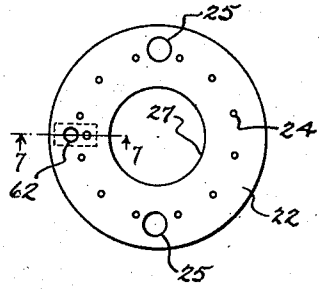


Fig 5

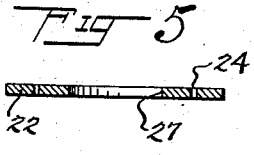
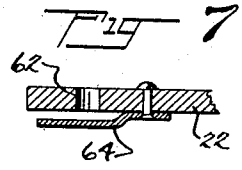


Fig 7



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UNITED STATES PATENT OFFICE

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ELEVATOR-DOOR-OPERATING MECHANISM

Application filed August 8, 1923. Serial No. 656,312.

The present invention relates to improvements in a power operated elevator door operating mechanism of the form having cushioning means operating in a liquid.

In mechanisms of the form disclosed in my application Serial No. 638,072, a leather washer is employed on the operating piston which requires more or less frequent lubrication with oil in order to prevent drying and loss of absorbed oil which serves to render the leather soft and pliable. It has been found with this form of device that when pressure fluid is admitted for the upstroke of the piston, corresponding to the opening movement of an elevator door, oil from the plunger cylinder or oil reservoir is sprayed more or less into the operating cylinder, which has the effect of keeping the leather of the piston washer soft and pliable, and of lubricating the cylinder walls. The amount of oil which passes to the piston cylinder through entraining or carrying of oil by the pressure fluid has been found, however, to be excessive with frequent operations of the apparatus, resulting in the passage of some of the oil above the piston. The loss of oil from the cushioning cylinder in this manner results in knocking or slamming at the end of the door opening stroke, or the upstroke, of the plunger, due to not having sufficient oil in the plunger cylinder and reservoir to give a liquid check at the top of the plunger cylinder. It has also been found in connection with this apparatus that the oil passing into the piston cylinder gradually leaks out of the apparatus by one means or another, and it is necesasry therefore to frequently replenish the oil in the system.

The present invention is designed to overcome the difficulties above enumerated by preventing passage of oil in appreciable amounts from the plunger cylinder to the piston cylinder above the piston, but permitting sufficient oil to pass from the plunger cylinder into the piston cylinder to lubricate the cylinder walls and to keep the leather washer attached to the piston soft, thus greatly increasing the life of the washer.

One of the objects of the present invention is to provide means whereby the leather washer in a mechanism of the kind above referred to, will be sufficiently lubricated by oil to keep it soft and pliable, but which at the same time will serve to prevent loss of oil from the plunger cylinder or passage of oil into the piston cylinder above the piston, whereby the operation of the device will be improved and whereby frequent refilling of the apparatus with oil will be avoided.

Another object of the invention is to provide means in such a mechanism for preventing splashing of oil from the plunger cylinder to the piston cylinder and to retain the oil in the plunger cylinder without interfering with the cushioning action of the device.

Another object of the invention is to provide means whereby the piston and leather washer or cup may be easily removed from the cylinder without dismounting other parts of the apparatus.

Another object of the invention is to provide means whereby pressure fluid may be admitted alternatively on one side or the other of the apparatus, whereby the apparatus may be mounted for either left or right hand elevator door operation.

A further object of the invention is to so position the regulating means, whereby the cushioning action is controlled, so that they may be accessible in mounted position.

A further object of the invention is to provide a method of lubrication whereby the cylinder walls of the device may be lubricated by means of an oil spray and whereby the cup washer may be supplied with a sufficient quantity of oil in the operation of the device to maintain the leather soft and pliable.

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

One feature of the invention involving the use of a diaphragm is based upon the discovery that a perforated diaphragm having a certain critical area opening may be employed in the apparatus below the point of admission of pressure fluid thereto, whereby lubrication of the leather washer will be attained and the main body of oil will be retained in the plunger cylinder so that under normal operating conditions the filling oper-

ation is required only once for at least five hundred thousand operations of the mechanism. The care and attention required in the operation of a device embodying the present improvement is therefore incomparably less than with the device of the invention described in the above-referred-to application.

The various features of the invention will be described in connection with the accompanying drawings, in which—

Fig. 1 is a vertical section of an elevator door operating mechanism embodying the the invention taken on the line 1—1 of Figure 2;

Fig. 2 is an exterior profile view of the operating device shown in section in Fig. 1;

Fig. 3 is a sectional view taken on the line 3—3 of Fig. 1;

Fig. 4 is a plan view of a foraminated diaphragm or partition having perforations therein;

Fig. 5 is a section through the line 5—5 of Fig. 4;

Fig. 6 is a plan view of a modified form of partition or diaphragm; and

Fig. 7 is a detail sectional view through the line 7—7 of Fig. 6.

Referring to the drawings, the device comprises a cylinder 10 in which is a piston 12 to which a leather washer or leather cup 13 is attached, the washer being held in place by means of a cup expander 11 and a follower or metal ring 17 attached to the piston by suitable means such as set screws, for example, as shown in the drawing. Cushioning means 14 adapted to operate with a liquid in the manner to be further described, are provided to check or cushion the movements of piston 12 and the parts attached thereto. The cushioning device 14 comprises a cylinder 38 to which an external casing 15 is attached so as to provide a reservoir or space 56 between the walls thereof. The upper portion of the casing 15 is preferably internally screwthreaded at 16 so as to permit engagement with a corresponding externally screwthreaded portion 18 on the cylinder casing 10, whereby the cylinders may be fastened together. In order to prevent leakage of oil which preferably exists in the cushioning mechanism to a level approximately as indicated by the section line 3—3 in Figure 1, although the desired operation does not necessitate the maintenance of the oil level at the precise height at the threaded portion 16, 18, the joint is sealed by means of red lead or other means suitable for the purpose.

It has been found that if a closed partition be employed between the plunger cylinder and the operating cylinder, that passage of oil from the former to the latter will be entirely prevented, but the cushioning means does not operate satisfactorily and the leather washer soon loses its flexibility due probably to the fact that the operating fluid, such as compressed air, absorbs the oil in the leather. Under these conditions the apparatus soon develops other defects in operation and it becomes necessary to disconnect the operating mechanism and to replace the leather washer. For these reasons it has been found necessary to have a more or less free communication between the plunger cylinder and piston cylinder to attain satisfactory operation of the cushioning means and to attain lubrication of the leather washer.

On the other hand, it has been found that without the use of a diaphragm or partition, the splashing of the oil becomes so great that considerable portions of oil pass from the plunger cylinder to the piston cylinder and accumulate above the piston therein, causing poor operation of the cushioning means and more or less loss of oil through leakage. I have discovered that by the use of a screen between the plunger cylinder and the operating cylinder, excessive splashing of the oil is prevented and the main body of the oil in the plunger cylinder is retained. A most satisfactory operation of the apparatus is attained, however, by the use of a solid diaphragm or partition having a series of perforations of certain dimensions therein by means of which cushioning action is not interfered with and the life of the leather washer is maintained, and little or no attention is required over long periods of time.

Below the threaded portion 16 of the plunger casing 15 is a recess 20 having a shoulder 21 adapted to support a partition or diaphragm 22. The diaphragm may be held in place by means of a washer or ring 23, which in turn is held in place by the edge of the cylinder casing 10 when the casings 10 and 15 are screwed together. In the central portion of the diaphragm 22 is an opening 27, in which is a stuffing box 25 through which a piston rod or plunger rod is adapted to pass. Around the central opening 27 in the diaphragm 22 are a series of openings 24, which are preferably symmetrically placed about the opening 27 at a distance therefrom so as to be between the outer edge of the stuffing box 25 and the inner edge of the ring 23. These openings are comparatively small so as to prevent the passage of oil in aggregate therethrough, but to permit the passage of oil spray therethrough. A diaphragm having twelve openings therein of about 1/64th of an inch in diameter has been found in actual practice to operate more satisfactorily than diaphragms having larger or smaller sized openings or with a larger or smaller number of holes therein. In addition to the openings 24 in the diaphragm are two larger openings 25′ (see Fig. 4), which are preferably diametrically opposite, and of such a size as to just permit the passage of pressure fluid conducting pipes 58 therethrough, by means of which pressure fluid may be ad-

mitted to the apparatus above the diaphragm.

The pipes 58 are preferably positioned at diametrically opposite points in the casing 15, and pass upwardly through the space or concentric opening 56 between the casing 15 and the upper portion of the cylinder 38. The pipes are positioned at these points in order to enable either one to be connected with a compressed air pipe or other source of pressure fluid supply, whereby the device may be used for either right or left hand elevator door operation. The ends of the pipes 58 may be closed by air-tight plugs or set screws 59, shown in Fig. 2, so that the pipe which is not in use, or which is not coupled to a fluid pressure pipe, will not exhaust or release pressure fluid into the atmosphere during operation of the device.

The inner portion of the diaphragm 22 around the central opening 27 rests, or is seated, upon the upper edge of the cylinder 38 as is shown in Fig. 1 of the drawings. The central opening 27 is preferably screwthreaded to receive a correspondingly threaded flange of the stuffing box 25, which is held in place thereby. The flange of the stuffing box is also internally screw-threaded to receive a packing nut 29 by means of which suitable packing in the stuffing box around the rod 26 is held in place.

The piston rod or plunger rod 26 above referred to, passes through a central opening through the piston 12 and through corresponding openings through the leather washer 13 and follower 17 and extends outside of the cylinder casing 10 through a head or cap 30 which is attached by screwthread connections 32 to the cylinder, and is operatively connected to a toggle lever or other mechanism to be operated. Within the cylinder casing 10 around the plunger rod and seated upon a flanged portion of the piston 12 is a helical spring 36 which serves to maintain the piston in its lowermost position when unacted upon by pressure fluid. Within the plunger cylinder 38 is a plunger 28 which is connected to the plunger rod or piston rod 26. Below the piston 12 on the rod 26 is a stop pin 61, which fits in a corresponding slot in the rod 26, by means of which the downward movement of the piston on the rod is limited. Attached to the piston 12 and extending upwardly around the rod 26 through an opening 34 in the cylinder head 30 is a piston sleeve 31. The end of the sleeve extending through the cap 30 has a screwthreaded portion to which a packing nut 33 having a corresponding internally screwthreaded portion, is attached, which serves to hold a packing in place between the end of the piston sleeve and the nut around the piston rod, and fastens the rod and the sleeve together so as to prevent relative movement thereof. The purpose of the sleeve construction attached to the piston is to permit withdrawal of the piston and the leather washer from the cylinder casing without dismounting the apparatus as a whole, or disconnecting the apparatus at the seams which have been calked or sealed to prevent leakage therethrough. In order to remove the piston and leather washer from the cylinder, it is only necessary to disconnect the piston rod from the toggle lever or bracket to which it is attached, and then to unscrew the cylinder head 30 and nut 33. The parts may then be withdrawn by sliding the sleeve along the piston rod until the piston, the leather washer and follower have passed over the end of the rod. When the parts are replaced in the cylinder, the stop or pin in the slot in the piston rod serves to position the piston and parts attached thereto in the cylinder, and the head is then screwed down against the tension of the spring 36 until the desired spring tension is attained for returning the piston to its normal position after operation by pressure fluid.

The cushioning means 14, attached to the cylinder casing 15, is preferably constructed with the plunger cylinder 38 placed concentrically with respect to the cylinder 10. This cylinder is preferably made integral with the casing 15, the lower portion of the cylinder extending downwardly and the upper portion extending upwardly from the point of connection, in the manner shown in the drawing. The lower portion of the cylinder 38 is closed by means of a head 40 to which a lug 42 is attached, by means of which the device may be suitably attached to a bracket or other supporting means. Within the walls of the cylinder casing 38 are passages 44 and 46 communicating between the upper portion of the cylinder and a mid-portion, and the lower end of the cylinder and the mid-portion respectively.

At the point of communication of the passages with the mid-portion of the cylinder the internal diameter thereof is somewhat enlarged as shown at 48, so as to permit free movement of the plunger in passing this portion of the cylinder in either its upward or downward movement. Regulating screws 50 and 52 serve to control the passage of liquid through the passages 44 and 46 respectively and the checking or cushioning action may thereby be regulated as desired by controlling the movements of the plunger. In the cylinder wall 38, preferably at the portion at which the wall is connected with the outer casing 15, is a passage 54 which serves to connect the enlarged portion 48 of the cylinder with the annular space 56 between the casing 15 and the upper portion of the cylinder 38. This annular space serves as a reservoir for the oil when the plunger 28 moves upwardly in the plunger cylinder so that in actual operation cushioning of the piston 12 by means of the plunger does not take place until the plunger reaches the portion of the cylinder

38 above the passage 54 at the enlarged portion 48.

In the operation of the device, pressure fluid is admitted through a pipe 58 and passes upwardly into the upper chamber 56 in the cylinder casing 10 above the diaphragm or partition 22. By thus admitting pressure fluid to the cylinder above the partition 22, the turbulent action of the pressure fluid is prevented from picking up large portions of oil and carrying it into the cylinder 10, and during the exhaust through the pipe 58 very little or substantially no oil is carried away in the exhaust.

In place of the partition 22 having a series of holes or perforations, I may employ a partition similarly constructed, but having an orifice 62 which will permit downward passage or return of oil therethrough in case a substantial amount of oil should pass upwardly through the perforations. By means of this orifice, oil may flow rapidly back into the annular chamber 56, and thereby join the main body of oil, thus preventing any decrease in the volume of oil necessary for cushioning the upward stroke of the piston. A bracket or splash plate 64 is suitably positioned below the orifice 62 so as to prevent oil from splashing upwardly through the orifice. The latter construction is shown more particularly in Figs. 6 and 7. I prefer, however, the form of partition shown in Figs. 4 and 5 for the reason of its greater simplicity in construction and the fact that it is cheaper to manufacture.

It is to be understood that certain of the features shown in the drawings are not absolutely essential and that various changes or modifications may be made in the device as disclosed without departing from the spirit or scope of the invention as defined in the claims. In place of the preferred form of partition 22, a perforated screen or some other form of partition having perforations differing in form or position in the partition from that above described, might be employed. It is apparent, furthermore, that the means by which the piston is operatively connected to the toggle levers or other device to be operated may be modified, for example, by connecting the sleeve 31 to the toggle levers directly, and then fastening the rod 26 to the sleeve by means of the pin passing through a slot through the parts or by other equivalent means.

It is to be understood, therefore, that the invention which has been described constitutes only the preferred form of the invention and that various changes may be made in the device by those skilled in the art within the scope of the following claims.

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

1. In an elevator door operating mechanism, a cylinder, a piston in said cylinder, a connection between said piston and the door to be operated, a plunger attached to said connection so as to move with said door, an oil chamber surrounding said plunger, and means for preventing passage of oil in the aggregate from said chamber while permitting the passage of oil in the form of a spray therefrom, said last-named means comprising a foraminated diaphragm.

2. 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, means for supplying pressure fluid to the cylinder to operate the piston, a liquid cushioning chamber connected to said cylinder, and a foraminated diaphragm between said chamber and said cylinder, said pressure fluid acting to entrain a portion of the liquid in said cushioning chamber in the form of a spray capable of permeating said diaphragm.

3. In a device of the class described, a cylinder, a piston in the cylinder, means for supplying pressure fluid to the cylinder to operate the piston, a liquid cushioning chamber connected to said cylinder, and a foraminated diaphragm between said chamber and said cylinder, said pressure fluid acting to entrain a portion of the liquid in said cushioning chamber in the form of a spray capable of permeating said diaphragm.

4. 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; cushioning means operatively connected to the cylinder comprising a cup, a plunger therein, and a liquid in said cup; and a diaphragm permeable to spray between said cushioning means and said cylinder to prevent passage of liquid in aggregate.

5. In a device of the class described, a cylinder, a piston therein, a cushioning chamber having a liquid therein, and a partition between said chamber and said cylinder having perforations therein of dimensions to permit passage of spray therethrough and to prevent the passage of liquid in aggregate therethrough.

6. In a device of the class described, a separatory diaphragm permeable to spray but preventing upward passage of liquid in aggregate therethrough, comprising a circular plate having a central opening therein for the passage of a piston rod therethrough, and a second opening for a pressure fluid conduit therein, the pressure fluid passing through said conduit acting to entrain a portion of the liquid below said diaphragm in the form of a spray capable of permeating said diaphragm.

7. In a device of the class described, a cylinder, a piston in the cylinder, means for admitting pressure fluid to said cylinder to operate said piston, cushioning means comprising a plunger operating in a liquid-containing chamber in which cushioning action

may be controlled, and a diaphragm permeable to spray between said chamber and said cylinder to prevent passage of liquid in aggregate, said pressure of fluid acting to entrain a portion of the liquid in said cushioning chamber in the form of a spray capable of permeating said diaphragm.

8. In a device of the class described, a cylinder, a piston and leather cup washer in said cylinder, means for admitting pressure fluid to said cylinder to operate said piston, cushioning means comprising an oil-containing chamber below said cylinder when in operative position, the said cushioning means causing splashing of oil toward said cylinder, and means to cut off communication between said chamber and cylinder for liquid in aggregate without interfering with the said cushioning action and without interfering with the entrainment of oil by said pressure of fluid to preserve and lubricate said leather washer.

9. In a device of the class described, a cylinder, a piston in the cylinder, a piston rod attached to said piston, means for admitting pressure fluid below said piston to cause movement thereof, a liquid-containing chamber connected to said cylinder, a plunger therein operatively connected to said piston, means for permitting passage of liquid from said liquid-containing chamber to a space between said chamber and said cylinder, and means for preventing passage of liquid in aggregate from said space to the piston portion of said cylinder without interfering with the cushioning action or entrainment of spray by said pressure of fluid to said piston.

10. 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 therein, restricted passageways to control the movements of the plunger, a reservoir, a passageway communicating between the plunger cylinder and said reservoir, and means in the path from said reservoir to said cylinder to prevent passage of liquid in aggregate, and a conduit for supplying pressure fluid above the last-named means, said pressure fluid acting to entrain a portion of the liquid in said reservoir in the form of a spray capable of permeating said last named means.

11. In a device of the class described a cylinder, a piston in said cylinder, a sleeve attached to said piston, a piston rod connected to said sleeve and adapted to move with said piston, means for connecting said piston rod to a mechanism to be operated, means for removing said piston and sleeve from said cylinder without removing said piston rod, an oil chamber connected with said cylinder, a plunger within said oil chamber connected to said rod and means permeable to the passage of oil spray to said cylinder from said oil chamber to lubricate the walls thereof and preventing the passage of liquid in aggregate thereto.

12. In a device of the class described a cylinder, a piston in said cylinder, a leather washer attached to said piston, a sleeve removably attached to said piston, a piston rod within said sleeve extending through said piston, means for operatively connecting said rod to a mechanism to be actuated, a plunger operating in a liquid connected to said piston rod, means for detachably connecting said plunger to said piston, means for disconnecting said rod from said mechanism to be operated, and means for withdrawing said piston and washer together with said sleeve from said cylinder without removing said plunger and piston rod therefrom.

13. In a device of the class described, a cylinder, a piston in said cylinder, means for operatively connecting said piston to a mechanism to be operated, means for admitting pressure fluid to said cylinder to operate said piston, cushioning means within said cylinder adapted to be operatively connected to said piston for cushioning the movements of said mechanism, and means permitting the removal of said piston from said cylinder from one end thereof without removing said cushioning means therefrom.

14. In a device of the class described the combination of a cylinder, a piston in the cylinder, means for connecting one of said parts to a mechanism to be operated, cushioning means connected to said cylinder comprising a liquid containing cylinder having a plunger therein operatively connected to said piston, a foraminous diaphragm to prevent passage of liquid in aggregate from the plunger cylinder to the piston cylinder and alternative means for admitting pressure fluid above said diaphragm whereby said cylinder may be connected for either right or left hand elevator door operation.

15. In a device of the class described a cylinder, a removable cap thereon, a piston in the cylinder, a leather cup washer attached to said piston, a cup expander to expand said washer into contact with the walls of said cylinder, a detachable sleeve connected to said piston and extending through said cap, means for attaching said piston to a mechanism to be operated, a cushioning means connected to said cylinder comprising an oil containing cylinder having a plunger therein, a rod attached to said plunger, means for operatively connecting said rod to said piston to cushion the movements thereof, means for regulating the movements of said plunger during pre-determined portions of the forward and return stroke thereof, and a foraminous diaphragm below said piston to prevent passage of liquid in aggregate from the plunger cylinder to the piston cylinder,

but permitting passage of oil spray thereto.

16. In a device of the class described, a cylinder, a removable cap thereon, a piston in the cylinder, a leather cup washer attached to said piston, a cup expander to expand said washer into contact with the walls of said cylinder, a detachable sleeve connected to said piston and extending through said cap, an oil cylinder connected to the piston cylinder, a plunger in said oil cylinder, a rod, means for attaching said rod to said plunger, means outside of the first named cylinder for detachably connecting said rod to said sleeve, means for connecting said rod to a mechanism to be operated, whereby said piston and washer may be removed from the piston cylinder by disconnecting said rod from the mechanism to be operated, disconnecting said rod from said sleeve and removing said cap from the cylinder.

17. In a device of the class described, a cylinder, a piston in the cylinder, means for conducting pressure fluid to said cylinder, an oil cylinder connected to the piston cylinder, a plunger in the oil cylinder, a rod in said cylinder, means for attaching the rod to said plunger, means for operatively connecting said rod to said piston, and means for attaching and detaching said piston to a mechanism to be operated thereby without mounting and discounting said oil cylinder, plunger and rod.

18. In a device of the class described a cylinder, a piston in said cylinder, a piston rod extending through and movable relatively to said piston, and means for preventing such relative movement of said piston and piston rod comprising a sleeve attached at one end to said piston, and removable means for holding said sleeve and piston rod in frictional engagement whereby the movement of said piston and sleeve causes corresponding movement of said piston rod.

Signed at New York city, N. Y., this 3rd day of August 1923.

WILLIAM B. CROWELL.