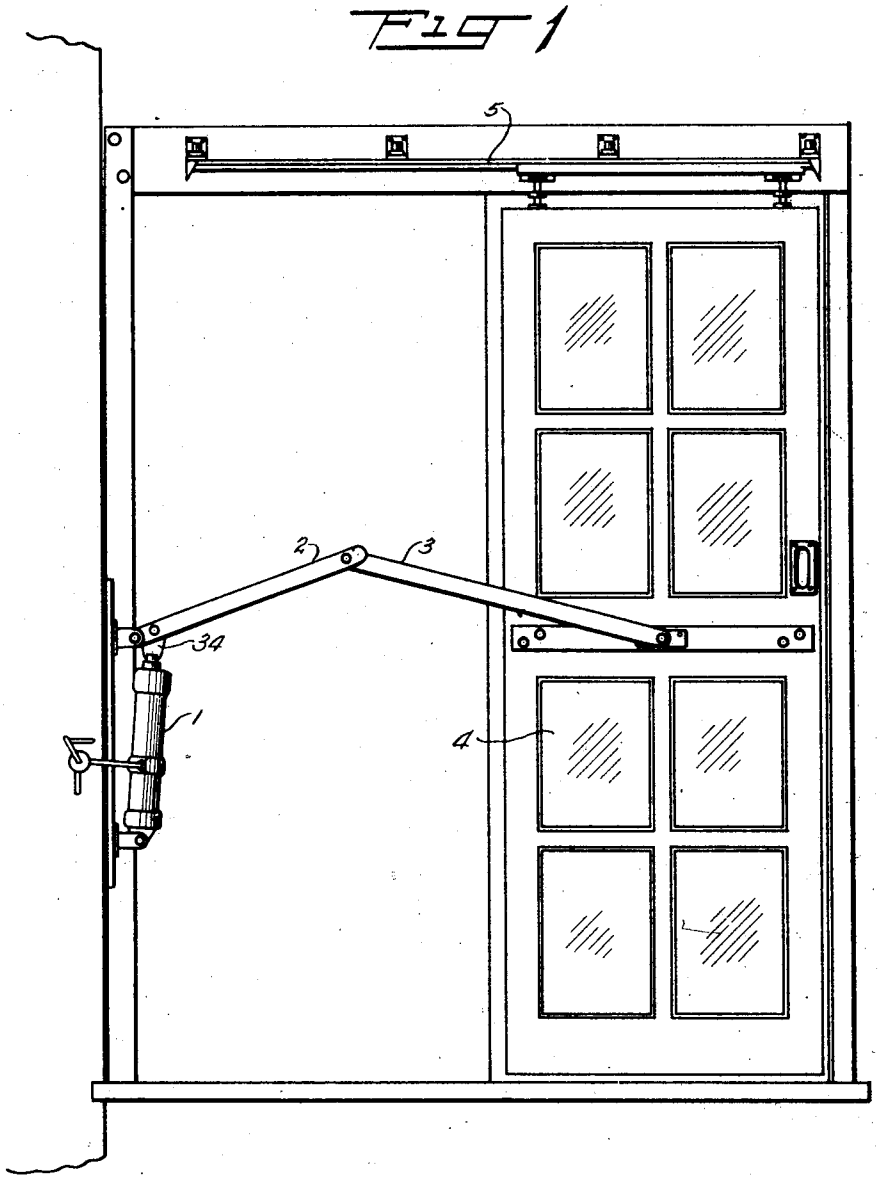
May 21, 1929. W. B. CROWELL ET AL 1,714,160

MEANS FOR CONTROLLING THE MOVEMENTS OF DOORS

Original Filed June 21, 1923 3 Sheets-Sheet 1

Fig 1



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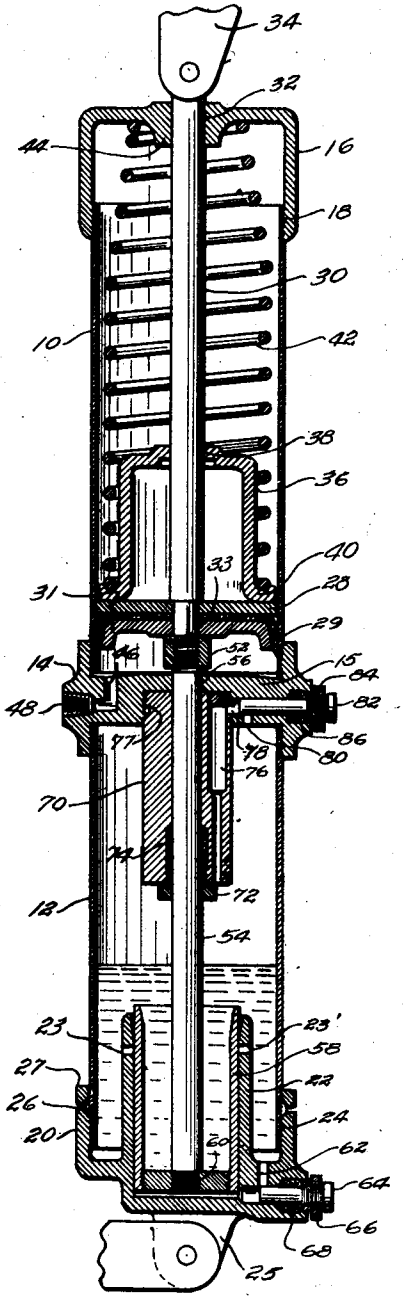
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MEANS FOR CONTROLLING THE MOVEMENTS OF DOORS

Original Filed June 21, 1923 3 Sheets-Sheet 2

Fig 2



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MEANS FOR CONTROLLING THE MOVEMENTS OF DOORS

Original Filed June 21, 1923 3 Sheets-Sheet 3

Fig 3

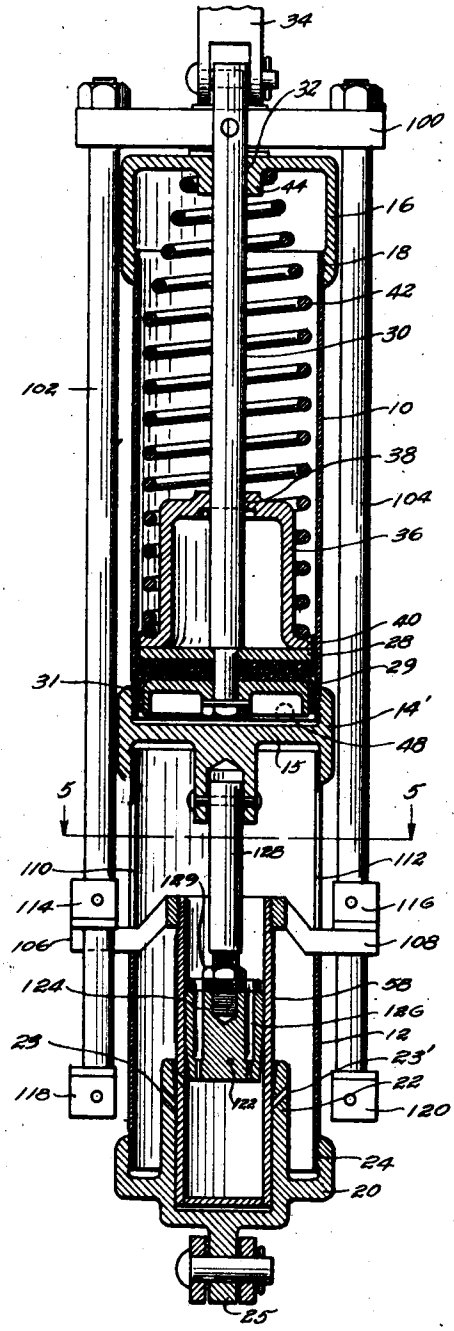
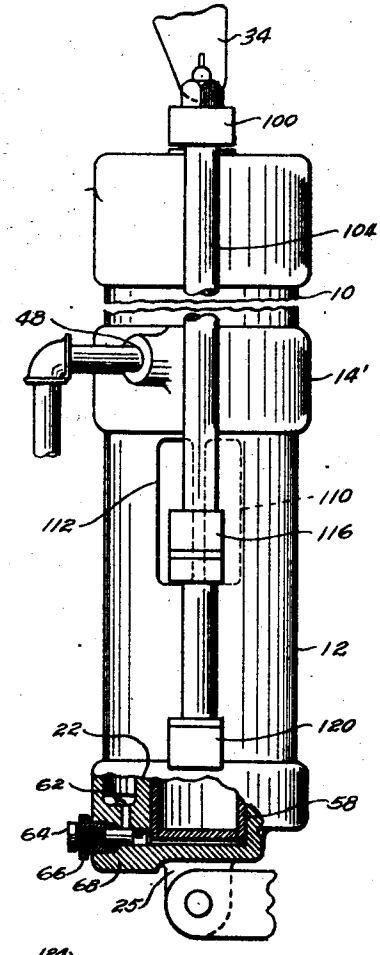


Fig 4



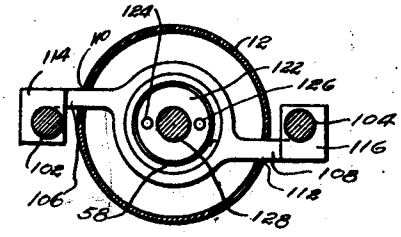


Fig 5

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UNITED STATES PATENT OFFICE.

WILLIAM B. CROWELL, OF NEW YORK, N. Y., AND CYRUS W. BASSETT, OF MONTCLAIR, NEW JERSEY, ASSIGNORS TO ELEVATOR SUPPLIES COMPANY, INC., OF HOBOKEN, NEW JERSEY, A CORPORATION OF NEW JERSEY.

MEANS FOR CONTROLLING THE MOVEMENTS OF DOORS.

Original application filed June 21, 1923, Serial No. 646,781. Divided and this application filed January 12, 1928. Serial No. 246,249.

This invention relates to a door-operating mechanism, and more particularly to a fluid pressure actuated device adapted for operating the toggle levers of elevator doors and other mechanisms.

A general object of the present invention is to provide an improved and simplified power-actuated mechanism for operating elevator doors and similar devices.

Another object of the invention is to provide an improved means for operating doors and the like by means of fluid pressure, in which cushioning action shall be attained in both the opening and closing movements of the device, and which shall be adapted to be manually operated in case of failure of power or other contingency.

This application, which is a divison of our copending application Serial No. 646,781 filed June 21st, 1923, is particularly directed to the cushioning means just referred to and the cushioning means forms the subject of the claims appended hereto.

Another object of the invention is to provide a door operating mechanism in which the speed of operation of the device may be regulated during portions of the forward and return movements of the parts operated.

Another object of the invention is to provide a power-operated mechanism having cushioning means which may be regulated to attain any desired amount of cushioning during predetermined positions of the actuated mechanism.

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

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

Figure 1 is a view showing the invention applied to the toggle levers of an elevator door;

Figure 2 is a vertical section of the preferred embodiment of the invention showing the parts of the device in assembled operative position;

Figure 3 is a vertical sectional view of a modification of the device;

Figure 4 is a profile view of the modified form of the invention, partly in section, showing the cushioning regulating means employed, and

Figure 5 is a horizontal section taken on the line 5—5 of Figure 3.

In Figure 1 of the drawings, a device embodying the invention, designated by numeral 1, is shown as applied in operative position to the toggle levers 2, 3 of an elevator door 4, which is mounted in the usual manner on rollers operating on an overhead track 5. By the admission of fluid pressure to the operating cylinder 1, the toggle levers 2, 3 are forced upwardly causing a sliding movement of the door to the open position, whereas by permitting the exhaust of the pressure fluid from the cylinder 1, the door will return to its closed position. The invention is here shown in operative position to an elevator door for purposes of illustration only, and may obviously be applied to other mechanisms.

The preferred form of the invention comprises two cylindrical casings 10, 12 which are joined together by means of a coupling member 14 having a partition 15 therein. Any suitable means may be employed for joining the coupling member to the casings, but we preferably employ screw-threaded connections for this purpose. The upper casing 10 is closed by means of a cylinder head 16 which is attached thereto preferably by means of screw-thread connections 18. The lower cylinder casing 12 is closed by means of a cylinder head 20 in which is a cylindrical cup 22 which is preferably formed integral therewith. The lower cylinder head is preferably attached to the cylinder by means of screw-threaded connections 24, and has a lug 25 thereon by means of which the cylinder may be attached to a bracket or other suitable supporting means. A suitable packing 26 held in place by means of a holding ring 27 is employed to prevent escape of liquid through the screw-threaded joint 24. Within the upper cylindrical casing 10 is a piston 28 which is slidably mounted therein and attached to a piston rod 30 which extends through an opening 32 in the upper head 16 and is attached to a lug 34 rigidly connected to the link 2 of the toggle levers or other mechanism to be operated.

Positioned upon the piston 28 is a thimble or inverted cup member 36, having an opening 38 therein through which the piston rod 30 passes. The thimble is preferably flanged at the lower portion 40 to permit the carrying of a compression spring 42 thereon. The upper portion of the spring is held in place by means of a projection 44 upon the inner portion of the cylinder head 16. By adjusting the position of the cylinder head upon the threaded portion 18 of the cylinder 10, the amount of compression in the spring may be adjusted or varied to suit the conditions of operation and to attain any desired speed and return of the piston to its normal position after operation thereof by means of fluid pressure.

In the partition 15 is a passage 46 through which operating fluid is admitted to the operating cylinder, and which is provided with a screw-threaded port 48 to which a pipe may be connected for conducting the operating fluid to the cylinder. The passage of operating fluid to the cylinder may be controlled by means of a suitable valve or other controlling means in the pipe connected with the port 48.

Attached to the lower side of the piston 28 is a leather cup washer 29 held in place by means of a plate 31 having a central opening 33 therein through which the piston rod 30 is adapted to pass. The leather washer and supporting plates are adjustably mounted on the piston rod 30 to attain a closely fitting connection between the washer and cylinder wall so as to prevent passage of fluid between the piston and cylinder walls.

In order to provide suitable fastening means for the plate 31, the lower portion of the rod 30 is preferably screw-threaded to receive a screw-threaded collar 52 which serves to hold the parts rigidly in place, and also as a connecting means for a plunger rod 54. The plunger rod passes through an opening 56 in the partition 15 and extends downwardly, reaching the lower end of the cylinder when the piston 28 is positioned in the lower end of the casing 10, as shown in Figure 2 of the drawings. Connected to the lower end of the piston rod 54 is a hollow plunger or cup 58 which is preferably connected to the piston rod by means of a screw-threaded connection 60. The hollow plunger is constructed so as to have an external diameter slightly less than the internal diameter of the cylindrical cup 22, so as to fit closely therein. In the lower cylinder head 20 is an oil passage 62 extending from the lower portion of the interior of the cylindrical cup 22 to the space between the cylinder wall 12 and the wall of the cup 22. In order to regulate the passage of fluid through the passage 62, we employ a regulating screw 64 by means of which the opening through the passage may be varied. The regulating screw is positioned in the cylinder head 20 in an opening therein provided with a bushing 66, and suitable packing 68 to prevent leakage of fluid past the bushing. In the side walls of the cup 22, near the upper portion thereof are passages 23, 23′ to prevent too sudden cushioning when the cup plunger 58 enters the cup 22 in its downward movement.

In the upper portion of the cylinder 12 is a stationary plunger 70 through which the plunger rod 54 passes and which is attached in a recess in the partition 15 preferably by means of screw-threaded connections. A bushing 72 in the lower end of the plunger 70 serves to attain a smooth sliding connection between the plunger 70 and the plunger rod 54 and to hold suitable packing 74 in place above the bushing 72 to prevent passage of oil into the upper cylinder 10 during the reciprocating movements of the plunger rod. A passage 76 is provided in the stationary plunger 70 which connects with a horizontal passage 78 in the partition 15, which in turn connects with a vertical passageway 80 therein as shown in the drawings. In order that the passage 76 may communicate at all times with the passage 78 irrespective of the position of the plunger 70, we provide a circular groove 77 at the top of the plunger which will register with the passage 78 and serve as a communicating passage when the passages 76 and 78 are out of alignment. These passageways serve for the passage of oil or other liquid medium when the cup plunger 58 is forced upwardly around the plunger 70 whereby the liquid in the cup plunger is forced through the passageways into the exterior cylinder. The passage of liquid through the passageways in the plunger 70 is controlled and regulated by means of a regulating screw 82 positioned in a suitable lateral opening in the partition 15, in which it is held in place by means of a bushing 84. Suitable packing 86 is provided in the opening, in which it is held in place by means of the bushing, and prevents leakage of liquid by the bushing.

In the operation of the device, pressure fluid is admitted to the cylinder 10 by means of a valve in the pipe connected to the port 48, which may be hand-operated by a lever positioned at any position in the elevator convenient for the operator. The pressure fluid passing through the passageway 46 forces the piston 28, together with the parts operatively attached thereto, in an upward direction compressing the spring 42. The piston rod 30, which is operatively attached to the toggle levers, forces the link 2 upwardly, causing the opening of the elevator door 4, which will remain open as long as the pressure fluid is allowed to operate on

the piston. When it is desired to close the elevator door, the lever operating the valve which controls admission of fluid to the cylinder 10 is turned to exhaust position, whereby the pressure in the cylinder is released and the spring 42 forces the toggle levers and door to the closed position.

Any preferred form of toggle lever or door-operating mechanism may obviously be used. Any pressure fluid which will operate satisfactorily may be used in the operating cylinder such as steam or compressed air, although we preferably employ the latter medium because of various obvious advantages. An operating pressure in the neighborhood of from 30 to 70 pounds per square inch will operate satisfactorily, but we have found that a pressure of about 35 pounds is the most satisfactory, and permits a manual operation of the toggle levers (which are usually provided with a manipulating handle for this purpose, as shown in the co-pending application of William B. Crowell, Serial No. 638,072) without undue exertion against the operating pressure. The liquid level in the plunger cylinder must be maintained above the level of the cup plunger when in its lowermost position, and may be maintained at approximately the level indicated by the dash line in Figure 2. Any suitable liquid may be employed in the plunger cylinder to attain the cushioning effect, such as oil or glycerine, but we prefer the use of a medium lubricating oil.

The modified form of power-operating mechanism shown in Figures 3, 4 and 5 is of slightly different construction although similar in operation to the preferred form of the invention to which our co-pending application No. 311,593, filed Oct. 10th, 1928, is directed. This form of the invention comprises a two-compartment cylinder casing having an upper and a lower casing joined together by means of a coupling member in a manner similar to that of the form already described. The cylindrical compartments are closed by means of adjustable heads or caps, and joined thereto preferably by means of screw-threaded connections. In the upper compartment, within the casing 10, is a piston to which is attached a piston rod which passes through an opening in the upper head, and is connected to the lever or mechanism to be operated. Surrounding the piston rod is a helical spring held in place preferably in the manner described in connection with Figure 1 of the drawings, and which serves to return the door mechanism to closed position after operation of the piston by fluid pressure. Connected to the upper part of the piston rod 30 and external to the casing 10 is a crosshead 100 to which are attached side operating rods 102, 104, adapted to move up and down with the movements of the piston and piston rod. In the lower casing 12 is a cup plunger 58 to which are rigidly attached side arms or extension arms 106, 108 which extend outwardly through slots 110 and 112 in the lower cylinder casing 12 and slidably engage the rods 102 and 104 respectively. Positioned upon the reciprocatory rods are two sets of adjustable stops or engagement blocks, the upper set 114, 116 serving to contact with the extension arms 106, 108 during the downward stroke of the piston and side rods, and the lower set 118, 120 serving to contact therewith during the upward movement of the piston and rods. During the opening movement of the door, the piston, piston rod and side rods move upwardly and the side arms 106, 108 at first slide upon the rods 102, 104 leaving the cup plunger in its lower position until toward the end of the stroke the stops 118, 120 engage the extension arms 106, 108. The cup plunger is then lifted upwardly by means of the stops and in cooperation with a stationary plunger, in a manner to be further described, serves to attain cushioning action. During the closing movement of the door the piston, piston rod and side rods move downwardly and the extension arms 106, 108 slide upon the side rods 102, 104 during the first part of the stroke, and toward the end of the stroke the stops 114, 116, engage the side arms, forcing the cup plunger downwardly into a cylindrical cup containing oil or other liquid, by means of which checking or cushioning action is attained at the end of the door-closing movement.

In the lower compartment of the device, within the casing 12, are members which operate in a manner similar to the corresponding members in the preferred form of the invention, providing cushioning or checking action. A stationary plunger 122 having passages 124, 126 therein is attached to the partition 15 by means of a plunger rod 128 upon which the plunger is adjustably attached by means of screw-threaded connections. A lock nut 129 is positioned upon the threaded portion of the plunger rod 128 and serves to hold the plunger in any desired position, a perforated washer being preferably interposed between the nut 129 and the stationary plunger 122, as illustrated in Figure 3. In the lower portion of the casing 12 is a cylindrical cup 22 similar to that shown in Figure 1 of the drawings and which is adapted for receiving the cup plunger. The lower cylinder 12 is filled with oil or other liquid to a level somewhat above the edge of the cup 22 for the most satisfactory action. At the lower portion of the cup 22 is a passage shown more particularly in Figure 4 of the drawings, through which the passage of liquid is controlled in a manner similar to that in connection with the corresponding passage

shown in Figure 2 of the drawings. In the side walls of the cup 22 are passages 23, 23' through which oil will flow when the cup plunger first passes into the cup, thus preventing a sudden cushioning action. In order also to prevent sudden cushioning action, the side walls of the outer cylindrical cup may be flared outwardly near the upper portion thereof. In the walls of the movable cup plunger are orifices or passages at a height somewhat above the passages in the outer cup, and preferably at a level corresponding to the flared portion in the outer cup, when the cup plunger is in its lowermost position.

In the operation of the modified form of the power-operating mechanism cushioning effect may be made to take place at substantially any desired portion of the stroke by positioning the lugs or blocks at suitable positions on the vertical rods 102, 104. In the preferred form of the device the same result is accomplished by varying the positions of the fixed plunger 70 or by using a plunger of the proper length to give the desired effect at the end of the upward stroke, and by varying the position of the cup 22 by suitably adjusting the position of the lower head 20, or by employing a cup 22 of a height to attain the desired effect. Cushioning action may therefore be made to take place at any desired point of the forward or return stroke of the plunger, and by suitably regulating the passage of liquid through the liquid passageways the speed of the cushioning action is also controlled. By suitably regulating the pressure applied to the piston, any desired speed of action of the mechanism together with cushioning at any predetermined part of the forward and return strokes of the plunger, may be attained.

It is to be understood that various changes or modifications may be made in the device described, as will be apparent to those skilled in the art, without departing from the spirit or scope of the invention.

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

1. In a door-operating mechanism, a cushioning device comprising a cylinder adapted to hold a liquid therein, a movable plunger in the cylinder, a cup within the cylinder, a liquid passage in said cup, means for regulating the passage of liquid therethrough, a stationary plunger having a liquid passage therein, means for regulating the passage of liquid therethrough, and means for reciprocating the movable plunger to co-operate with the cup and stationary plunger to attain cushioning action during movements thereof.

2. In a door-operating mechanism, a cushioning device comprising a cylinder, a liquid in the cylinder, a cup in the lower end of said cylinder, a stationary plunger in the upper end of said cylinder, a movable plunger adapted to pass into said cup on one stroke and to pass around the stationary plunger on the other stroke, and liquid passages in said cup and stationary plunger through which liquid is forced by the movable plunger.

3. In a door-operating mechanism, a cushioning device comprising a cylinder, closure means for the cylinder, a cup in the lower end of the cylinder, a restricted passageway from the interior of the cup to the exterior thereof, a stationary plunger in the upper part of said cylinder, a restricted liquid passageway in said stationary plunger, a movable plunger adapted to reciprocate within the cylinder and to be retarded in its downward movement by passing into the said cup whereby liquid is forced through said restricted passageway therein, and to be retarded in its upward movement by passing around said stationary plunger so as to force liquid through said restricted passageway therein, and means for regulating the passage of liquid through said restricted passageways to regulate the cushioning action.

4. In a device of the class described, a fixed plunger, a cup having a flared rim and positioned in spaced relation with respect to the said plunger, and a cup plunger operatively connected to a mechanism to be controlled, the said cup plunger having a flared upper portion and adapted to receive the fixed plunger in one position thereof and to be received by the said cup in another position thereof.

5. In a device of the class described, a cylinder adapted to contain a liquid, a fixed plunger in the cylinder having a passageway therein, a cup having a flared rim, a passageway in the cup, and a cup plunger, operatively connected to a mechanism to be controlled, said cup plunger being adapted to receive the fixed plunger and having the upper portion of its internal surface flared to regulate by means of the flow of liquid, the movement of the cup plunger with respect to the fixed plunger, the said cup plunger being also adapted to be received by the said cup and to be controlled in its movement by the flow of liquid at the flared portion thereof and through the said passageway in the cup.

6. In a device of the class described, a stationary plunger, a cup positioned in spaced relation to said stationary plunger, a cup plunger operatively connected to a mechanism to be actuated, the said cup plunger co-operating with said stationary plunger and said cup to cushion the movements of said mechanism.

In testimony whereof we affix our signatures.

WILLIAM B. CROWELL.
CYRUS W. BASSETT.