

Dec. 26, 1939.

A. SWANSON
HYDRAULIC DOOR CHECK
Filed Jan. 15, 1936

2,184,607

2 Sheets-Sheet 1

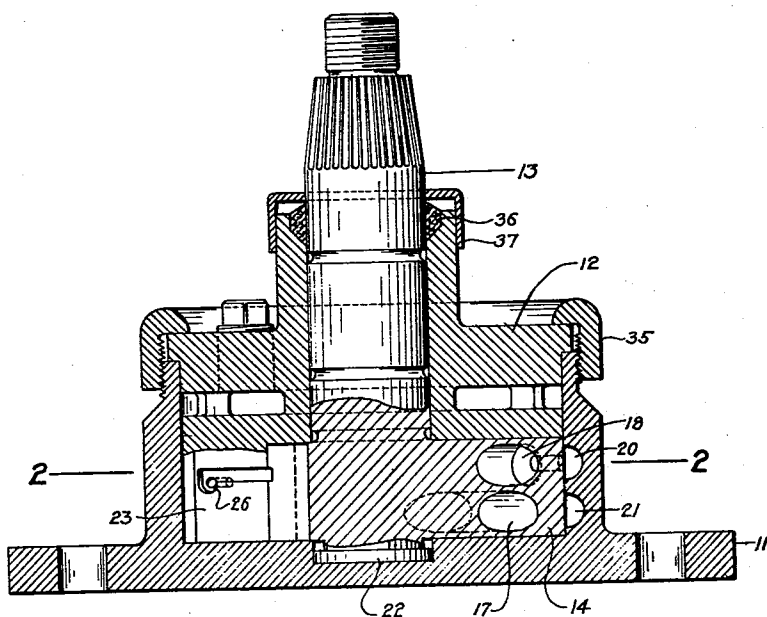


Fig. 1

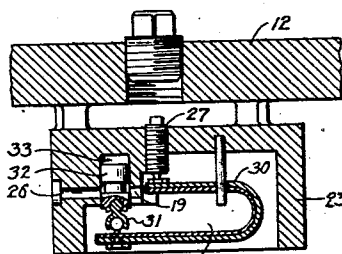


Fig. 3

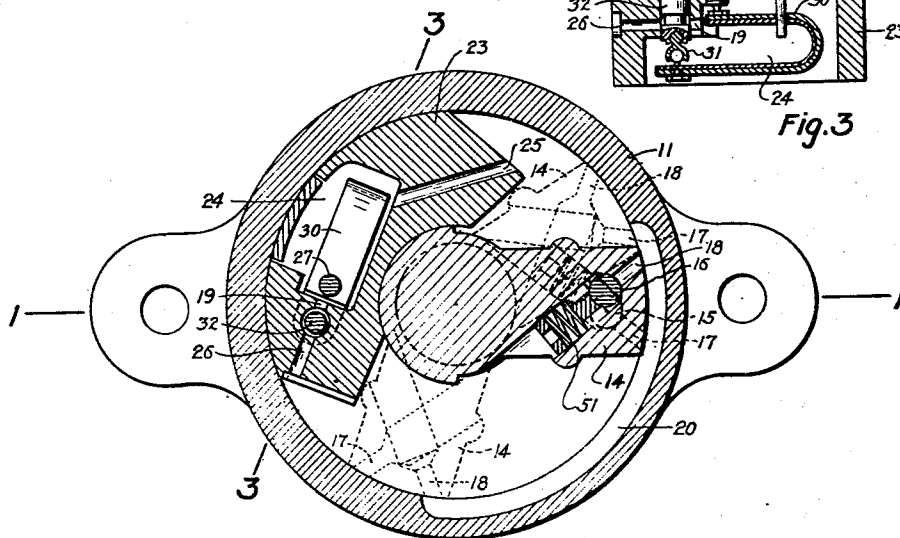


Fig. 2

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2 Sheets-Sheet 2

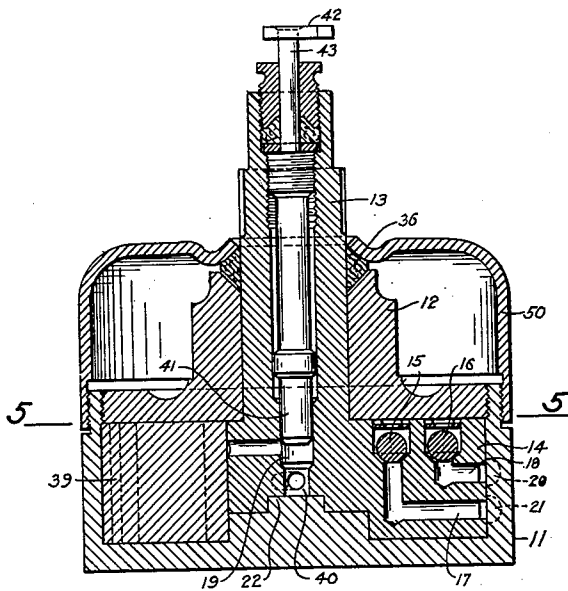


Fig. 4

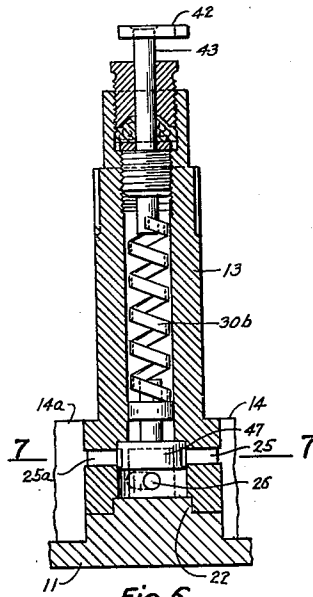


Fig. 6

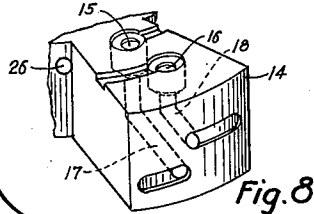


Fig. 8

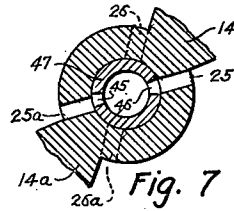


Fig. 7

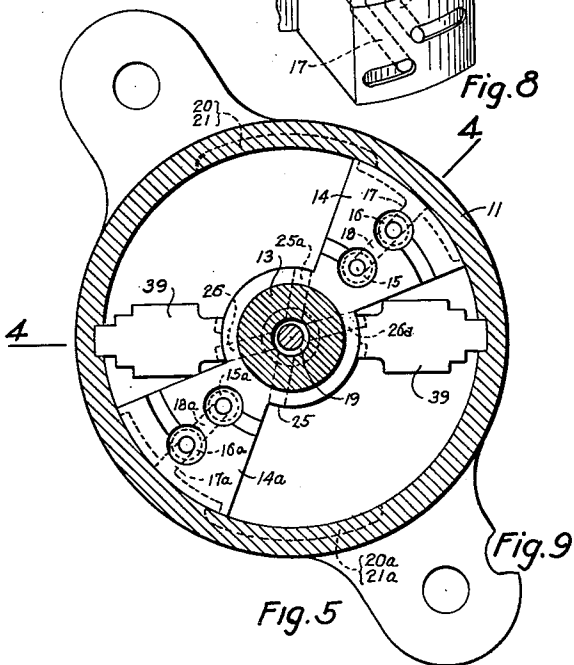


Fig. 5

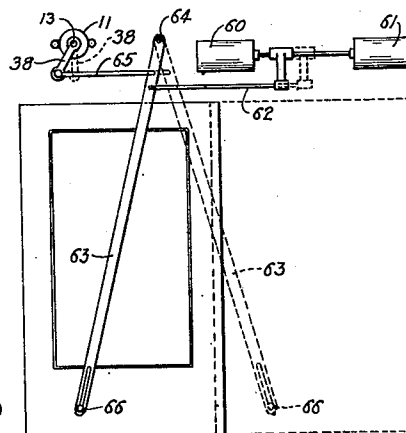


Fig. 9

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HYDRAULIC DOOR CHECK

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4 Claims. (Cl. 16—82)

This invention relates to door checks, and more particularly to hydraulic checks for controlling the rate of movement of a sliding door through any portion or all of its movement.

One of the objects of the invention is to provide an hydraulic door check which controls the movement of a sliding door through any portion of its opening or closing movement. Another object is to provide an hydraulic door check for sliding doors such as elevator doors by which the movement of the door near the end of its travel either on opening or closing, or near the end of both movements is decelerated, while the reverse movements are unretarded. Another object is to provide checks for sliding doors by which the motion of a door during the movement intermediate the decelerated closed position and the decelerated opened position is relatively unretarded. Still another object of this invention is the provision of a controlled-movement hydraulic door check for sliding doors having means for automatic compensation for the effects of changes of temperature upon the rate of deceleration of movement. These and other objects will be apparent from the description and drawings, in which

Fig. 1 is a vertical cross-section, partly in elevation, showing one form of my door check.

Fig. 2 is a horizontal section of a door check taken on the line 2—2 of Fig. 1.

Fig. 3 is a partial section taken on the line 3—3 of Fig. 2 showing in detail the thermostatically controlled valve mechanism.

Fig. 4 is a vertical cross-section, partly in elevation, showing another form of my invention.

Fig. 5 is a horizontal section taken on the line 5—5 of Fig. 4, showing a double piston arrangement involving my invention.

Fig. 6 shows in section a thermostatically controlled valve arrangement adaptable to the double piston device of Figs. 4 and 5.

Fig. 7 shows in detail a section through the valve on the line 7—7 of Fig. 6.

Fig. 8 shows in perspective the details of the ball check cross valves in the pistons of Figs. 4 and 5.

Fig. 9 shows diagrammatically one method of applying my door check invention to the operation of a sliding door actuated by a double acting piston, such as commonly employed for operating elevator doors and the like.

Referring to these figures, 11 represents generally the main casing and base, which together with the top plate 12 defines the working chamber which is normally filled with liquid; 13 represents

a shaft upon which is fastened the vane or piston 14 (and 14a in Figs. 4 and 5), in which are by-passes 17 and 18 (with 17a and 18a in Figs. 4 and 5) and corresponding check valves 15 and 16 (and 15a and 16a). These by-passes connect the two portions of the working chamber on either side of the piston with by-pass grooves 20 and 21 (with 20a and 21a in Figs. 4 and 5) which are cut in the sliding contact surface between the piston and the inside working chamber wall of the main casing and base 11. An orifice 19 controls the flow of liquid from one part of the working chamber to the other when the by-passes 17 and 18 are not functioning. These by-passes 17 and 18, with their respective ball checks 15 and 16, allow the flow of the fluid through the piston when the motion of the piston is reversed at the end of the stroke, at which positions one of the by-passes, either 17 or 18 is in communication with its respective slot, either 20 or 21. Light springs holding the balls of the check valves in the seats are preferred, and are indicated at 51. The shaft 13 is seated at 22 on the base 11, and is journaled in the top plate 12 for rotation with the movement of the vane or piston 14.

Referring specifically to Figs. 1, 2 and 3, a fixed block 23 having an auxiliary liquid reservoir 24 is attached within the space defined by the base 11 and the top plate 12. The reservoir 24 communicates with the right hand portion of the working chamber by the duct 25 and with the left hand portion of the working chamber by the duct 26, interposed in which is the orifice 19 whose opening is controlled by the hand adjustment screw 27, which is adapted to raise and lower the position of the U shaped thermostatic element 30, which in turn through the ball and socket joint 31 controls the position of the grooved cylinder 32 in its seat 33. The bimetallic thermostatic element 30, by expanding and contracting with the rise and fall of the temperature of the liquid in the instrument, also automatically opens the orifice more when the temperature is lower, and restricts the orifice when the temperature is higher, thus compensating for the change in rate of flow of liquid through the orifice due to temperature changes in viscosity. In the instrument shown in Figs. 1 and 2, the top plate 12 is held in place relative to the base 11 by the threaded collar 35. The packing 36 is held closely around the shaft 13 to prevent leakage of liquid by the cap 37. The exterior portion of the shaft is fluted and

threaded to adapt it to hold the lever arm 38 (of Fig. 9).

The instruments shown in Figs. 4 to 8 vary in details of construction from those shown in Figs. 1 to 3, but utilize the same underlying ideas of my invention. In Figs. 4 and 5 is shown a double piston heretofore designated as 14 and 14a, joined as radii revolving partly around the shaft 13 in the duplicate working chambers, separated by a fixed partition 39. As the contained liquid is moved from one side of each piston to the other in its respective working chamber, the liquid, when not by-passed through the valves 17 and 18, or 17a and 18a, is forced by way of the ducts 25 and 25a through the common orifice 19 which in this design is constructed within the lower end of the shaft 13, and then through ducts 26 and 26a into the other side of the working chamber in each of the units. The liquid after passing through the orifice 19 passes through a common connecting duct 40 cut in the shaft 13 just below the orifice, and in turn communicating with the working chambers through the ducts 26 and 26a above mentioned. The liquid pressure load is therefore distributed between the two working chambers and pistons, which therefore function simultaneously. The size of the orifice 19 may be adjusted manually by screwing the plunger 41 in and out by means of the threaded rod 43 and hand lever 42. This type of instrument may also be equipped with thermostatic control of the orifice opening to compensate for the temperature change in viscosity of the liquid. One arrangement for this is shown in Fig. 7, in which the shaft 13 encloses a spirally wound bimetallic thermostat element 30b attached at the upper end to the hand adjusting means 42 and 43, and at the lower end to a cylindrical valve 47 having two ports 45 and 46 which may be aligned with the ducts 25 and 25a forming orifices for restricting the flow of liquid. The changes in temperature of the bimetallic helix partly opens or closes the ducts 25 and 25a by slightly revolving the cylinder valve 47. Fig. 7 shows in detail this valve or orifice arrangement. The packing 36 around the shaft 13 in Fig. 4 is held in place to prevent leakage of liquid, by the covering cap 50 which is threaded to the base portion 11. Slots 20 and 21, and 21a and 20a, are cut in the side walls of the base portion 11, in the area of contact with the pistons 14 and 14a. These slots are so placed that as the piston moves, they are in alignment with the ducts 17 and 18 (and 17a and 18a) leading from the contact surface between the cylindrical face of the piston and the larger cylindrical wall of the working chamber. Ball checks are placed in the ducts 17 and 18, and 17a and 18a to control the flow of liquid in one direction only.

Fig. 9 shows one method of applying my door check to the operation of a sliding door such as an elevator door. The motive force for moving the door is supplied by any suitable means such as the double cylinder and piston arrangement indicated at 60 and 61, which is adapted to move the arm 62 horizontally. This arm 62 is pivotally attached to the long lever arm 63 rotatably pivoted at 64, the opposite end being attached to the door by a sliding pivotal attachment means 66. Also attached to the arm 63 is lever 65, which is also linked to the lever arm 38 which is rotated around the shaft 13 of my door checks by the oscillation of the piston or pistons. As the door is moved toward the right position by the pressure (air or liquid) exerted in the piston and

cylinder means represented by 60 and 61, the piston 14 in the door check (for example the type shown in Figs. 1 and 2) is moved from left to right with practically no retarding action. The liquid in the working chamber, at the beginning of the left to right stroke, passes through the groove 20 into the by-pass 18, opens the check valve 16 by pushing the ball out of its seat against the slight pressure exerted by the spring 51, and the liquid passes to the left hand portion of the working chamber. Some of the liquid may also pass through the duct 25 to the auxiliary reservoir 24 through the orifice 19 and out through the duct 26 to fill the working chamber portion to the left of the piston, although only a small portion will flow through this latter path because of the restricted orifice 19. As the piston approaches the right hand end of its travel, the by-pass 18 is shut off because its opening moves beyond the groove 20 in the cylinder wall. The liquid cannot then pass through this by-pass 18, nor can it pass through the other by-pass 17 connected with the groove 21 because the ball check valve 15 is closed by the liquid pressure. Therefore the liquid must pass through the duct 25 to the reservoir 24, through the orifice 19 (adjusted by hand or thermostatically to the desired opening) and out through the duct 26. This restricted flow of liquid through the orifice checks the action of the door at the end portion of its movement to the right. When the door is next moved toward the left hand position, the door check instrument of my invention offers no resisting force from the beginning of movement nor until the door is nearly in its extreme left hand position. In the instrument itself, referring again specifically to the modification shown in Figs. 1 and 2, the liquid passes freely through the by-pass 17, whose ball check valve 15 is unseated when the movement is reversed by the liquid flowing through the groove 21 from the left hand portion of the working chamber to the right hand portion. As before, a smaller portion of the liquid flows through the duct 26, through the orifice 19 to the reservoir 24 and out through the duct 25, but because of the restricted orifice this flow is less than through the by-pass 17. As the end of the movement of the door to the left is approached, the piston 14 in my door check meets resistance because the outlet of the by-pass 17 is cut off by the piston movement past the groove 21 in the cylinder wall, and the only passage open for the flow of the liquid is then through the duct 26, through the orifice 19 (adjusted by hand or thermostatically to the desired opening) to the reservoir 24 and out through the duct 25. It is this restricted flow of liquid in the door check which retards the door movement near its extreme left hand movement. When the door movement is again reversed, moving to the right, the same cycle of events occurs in the door check instrument as first described above. The hand adjustment of the orifice 19 permits regulation of the checking action of the movement, and the automatic thermostatic regulation compensates for changes in temperature.

The modifications of my invention shown in Figs. 4 to 8 function in an analogous manner to that described for the form shown in Figs. 1 to 3, with the variations necessitated by the differences in structure. The movement of the two pistons 14 and 14a is simultaneous, and the common orifice 19 is analogous to that above described. The angular movement of the double piston form is usually less than the angular movement of

the single piston form, but the retarding action at the end of the stroke either to the left or to the right, is similar in the two forms.

The portion of the stroke which may be retarded may be altered by varying the position and length of the grooves 20 and 21 in the cylinder walls. It is also possible to attain the same result by putting the grooves in any part of the sliding contact surface over which the piston moves in its stroke, with appropriate alterations of the by-pass ducts in the piston.

Although I have shown and described certain specific embodiments of my invention, I am aware that many modifications are possible, and my invention therefore is not to be restricted except insofar as is necessitated by the prior art and by the spirit of the appended claims.

I claim:

1. In an hydraulic door check, an enclosed working chamber, a reciprocative rotary piston acting within said chamber, a passageway communicating between the two portions of the working chamber on either side of the piston, an adjustable orifice in said passageway, means for thermostatically adjusting the opening of the orifice, a groove in the piston-contacting surface of the working chamber adapted to allow the flow of liquid around the piston during the middle portion of the piston stroke, and two by-pass conduits in said piston, each having one end terminating in the face of said piston in position to coact with said groove and having the other ends terminating on opposite sidewalls of the piston, and check valves in said conduits permitting the flow of liquid only from the groove end to the sidewall end of said conduits.

2. In an hydraulic door check having a reciprocative rotary piston acting within an enclosed working chamber, an adjustable orifice through which an hydraulic fluid may be passed from one side of the piston to the other, manual means for adjusting the size of said orifice, means for thermostatically adjusting the orifice to compensate for temperature changes in the fluid, and means for by-passing a portion of the hydraulic fluid around the said orifice during portions of the piston stroke.

3. In an hydraulic door check, an enclosed working chamber for a single piston, a reciprocative piston adapted to rotate within said cham-

ber, a shaft attached to said piston, a reservoir adjacent said chamber, an open conduit connecting said chamber and said reservoir on one side of the piston, another conduit connecting said reservoir and said chamber on the other side of said piston, said other conduit being provided with an orifice, thermostat means for adjusting the size of said orifice, a groove in the piston-contacting cylindrical wall within said working chamber adapted to permit free flow of the hydraulic liquid past the end of said piston during the middle portion of its stroke, and spring-controlled by-pass conduits through said piston permitting the fluid on one side of the piston to flow through the piston in the direction opposite the movement of the piston at the time the piston movement is reversed near the ends of the working chamber.

4. In an hydraulic door check, a casing, an enclosed working chamber for a single piston, a reciprocative piston adapted to rotate within said chamber, a shaft attached to said piston and rotating in bearings in said casing and extending therefrom, a reservoir within said casing having walls defining the limits of rotation of said piston to the right and to the left and forming two end walls for said working chamber, an open conduit through one of said walls between said working chamber and said reservoir, another conduit through the other of said walls between said reservoir and said working chamber, said other conduit being provided with an orifice, a thermostat means located within said reservoir for adjusting the size of said orifice, a groove in the piston-contacting cylindrical wall of said casing within the working chamber adapted to permit free flow of the hydraulic fluid past the end of said piston during the middle portion of its stroke, two by-pass conduits in said piston each having one end terminating in the face of said piston in position to coact with said groove and having the other ends terminating on opposite sidewalls of the piston, and spring controlled check valves in each of said conduits permitting the flow of the liquid only in the direction from the groove end to the sidewall end of said conduits when the liquid pressure in the groove exceeds the liquid pressure on the piston sidewall by an amount sufficient to overcome the springs controlling said check valves.

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