The present invention relates to a door check and is particularly directed to those hydraulic door checks of the type operating a spring for closing the door.

Door checks as such have been in use for many years. Many of the prior art devices incorporate an adjustment means to control the flow of fluid, compressed in one end of the cylinder as the door is being closed, so that the speed at which the door closes may be varied. In door closers of the hydraulic type as distinguished from those of the air type, the adjustment means heretofore provided on the devices commercially available generally require the dismantling of at least a portion of the apparatus, or, if, in any event, the use of a tool in making the adjustment, it is impracticable, or the method of manufacture is such that the adjustment of the speed at which the door will close can be made without tools and without any dismantling of the apparatus, removal of parts, etc., but simply by grasping the door check cylinder and turning it. Once the adjustment is set it will be maintained until it is again intentionally reset.

Suggestions have heretofore been made to utilize in a hydraulic check an adjustment means which does not require disassembly or removal of any parts to achieve adjustment. Such suggestions invariably required a part that was not readily available and which normally remained fixed while the latter moved. Obviously, this introduced additional packing glands with their attendant disadvantages. Probably this was the reason why their use has not been generally adopted in commercial devices, which, to the best of my knowledge, is the case.

Another important object and advantage of my invention is the provision of a combination door closing mechanism and door check which is simple and inexpensive to manufacture. At the same time, it is reliable and trouble free over an extraordinary long period, taking into consideration the fact that the precision fitting of parts with its attendant expense is not required.

Further objects and advantages will become apparent from the following description taken in conjunction with the drawings which:

FIGURE 1 is a perspective view of the top of a door illustrating an embodiment of my invention in operating position, and being adjusted by an individual;

FIGURE 2 is a plan view of the top of the door of FIGURE 1 in closed position and the embodiment secured thereto;

FIGURE 3 is a section through the length of the embodiment illustrating the internal structure thereof;

FIGURE 4 is a partial section corresponding to FIGURE 3, but with the piston rotated 90° and showing the parts as they are positioned as the door is being opened;

FIGURE 5 is a fragmentary section as viewed in FIGURE 3, but illustrating the structure as the door is being closed;

FIGURE 6 is a transverse section as viewed at line 6—6 of FIGURE 5; and

FIGURE 7 is a section of an alternate structure for mounting the closed end of the cylinder.

FIGURE 1 illustrates a portion of a door 10 mounted on a door frame 11 by hinges 12. The door check apparatus of my invention includes a pair of mounting brackets 13 and 14. A stud 15 at the forward end of the check apparatus is pivotally connected to bracket 14 by means of pin 16. Similarly, the outstanding end of piston rod 17 at the backward end of the check apparatus is pivotally connected to bracket 14 by means of pin 18.

The operating structure of the check apparatus is best illustrated in FIGURES 3-6. It will be seen that the apparatus comprises a tubular shell 20, the inner cylindrical wall of which defines a fluid cylinder 21. Stud 15 is rotatably mounted at the forward end of shell 20. To achieve this a washer 22 is seated against an abutment 23 on the interior of the shell. Stud 15 has an annular boss 24 forming a plug within shell 20 and abutting washer 22. The end 25 of shell 20 is spanned or crimped about boss 24 so that the boss is fixed in place between washer 22 and the inward flanges formed by end 25. An O seal ring 26 is seated in an annular groove 27 in boss 24, and contacts the boss as well as the inner wall of shell 20. Seal ring 26 and boss 24 provide a fluid-tight closure in that end of the fluid cylinder.

With the structure described, while boss 24 is restrained against movement along a line parallel to the axis of cylinder 21 it is, at the same time, permitted to rotate about said axis with respect to the cylinder. This is an important feature of my invention as will hereinafter be apparent. It will be seen that the structure I have devised is sufficiently sturdy that it will withstand the compressive forces present when the door is released as well as any tendency to "cook" or misposition one of the rotatable parts of the joint with respect to the other. A rotatable joint which would not withstand such abuse could not be used in my invention.

At the backward end of shell 20 there is a plug 30 through which piston rod 17 extends. The outer end of plug 30 has a circular recess 31 within which is seated an O seal ring 32. End 33 of shell 20 is spun over seal ring 32 to provide a fluid-tight seal between the shell and the plug.

Inner face 35 of plug 30 has the configuration of a frustum of a cone. A resilient annular seal 36 is received about piston rod 17 and abuts face 35 of plug 30. At the opposite side of seal 36 is the frusto-conical face 37 of a washer 38. The pressure of compression spring 39, as hereinafter described, in conjunction with frusto-conical faces 35 and 37 urges seal 36 into contact with the periphery of piston rod 17 to maintain an oil-tight seal between plug 30 and piston rod 17.

Piston 41 has a threaded axial opening 42 extending therethrough. End 43 of piston rod 17 is correspondingly threaded to engage the threads of the piston. Piston 41 includes an annular boss 44 extending from one side face 45 of the piston. Along a portion of one side of opening 42, parallel to the axis of opening 42, extends a groove 46. Groove 46 extends the full length of boss 44, but terminates at 47 before reaching the end of opening 42 at the opposite side 48 of the piston. Piston 41 has a pair of slots or openings 49 on its periphery and extending from side 45 to side 48 thereof.

An annular resilient piston ring 50 abuts outer face 43 of piston 41. Piston ring 50 is held in place by a washer 51. In turn, washer 51 is fixed between abutment 52 and the flanged end 53 of piston 41. It will be noted that piston ring 50 has a configuration similar to that of a flat washer. It not only serves the function of a normal piston ring on the door closing stroke, but it unblocks openings 49 as a check valve on the door opening strokes.

The shell of the closer contains a suitable oil with sufficient air space to allow the apparatus to operate as a type which comprises a tubular extension of the piston rod is extended and retracted. The composition of the various sealing members 26, 32, 26 and 48 will be of a type which can be selected from various available materials well known to those skilled in the art, such as Buna N rubber or the chloroprene rubber sold under the trademarks Neoprene or Duprene.
With the check apparatus mounted as illustrated in FIGURES 1 and 2, the opening of door 10 withdraws piston rod 17 from the cylinder 21. This movement compresses spring 39 between face 45 of piston 41 and washer 38. The direction of movement of piston rod 17 itself, illustrated by arrow 69 in FIGURE 4, forces the oil through openings 49 as well as through the passageway comprising groove 46 and the connecting portions of opening 42; the oil being forced through opening 49 bends sealing ring 69 away from face 70 of the piston as illustrated in FIGURE 4. This permits the oil to move freely from the left side of piston 41 to the right side thereof. In the structure illustrated, sealing ring 59, in conjunction with slots 49, functions as a check valve to let the oil move freely from one side of the piston to the other but to prevent the oil from moving from said other side of the piston to said one side.

It should be noted that the position of the apparatus illustrated in FIGURE 4 is rotated 90° about the axis of the cylinder from the position illustrated in FIGURES 5 and 6. This was done to better illustrate the structure. It also should be noted that the two ends of the apparatus have been turned end for end in illustrating the apparatus in FIGURES 1 and 2 as compared to the manner in which it is illustrated in FIGURES 3, 4, and 5. For example, in FIGURES 1 and 2 piston rod 17 extends from the right end of the apparatus as illustrated, while in FIGURES 3, 4 and 5 the piston rod extends from the left end of the apparatus.

When door 10 is released spring 39 urges piston 41 away from end 33 of the shell. This, of course, creates a force which operates to close the door 10. The speed at which the door closes will depend upon the rate of flow of the oil from the right or forward end of the cylinder (as illustrated in FIGURES 3, 4, and 5) to the left or backward end of the cylinder through the orifice defined by the end of piston rod 17 and the orifice 47 of passageway 46. Sealing ring 59 is pressed against face 48 of piston 41 and effectively prevents any flow of oil about the periphery of the piston from the right side to the left, including preventing any flow through grooves 49. If the orifice defined by the end of piston rod 17 and the orifice 47 of groove 46 is relatively small, the flow of oil through the passageway will be slow and door 10 will close slowly. Conversely, if the orifice is relatively large, the flow of oil from the right side to the left, as piston rod 17 moves in the direction indicated by arrow 61 in FIGURE 5, will be rapid and door 10 will close rapidly.

By reason of shell 20 being rotatably mounted with respect to the brackets 23 and 14 at opposite ends thereof, and the ability of cylinder 20 to frictionally engage piston 41 through the medium of seal ring 59 and the force of the spring bearing against the piston, one is able to adjust the speed at which the door will close without any dismantling of the apparatus whatsoever. As illustrated in FIGURE 1, an individual can grasp shell 26 and by rotating the shell one or the other, can increase or decrease the size of the orifice defined by the end of piston rod 17 and the end of groove 46. For example, referring to FIGURE 3, if shell 20 and thus piston 41 is rotated in a direction such that the threads of piston 41 and piston rod 17 cause piston 41 to move to the left as respects piston rod 17, the size of the orifice will be decreased, thus, when door 10 is released the oil will flow more slowly through the orifice and the door will close more slowly. Conversely, if the shell 20 is rotated in the opposite direction and piston 41 moves to the right with respect to piston rod 17, the size of the orifice will be increased and the door 10 will close more rapidly when it is released.

It will be clear from the foregoing that the means for controlling the speed at which a door on which the door check apparatus is mounted closes is adjusted by adjusting the permissible rate of flow of fluid through the passageway comprising groove 46 and the forward end of opening 42 in the piston. More specifically, this control is achieved by adjusting the size of the orifice defined by the end of piston rod 17 and the end of groove 46. Minimum permissible flow occurs when the piston rod completely closes the passageway as a consequence of projection of the piston rod to or beyond the transition 47 of groove 46 to close the passageway substantially completely. Adjustment of the piston rod with respect to the platen located in these extreme positions makes it possible to adjust the permissible rate of flow of fluid through the passageway and thus the speed at which a door is permitted to close.

In the alternative embodiment of FIGURE 7 there is a shell 79 defining a hydraulic cylinder 71 corresponding to and performing substantially the same functions as the piston rod in FIGURE 4. Cylinder 71, closed by a cross-wall 72, a stud 73 corresponding to stud 15 is secured to bracket 13 by pin 16. Stud 73 has a circular boss 74 held in place by the crimping of end 75 of the shell 79. Mounting means comprises: a plug received in the other end of the cylinder and providing a fluid-tight closure and the mounting means comprises: a plug received in the other end of the cylinder and re...
straining therein against movement axially of the cylinder; a seal between the cylinder and the plug; and a mounting stud extending from the plug.

4. In a door check apparatus having means to control the rate of flow of fluid from one end of the cylinder to the other which means is adjustable by a relative rotation of the piston with respect to the piston rod, and a fixed mounting bracket for the piston rod and a fixed mounting bracket for the closed end of the cylinder, the improvement comprising: a rotatable connection between the last mentioned bracket and the respective end of the cylinder to permit the cylinder to be rotated about its axis with respect to the bracket whereby with the apparatus so mounted said means may be adjusted by a rotation of the cylinder about its axis.

5. In a door check apparatus including a cylinder, a piston having a threaded opening extending axially therethrough, a piston rod threaded into the piston and extending through the backward end of the cylinder, and having means to control the speed at which a door closes by adjusting the rate of flow of fluid through a passageway in the piston and wherein said means is adjustable by rotation of the piston relative to the piston rod, the improvement comprising a mounting stud extending from the forward end of the cylinder and rotatably mounted therein whereby said cylinder may be rotated with respect to said stud, a groove extending along the side of the opening in the piston from the backward side thereof and terminating short of the forward side thereof, and resilient piston ring means mounted upon said piston for preventing the flow of fluid between said piston and said cylinder during the forward stroke of said piston while permitting such flow during the backward stroke, said piston ring means frictionally engaging said cylinder whereby rotation of said cylinder results in rotation of said piston, the arrangement being such that rotation of the cylinder while the piston rod is fixed against rotation changes the extent to which the piston rod extends into the opening in the piston to thereby change the cross-sectional area of the passageway for the flow of fluid through the piston and thus the permitted rate of flow of fluid through said passageway.

References Cited by the Examiner

UNITED STATES PATENTS

991,889 5/11 Proven 16–57
1,675,980 7/28 Lembert 16–66
2,996,754 8/63 Ziegler et al. 16–52
3,057,004 10/62 Sogolan 16–52
3,064,303 11/62 Gray et al. 16–52
3,088,555 5/63 Karlgaard 188–100 X

FOREIGN PATENTS

824,964 12/59 Great Britain.

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