March 29, 1960 B. J. UEBELHOER 2,930,070

DOOR CLOSER

Filed Dec. 7, 1956 2 Sheets-Sheet 1

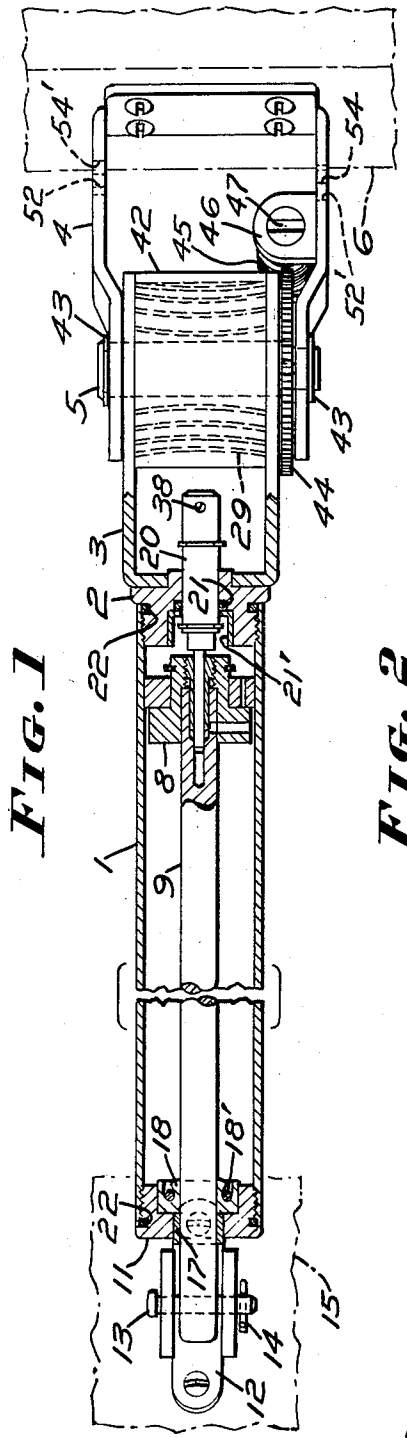


FIG. 1

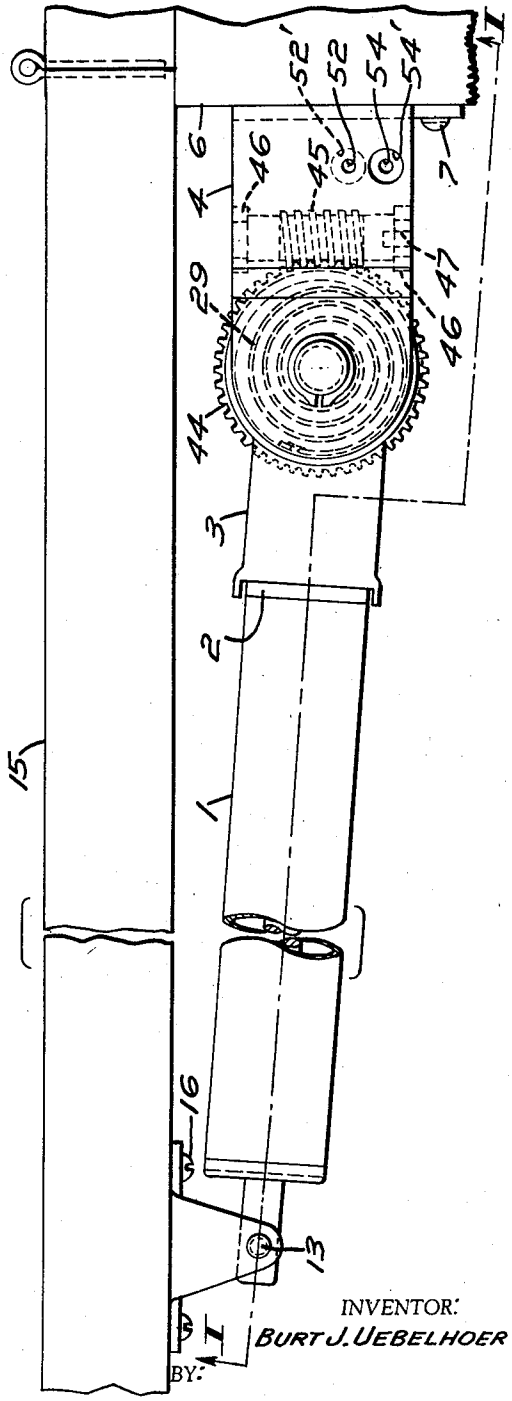


FIG. 2

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FIG. 4

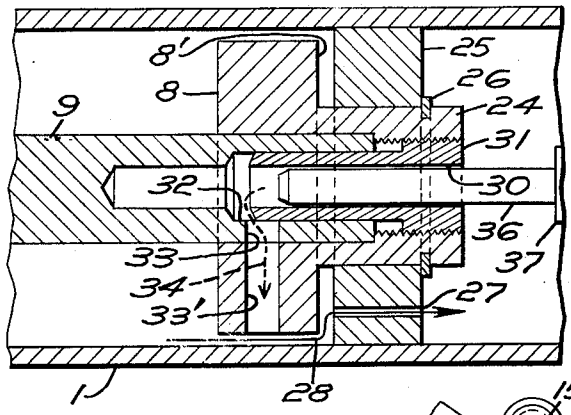


FIG. 3

FIG. 6

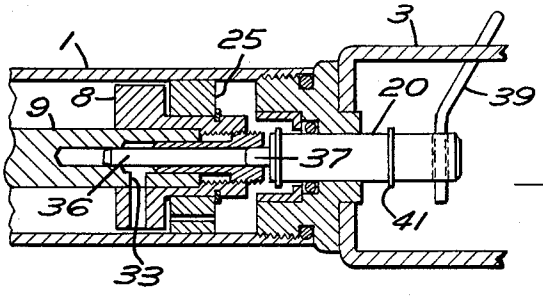


FIG. 5

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DOOR CLOSER

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10 Claims. (Cl. 16—51)

This invention relates generally to the door closer art, and more particularly to a new and useful door closing and checking mechanism of the hydraulic type. Conventional air check door closers have the advantage of being relatively inexpensive and small in size, but suffer from the disadvantage of being relatively weak whereby their field of application is limited. Conventional hydraulic door closer and checking devices offer the strength required for heavy doors, but are relatively expensive and large in size.

Accordingly, a primary object of this invention is to provide a highly practical door closer and check device generally corresponding in size and cost to an air check but which controls an associated door with a hydraulic action, thereby filling the gap between conventional air checks and hydraulic door closers.

Another object of this invention is to provide a hydraulic door closer having improved speed regulating and checking means.

In one aspect thereof, a door closer constructed in accordance with my invention is characterized by the provision of a first bracket, a second bracket pivoted thereto, spring means connected to the second bracket for biasing the latter about its pivot relative to the first bracket, and means for selectively adjusting the tension on said spring means including a worm wheel connected thereto and a worm carried by the first bracket and engaging the wheel for rotating the same.

In another aspect thereof, a door closer and check in accordance with my invention is characterized by the provision of a cylinder containing hydraulic fluid, a piston movable lengthwise of said cylinder, the piston including a head part and a ring part movable toward and away from the head part, a first fluid passage through the piston head part, means for selectively adjusting the size of said first passage, and a by-pass second fluid passage through said piston ring part, said ring part moving toward said head part to close said by-pass upon door closing movement of the piston.

The foregoing and other objects, advantages and characterizing features of a door closing and checking mechanism constructed in accordance with my invention will become clearly apparent from the ensuing detailed description of a presently preferred embodiment thereof, taken together with the accompanying drawings illustrating such embodiment wherein like reference numerals designate like parts throughout the various views and wherein:

Fig. 1 is a side view, partly in elevation and partly in longitudinal section, being taken approximately on line I—I of Fig. 2 with parts broken away for ease of illustration and showing the position assumed by various parts during closing movement of an associated door and prior to opening movement thereof;

Fig. 2 is a top plan view of the door closer and check illustrated in Fig. 1, showing the same as it appears in use, with parts broken away for ease of illustration;

Fig. 3 is a fragmentary top view, partly in plan and partly in longitudinal section, showing the position assumed by various parts of the device when an associated door is in an open position prior to closing movement thereof;

Fig. 4 is a fragmentary enlarged longitudinal sectional view showing the position assumed by the piston parts open initial opening movement of an associated door;

Fig. 5 is a fragmentary, longitudinal sectional view illustrating the manner of regulating the adjusting by-pass; and

Fig. 6 is a fragmentary view showing a stop device for holding the door closer in an open position.

In the illustrated, presently preferred embodiment of a door closing and checking mechanism constructed in accordance with my invention, there is provided a hollow cylinder 1 containing hydraulic fluid and having a cap 2 threadedly engaged in one end thereof. Cap 2 is carried by a yoke 3 pivotally connected to a bracket 4 as by a shaft 5, the bracket 4 being adapted to be mounted on a door jamb 6 as by means of screws 7 or the like.

A piston comprising a head part 8 is movable within cylinder 1 lengthwise thereof, being carried on one end of a piston rod 9. Rod 9 extends through a cap 11 threadedly engaged in the opposite end of cylinder 1, and is pivotally secured at its other end to a bracket 12 as by a pin 13 locked in place by a cotter pin 14. Bracket 12 in turn is secured to a door member 15, as by screws 16. Piston rod 9 is slidable in a bushing 17 carried by end cap 11, and because hydraulic fluid is contained within cylinder 1 appropriate packing 18 of well known construction is force fitted in a recess in end cap 11, and is held against rod 9 as by a spring 18'. A metering pin 20 extends through end cap 2 and is slidable therein for a purpose to be described, and for sealing purposes an O-ring 21 surrounds the same, being held in place by a sleeve 21'. O-rings 22 are provided between cylinder 1 and each of end caps 2 and 11, to further insure a fluid tight seal while permitting ready removal of the end caps.

A particular feature of a door closer and check device constructed in accordance with my invention resides in the speed regulating and checking arrangement provided thereby permitting rapid opening of an associated door, while avoiding uncontrolled opening thereof, and providing an adjustable, controlled rate of closing with means automatically slowing down the closing movement of an associated door just prior to final closing thereof.

To this end, the piston head part 8 is formed to provide a sleeve-like, axial extension 24 thereof of reduced diameter, on which a piston ring part 25 is slidable toward and away from head part 8 between preset limits determined by the adjacent end face 8' of head part 8 and a retainer ring 26 carried by extension 24. Ring part 25 is of a diameter substantially equal to the inside diameter of cylinder 1, whereby it has sliding contact with the inner wall thereof, whereas head part 8 is of substantially less diameter and is spaced therefrom, and ring part 25 is provided with one or more openings 27 therethrough, alined with head part 8, for the passage of hydraulic fluid. Thus, upon opening movement of the associated door 15, the hydraulic fluid on the left side of the piston, as illustrated in the drawings, will force the piston ring part 25 to its extended position away from head part 8 as illustrated in Figs. 3, 4 and 5 whereby hydraulic fluid will pass to the opposite side of the piston around head part 8 and through openings 27 in ring part 25, as indicated by the full line arrow 28 in Fig. 4, as well as through a passage comprising portions 33', 33, 32 and 30, to be described .

However, upon return movement of the associated door 15, which as will be described is induced by a spring 29 surrounding the pivot shaft 5 interconnecting brackets

3 and 4, the hydraulic fluid on the right hand side of the piston will cause ring part 25 to move along extension 24 to its retracted position against the end face 8' of head part 8, as illustrated in Fig. 1, whereby the piston head part 8 will prevent reverse flow of hydraulic fluid through openings 27.

In this way, upon return, closing movement the hydraulic fluid is forced to flow inwardly through an axial passage 30 in a tubular throttling screw 31, which is threaded into the outer end of extension 24 and projects into a central bore 32 in piston rod 9. The hydraulic fluid then flows outwardly through a radial passage 33 in rod 9 which communicates with a radial passage 33' through the piston head part 8, all as indicated by the broken line arrow 34 in Fig. 4.

Screw 31 is adjustable lengthwise of the piston, because of its threaded engagement with extension 24, whereby it can be turned to any one of an infinite number of restricting positions across the radial opening 33 thereby to throttle fluid flow through said opening to various degrees. Thus, the reverse flow of hydraulic fluid, upon door closing movement can be selectively throttled to provide the desired rate of closing movement which, once it is set, is relatively constant until the door member approaches closed position.

At that point, in order to reduce the speed of the associated door member and thereby provide for gentle closing thereof, the flow of hydraulic fluid through the piston is further throttled by the entrance of the outer end portion 36 of metering pin 20 into the passage 30 in screw 31. While the metering pin end portion 36 has a sliding fit within throttling screw passage 30, it substantially fills said passage and thereby effectively reduces the passage area available for fluid flow and causes the associated door member to slow down and gently close.

This arrangement, with its many advantages is characterized by its simplicity, durability and highly dependable action. Upon opening movement of an associated door, fluid flow takes place through the by-pass opening 27, whereby relatively rapid door opening movement at a substantially constant rate, determined by the size of opening 27 which can be varied in manufacture, is provided. At the same time, because of the hydraulic action a gust of wind or other sudden force which happens to catch the associated door member cannot slam it open. Similarly, the door member cannot be slammed shut. However, upon releasing the associated door member 15 it is closed by spring 29 at a substantially constant rate determined by the position of adjusting screw 31 across passage 33, until the door approaches its fully closed position, whereupon the metering pin end portion 36 enters passage 30 and further throttles the flow of fluid from one side of the piston to the other, automatically causing the door member to close gently. It will be noted that this checking action occurs even when the associated door member is opened only a very few inches.

Further, in accordance with this invention, the throttling screw 31 is readily adjusted from the exterior of the door closer cylinder without using special tools. For this purpose, metering pin 20 is provided adjacent the inner end of portion 36 thereof with a tool portion 37 formed to engage screw 31 for turning the same. In the illustrated embodiment, tool portion 37 comprises a screw driver blade and throttling screw 31 is transversely grooved at its outer end to receive the same as indicated in Fig. 5. Then, metering pin 20 can be rotated to screw throttling screw 31 further into the piston and across passage 33, or to retract the same, in that way adjusting the effective opening into passage 33 determined by the inner end of screw 31. Fig. 5 shows the throttling screw 31 retracted to a point where it does not restrict the passage 33 at all. It will be noted that Fig. 5 shows the piston parts separated in response to slight opening movement of the associated door member.

Metering pin 20 can be rotated by any desired means and can even be exteriorly shaped to receive a wrench or other tool. However, I prefer simply to provide an opening 38 therein adjacent the outer end thereof to receive a pin or piece of heavy wire 39, nail or the like which can be slipped between the opposite legs of yoke 3.

Thus, when it is desired to vary the setting of throttling screw 31, an appropriate tool 39 is inserted between the legs of yoke 3 and into opening 38 of metering pin 20, and the pin 20 then is slid inwardly into cylinder 1 to cause the tool portion 37 thereof to engage screw 31. Pin 20 then is rotated by tool 39 to screw member 31 to the desired position, whereupon the metering pin 20 is retracted. The longitudinal movement of metering pin 20 is limited by retainer rings 41, and it will be noted that whereas pin 20 normally will be retracted outwardly from cylinder 1 it can be slid inwardly to somewhat advance the point at which the extreme checking action will first occur. All of this is accomplished exteriorly of cylinder 1 without requiring special tools.

As previously noted, return spring 29 surrounds pivot shaft 5. Preferably, a clock type spring is used, to provide greater torque and a more uniform torque, and the spring is enclosed by a cover 42. One end of spring 29 is connected to shaft 5, which can be slotted to receive the same, and the other end thereof is connected to cover 42, as by insertion in a slot therein, which cover is connected to yoke 3, as illustrated in Fig. 2, whereby spring 29 biases cylinder 1 and yoke 3 about the pivot axis defined by shaft 5, which latter is held in place as by retainer rings 43.

Another significant feature of a door closer constructed in accordance with my invention resides in the means provided thereby for selectively adjusting spring tension. In the presently preferred embodiment illustrated in the drawings such means comprise a worm wheel or gear 44 fixed to shaft 5 for movement therewith between one ear of yoke 3 and the overlapping adjacent ear of bracket 4, which also is in the form of a yoke. I also provide a worm 45, journalled in bearing 46 carried by bracket 4, which engages wheel 44 for rotating the same. Worm 45 is slotted at one end, as at 47, to receive a screwdriver or like tool for rotating the worm in opposite directions. Thus, when it is desired to adjust the closing spring tension, it is necessary only to insert a screwdriver between the opposite legs of bracket 4 into engagement with groove 47 and rotate worm 45, a relatively simple procedure, which in turn rotates wheel 44 and thereby either increases or decreases the tension on spring 29.

To hold the associated door member in an open position, I provide stop means in the form of a plate 49 which can be generally oval in shape and carries a grommet 50 of cushioning material adapted to slidably receive piston rod 9. Grommet 50 is peripherally recessed to receive that portion of plate 49 which surrounds the opening therethrough as illustrated in Fig. 6, whereby the plate opening through which rod 9 extends is surrounded by cushioning material, and is initially distorted and slip-fitted into position on plate 49 in a well known manner. One end 49' of plate 49 is bent toward cylinder 1, and the other end thereof is bent away from the cylinder toward bracket 12, whereby when the door member 15 closes to a point where the inturned end 49' engages cylinder 1, the plate 49, which normally assumes the position shown in broken lines in Fig. 6, will tilt or cant as shown in full lines therein, in a manner such as to bind on rod 9 and hold rod 9 and cylinder 1 against further relative movement. The grommet 50, being formed of cushioning material such as rubber, avoids nicking of rod 9, because the latter bears against the grommet instead of plate 49, which is important in order to prevent leakage of hydraulic fluid through the end cap 11. When it is desired to permit the door member to move further toward closed position, plate 49 can be manually grasped and slid along rod 9 to another position.

Also, in order to provide a stronger connection between

the door closer and its fixed support, I provide an opening 52 in one leg of bracket 4, and a similar opening 54, laterally offset therefrom, in the other leg of said bracket. Each opening 52, 54 is adapted to accommodate a screw, such as illustrated at 7, or like fastener to secure the bracket 4 to the doorhead, as well as to the door jamb, which ever way the door closer is turned.

To facilitate the insertion of fasteners through openings 52 and 54, larger openings 52' and 54', respectively, are provided in the side legs of bracket 4 directly opposite openings 52 and 54 in alignment therewith. Openings 52' and 54' are adapted to accommodate the shank of a screwdriver, or other appropriate tool, to drive home a screw or other fastener in the respective openings 52 and 54.

Thus, there is provided by my invention a relatively small and inexpensive door closing and checking mechanism which can be mounted on either a left or a right hand door, without being disassembled, and which because of its hydraulic action, has enough power for use with large, heavy door members as well as smaller, lighter ones.

While only one embodiment of the instant invention is disclosed and described in detail herein, it is clear that the same is susceptible of various modifications and variations all without departing from the spirit of the invention and the scope of the appended claims.

Having fully disclosed and completely described my invention, together with its mode of operation, what I claim as new is:

1. In a door closing and checking mechanism, a cylinder adapted to contain hydraulic fluid, a piston rod extending through one end of said cylinder, a piston carried by said rod and movable within said cylinder lengthwise thereof, said piston being provided with a fluid passage extending through said piston from one side to the other thereof, a throttling plug having a fluid passage portion therein extending generally lengthwise of said cylinder, said throttling plug being mounted in and adjustable in said piston on the side thereof adjacent the other end of said cylinder to selectively variably restrict the flow of hydraulic fluid through said fluid passage, and metering pin means extending inwardly of said cylinder from said other end thereof in alinement with said fluid passage portion for entering therein and thereby further restricting fluid flow through said fluid passage upon said piston approaching said other end of said cylinder.

2. In a door closing and checking mechanism, a cylinder adapted to contain hydraulic fluid, a piston movable within said cylinder lengthwise thereof, said piston being provided with a fluid passage extending through said piston from one side to the other thereof, said passage including a portion extending generally lengthwise of said cylinder from the side of said piston facing one end of said cylinder, a throttling plug adjustably threaded in said passage portion to selectively variably restrict the flow of hydraulic fluid through said passage, and metering pin means extending inwardly of said cylinder from said one end thereof in alignment with said passage portion for entering therein and thereby further restricting fluid flow therethrough upon said piston approaching said one end of said cylinder, said throttling plug and said metering pin means having parts adapted to be engaged for rotating the former by the latter, whereby to vary the restriction of said passage by said throttling plug, said metering pin means being supported for movement lengthwise of said cylinder between predetermined limits to so engage said parts and extending through said one end of said cylinder for manipulation exteriorly thereof.

3. A door closing and checking mechanism as set forth in claim 1, wherein said piston comprises a head part of less diameter than the inner wall of said cylinder, said head part having a portion of reduced diameter providing an extension from said head part toward said other cylinder end, a ring part movable on said extension toward and away from said head part, and means limiting movement of said ring part away from said head part, said ring part substantially corresponding in diameter to said cylinder inner wall so as to have sliding contact therewith, said throttling plug being carried by said extension, and said ring part being provided with a second fluid passage extending through said ring part from one side to the other thereof whereby displacement of said ring part away from said head part by the hydraulic fluid during movement of said piston toward said one cylinder end will open said second fluid passage, said ring part moving toward said head part to restrict fluid flow substantially to said first passage during movement of said piston toward said other cylinder end.

4. In a hydraulic door closer, a hollow cylinder adapted to contain hydraulic fluid, a piston movable lengthwise of said cylinder, a piston rod connected at one end to said piston for movement therewith and adapted to be connected at its other end to a door, said piston rod extending through one end of said cylinder, said piston including a head part of less diameter than the inner wall of said cylinder, a reduced diameter axial extension projecting from said head part toward the other end of said cylinder, and a ring part movable on said extension toward and away from said head part, stop means limiting movement of said ring part away from said head part, said ring part substantially corresponding in diameter to said cylinder inner wall so as to have sliding contact therewith, said head part being provided with a first fluid passage extending axially into said extension and laterally outwardly through said head part, adjustable throttling plug means in said first passage for selectively throttling the flow of hydraulic fluid therethrough and said ring part being provided with a second fluid passage extending through said ring part from one side to the other thereof whereby displacement of said ring part away from said head part by the hydraulic fluid during opening movement of the door associated with said piston rod will open said second fluid passage, said ring part moving toward said head part to close said second passage and thereby substantially restrict fluid flow to said first passage during closing movement of the door associated with said piston rod, wherein said throttling plug means is provided with adjusting means normally disengaged therefrom and accessible from exteriorly of said cylinder and extending through said other end thereof for selective engagement with said plug means to adjust the same and thereby vary the throttling of said first passage.

5. In a door closer, a first bracket having an end wall adapted for connection to a fixed support and a pair of opposed legs extending therefrom, a second bracket, a shaft extending through each of said opposed legs and pivotally connecting said second bracket to said first bracket, a cylinder carried by said second bracket for pivoting movement therewith about the axis of said shaft, said shaft being rotatable about said axis relative to said second bracket, a spring surrounding said shaft and connected at one end to said shaft, means connecting the other end of said spring to said second bracket, a worm wheel connected to said shaft for rotation therewith, and a worm journalled on said first bracket between said opposed legs thereof and engaging said wheel for selectively adjusting the tension on said spring.

6. A door closer as set forth in claim 5, wherein said first bracket has a small first opening in one of said legs for receiving a fastener therethrough for connection to a fixed support such as a doorhead concurrent with connection of said end wall to a fixed support and a large second opening in the other of said legs in alinement with said first opening, said second opening being adapted to receive a tool therethrough to manipulate such fastener, and an additional pair of first and second alined openings in said other leg and said one leg, respectively.

7. In a hydraulic door closer, a hollow cylinder adapted

to contain hydraulic fluid, a piston movable lengthwise of said cylinder, a piston rod connected at one end to said piston for movement therewith and adapted to be connected at its other end to a door, said piston rod extending through one end of said cylinder, said piston including a head part of less diameter than the inner wall of said cylinder, a reduced diameter axial extension projecting from said head part toward the other end of said cylinder, and a ring part movable on said extension toward and away from said head part, stop means limiting movement of said ring part away from said head part, said ring part substantially corresponding in diameter to said cylinder inner wall so as to have sliding contact therewith, said head part being provided with a first fluid passage extending axially into said extension and laterally outwardly through said head part, adjustable throttling plug means in said first passage for selectively throttling the flow of hydraulic fluid therethrough, and said ring part being provided with a second fluid passage extending through said ring part from one side to the other thereof whereby displacement of said ring part away from said head part by the hydraulic fluid during opening movement of the door associated with said piston rod will open said second fluid passage, said ring part moving toward said head part to close said second passage and thereby substantially restrict fluid flow to said first passage during closing movement of the door associated with said piston rod.

8. In a hydraulic door closing and checking mechanism, a hollow cylinder containing hydraulic fluid, a piston rod extending into said cylinder through one end thereof for movement relative thereto and adapted to be connected to a door, piston means carried by said piston rod for movement therewith, said piston means comprising a head part, a sleeve-like part extending from said head part toward the other end of said cylinder, a ring part carried by said sleeve-like part for movement toward and away from said head part, means limiting movement of said ring part away from said head part, said piston means being provided with a first fluid passage extending through said sleeve-like part and said head part from one side of said piston to the other thereof, first throttling means in the form of a plug adjustable in said first passage for restricting the flow of hydraulic fluid therethrough, and second throttling means extending inwardly of said cylinder from said other end thereof in alinement with said first passage for entering the same and thereby further restricting fluid flow therethrough during final closing movement of the door associated with said piston rod, and said ring part being provided with a second fluid passage through said ring part whereby displacement of said ring part away from said head part by the hydraulic fluid during opening movement of the door associated with said piston rod will open said second fluid passage, said ring part moving toward said head part to impede fluid flow through said second passage during closing movement of the door associated with said piston rod.

9. In a door closing and checking mechanism, a cylinder for hydraulic fluid, a piston rod extending into said cylinder through one end thereof for movement relative thereto, piston means carried by said piston rod for movement therewith, said piston means including a head part of lesser diameter than the inner wall of said cylinder, a sleeve-like part of lesser diameter than said head part extending therefrom toward the other end of said cylinder, a ring part of substantially the same diameter as said cylinder inner wall so as to be in sliding contact therewith, said ring part being mounted on said sleeve-like part for movement toward and away from said head part, and stop means limiting movement of said ring part away from said head part, said piston means being provided with a first fluid passage having one portion extending inwardly of said sleeve-like part and another portion communicating with said one portion and extending laterally outwardly through said head part, a throttling plug adjustable in said one portion for restricting fluid flow through said other portion of said first passage, said throttling plug having a passage therethrough communicating with said one portion of said first fluid passage, metering pin means extending inwardly of said cylinder from said other end thereof in alinement with said plug passage for entering the same and thereby further restricting fluid flow through said first passage, said plug and said metering pin means having cooperating parts adapted to be engaged for rotating the former by the latter to selectively vary the rate of fluid flow through said first passage, said metering pin means being supported at said other end of said cylinder for limited movement lengthwise thereof to engage and disengage said cooperating parts, said metering pin means extending through said other end of said cylinder for manipulation exteriorly of said cylinder, and said ring part being provided with a by-pass second fluid passage extending through said ring part in alinement with said head part, said ring part moving toward said head part to block fluid flow through said second passage upon movement of said piston means toward said other cylinder end.

10. In a door closing and checking mechanism, a first bracket, a cylinder containing hydraulic fluid pivotally connected to said first bracket, a second bracket, a piston rod pivotally connected to said second bracket and extending through one end of said cylinder, one of said brackets being adapted for connection to a fixed support and the other thereof being adapted for connection to a door member, a piston carried by said rod within said cylinder, a stop member slidable along said piston rod, and cushioning means carried by said stop member between said stop member and said rod and surrounding the latter so as to hold the former spaced therefrom, a portion of said stop member laterally spaced from said piston rod being offset toward said cylinder, whereby said stop member cants upon engagement of said stop member portion with said cylinder and binds said cushioning means on said piston rod to hold an associated door member in an open position while said cushioning means prevents damage to said piston rod by said stop member from such binding action.

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