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DOOR CLOSER

Filed March 25, 1959

2 Sheets-Sheet 1

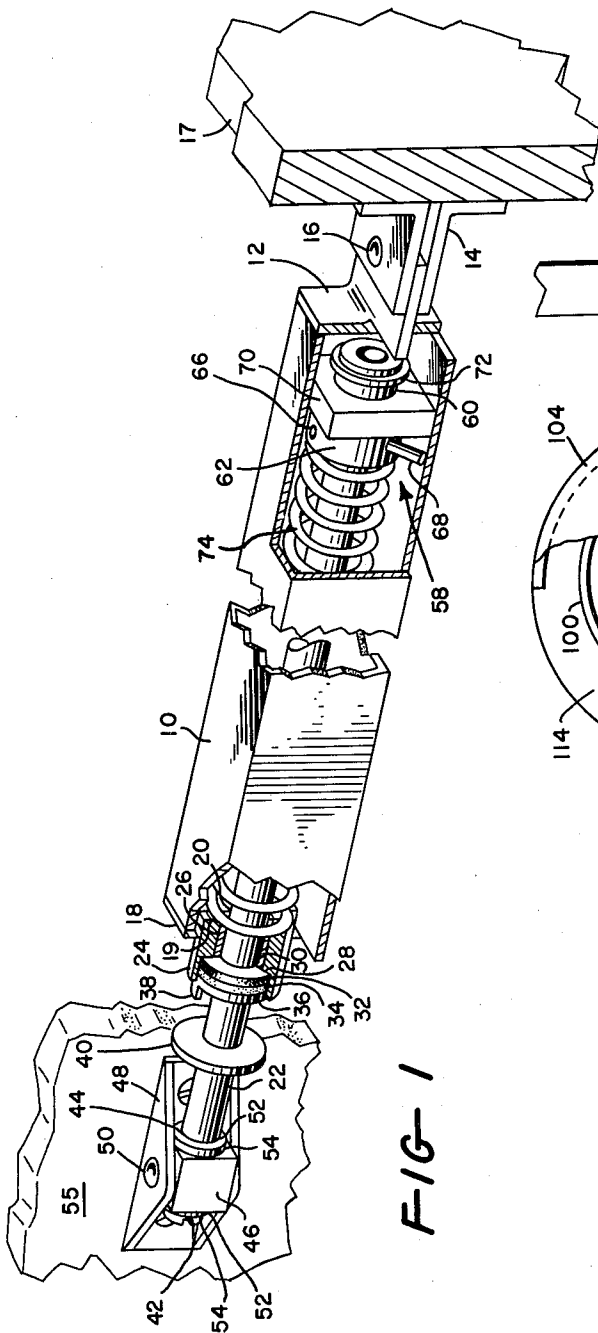


FIG-1

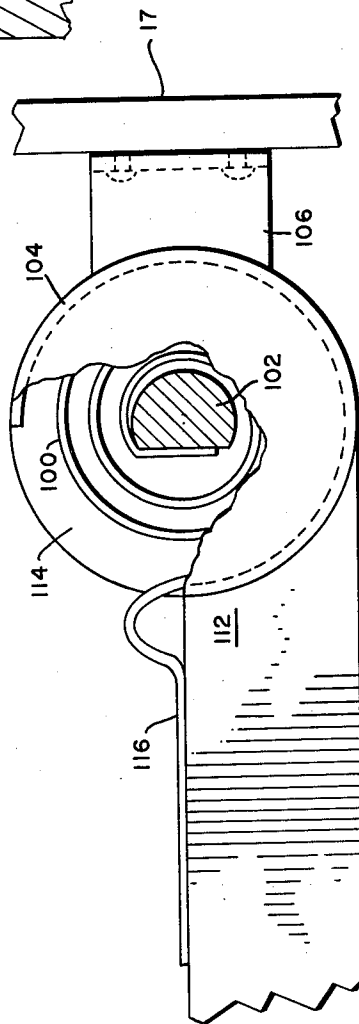


FIG-3

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2 Sheets-Sheet 2

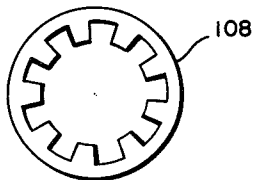
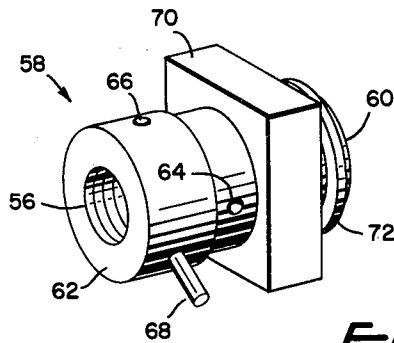
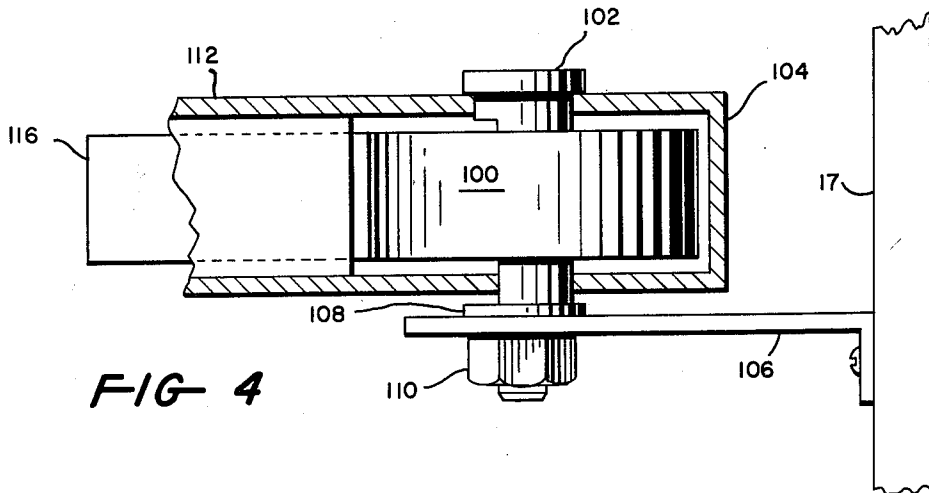


FIG 5

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DOOR CLOSER

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This invention relates to an improved automatic door closing device of the hydraulic type.

Hydraulic door closers presently in use have not been entirely successful for several reasons. Besides being quite complicated and costly to manufacture, they are often unreliable in their operation. Furthermore, present closers do not perform the closing operation at uniform speed and they are not easily adjusted to control their closing speed. Also, present closers making use of clock type springs employ relatively complicated and expensive mechanisms for pre-setting tension on the spring in the closed position of the door and for fixedly positioning the member about which the spring is wound to increase its tension upon opening of the door.

This invention overcomes all of the above difficulties. It includes a valve member provided with a first port and a second port displaced longitudinally from the first port. A substantially square shaped piston is movable longitudinally on the valve member to block the first port. The valve member and the piston are disposed within a substantially square shaped housing for longitudinal movement within the housing. A pin protruding from the valve member prevents it from rotating within the housing.

One end of a rod is screwed into the valve member and the other end of the rod extends through an end wall of the housing for attachment to a door bracket. A screw driver fitting is provided at the external end of the rod so that it may be rotated with respect to the valve member to adjust the opening of the second port. When the door is opened, the piston is displaced longitudinally to open the first port for free flow of hydraulic fluid through the first and second ports thereby making it easy to open the door. Upon closing of the door the piston is displaced to block the first port so that fluid will flow only through the second port thereby controlling the speed of door closing. The closing speed can be regulated by the positioning of the rod to adjust the opening of the second port.

In one embodiment of this invention using a clock type spring, a shakeproof washer is used between a bracket and a D-bolt about which the spring is wound. A tension may be pre-set on the spring in the closed position of the door by simply rotating the D-bolt to produce the desired tension and tightening a nut on the bolt to fix its position on the bracket. With the bolt so fixed, the spring is wound around it upon opening of the door to provide the tension needed for closing the door.

An object of this invention is to provide an improved door closing device which includes a valve member provided with first and second ports longitudinally displaced on the member.

Another object is to provide a door closing device of the above character which includes a piston mounted to move in a longitudinal direction on the valve member so as to block the first port when the door is being closed.

A further object is to provide a door closing device of the above character wherein the piston and the housing are substantially square in shape to provide optimum strength and to prevent rotation of the piston within the housing.

Still another object is to provide a closer of the above character which includes a rod screwed into the valve member and adjustable relative thereto to vary the opening of the second port.

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A still further object is to provide a closer of the above character wherein the valve member is prevented from rotating within the housing.

Another object is to provide improved means for fixing to a bracket the bolt about which a clock type spring is wound in an embodiment of the invention.

Still another object is to provide a closer of the above character which is simple and inexpensive to build, is trouble-free in its operation and lasts for the life of a door.

Other objects and advantages will become apparent from the following detailed description and from the appended claims and drawings.

In the drawings:

FIGURE 1 is a perspective view, partly broken away, of an embodiment of this invention.

FIGURE 2 is an enlarged view of one of the components shown in FIGURE 1.

FIGURE 3 is a top view, partly broken away, of a second embodiment of this invention.

FIGURE 4 is a side view, partly broken away, of the embodiment in FIGURE 3.

FIGURE 5 is a top view of one of the components in FIGURE 4.

In FIGURE 1 a housing 10 of substantially square configuration is sealed at one end by one side of a T-plate 12 which is pivotably connected to a bracket 14 by means of a rivet 16. The bracket 14 is mounted on a door jamb 17.

The opposite end of the housing 10 is sealed by a substantially square plate 18 provided with an annular recess 19 and a central opening 20 through which is disposed a piston rod 22. Annular recess 19 is formed by bending the plate 18 axially inwardly relative to the housing 10 and then radially inwardly. An annular bushing retainer 24 provided with a hole 26 and an annular shoulder 28 is welded into the recess 19. An annular brass bushing 30 is press fitted into the hole 26. A rubber oil seal 32, a leather dust wiper 34 and a metal washer 36 are press fitted against the shoulder 28. A portion 38 of the washer 36 protrudes from the washer to engage a hold open washer 40 which is movable relative to the rod 22. When the door is swung open and hold-open washer 40 is moved axially along piston rod 22, upon release of the door, portion 38 of washer 36 engages the hold-open washer camming the washer and locking the closer, and, in turn, the door, in open position.

The end of the rod 22 disposed externally of the housing 10 is provided with a screw driver fitting 42. The rod 22 extends through a hole 44 in a substantially square block 46 which is pivotably connected to a bracket 48 by means of a rivet 50. Grooves 52 in the rod 22 receive clips 54 to prevent a longitudinal movement of the rod 22 relative to the block 46 but permitting a rotational movement of the rod within the hole 44. The bracket 48 is screwed to a door 55.

The internal end of the rod 22 is screwed into a hole 56 extending through a valve member generally indicated at 58. The valve member 58 includes an annular portion 60 and an annular portion 62 of greater diameter than the portion 60. A port 64 extending through the portion 60 communicates with the hole 56 and a port 66 extending through the portion 62 also communicates with the hole 56. A pin 68 protrudes from the portion 62 towards a corner of the housing 10 and limits the rotational movement of the valve member 58.

A piston 70 of substantially square shape to fit the inside of the housing 10 is retained on the portion 60 and is freely movable relative thereto in its axial direction. A piston retaining washer 72 is fixedly attached to the end of the portion 60 to limit the axial movement of the piston

70. When the piston 70 is positioned against the washer 72 it leaves the port 64 completely open but when it is displaced against the portion 62 the port 64 is completely blocked.

A coil spring 74 is retained in the housing 10 between the plate 18 and the valve member 58. The spring 74 is retained under tension to maintain the valve member 58 against the plate 12. The housing 10 is completely filled with a hydraulic fluid, such as oil.

In mounting the door closer disclosed above, the bracket 14 is initially screwed to the jamb 17. By using a screwdriver in the fitting 42, the rod 22 is then screwed in a counter clockwise direction to move it out a maximum amount from the opening 56 in the valve member 58. After the bracket 48 is fastened to the door 55, the rod 22 is screwed clockwise into the member 58. This causes the member 58 to be displaced towards the plate 18 thus compressing the spring 74 a desired amount for providing the amount of force necessary to maintain the door in a closed position.

When the door is opened, the rod 22 is moved out of the housing 10 and displaces the member 58 towards the plate 18. The movement of the member 58 in this direction causes the piston 70 to be displaced against the washer 72 thereby leaving the port 64 open. Since both ports 64 and 66 are open, the oil flow through these ports and the hole 56 to the right side of the piston 70 is at a maximum and therefore the door is opened with ease. The displacement of the member 58 towards the plate 18 causes the spring 74 to become further compressed so as to provide the necessary force for closing the door automatically upon its release.

When the door is released, the rod 22 and the valve member 58 move into the housing 10 towards the plate 12. This causes the piston 70 to be displaced against the portion 62 thus blocking the port 64. Since the fluid now can pass from the right to the left side of the piston 70 only through the port 66, the resistance to the fluid flow on closing is greater than on opening thus causing the door to close at a slower, but constant speed. The speed at which the door closes may be further reduced by screwing the rod 22 further into the member 58 so as to partially block the port 66 to the extent desired to increase the resistance to the fluid flow.

The door closer disclosed above has several important advantages. For a hydraulic closer it is very simple and inexpensive to build. It has trouble-free operation and as a matter of fact will perform reliably for the life of any door. The substantially square piston is prevented from rotating within the housing and since the pin 68 prevents the valve member 58 from being rotated, adjustments can be made with ease by screwing the rod 22 into or out of the valve member 58 while its position is maintained.

Another advantage of the door closer is that the tension of the spring 74 can be easily adjusted to the closed position of the door by the simple expedient of screwing the rod 22 into or out of the member 58 to obtain the desired tension for maintaining the door closed. Also, by screwing the rod 22 to vary the opening of the port 66 in the member 58, the speed at which the door closes is regulated. A further advantage is that it closes the door at uniform speed, thus eliminating shock as occurs in certain pneumatic type closers which are braked just before the door is fully closed. Elimination of this shock greatly increases the life of the closer.

A second embodiment of this invention is shown in FIGURE 3. This embodiment is substantially the same as the embodiment in FIGURE 1 except that a clock type spring 100 positioned outside the piston housing is used instead of a coil spring 74 within the housing. The clock spring 100 is wound around a D-bolt 102 which extends through a cylindrical housing 104 and through a jamb bracket 106. Positioned between the body of the D-bolt

and the bracket 106 is a Shakeproof internal washer 108. Washer 108 is of conventional construction and includes radially extending fingers as shown in FIG. 5. A nut 110 tightens the bracket 106, the washer 108 and the body of the D-bolt 102 against one another. The housing 104 is welded to a substantially square housing 112 and seals one end of the housing. The housing 112 corresponds with the housing 10 in FIGURE 1. The housing 104 is provided with an opening 114 through which the end 116 of the spring 100 extends and is maintained against the backside of the housing 112.

After the door closer has been mounted, the tension of the spring 100 in the closed position of the door can be easily adjusted by loosening the nut 110, rotating the D-bolt 102 until the desired tension is attained for maintaining the door closed and finally tightening the nut 110 to cause the washer 108 to press against the bracket 106 and the D-bolt 102 so that the bolt cannot rotate relative to the bracket.

The use of the Shakeproof washer 108 in the manner disclosed greatly simplifies the adjustment and maintenance of tension on a clock type spring. Present closers with clock type springs utilize extremely complicated mechanisms which are expensive to produce and are often unreliable.

The components provided in the housing 112 and at the opposite end of the housing are the same as shown in FIGURE 1 and operate in the same manner except that the spring 74 is not present. Instead, upon opening of the door, the end 116 of the spring 100 is wound in a clockwise direction to increase the tension on the spring. The force on the spring 100 acts against the housing 112 to automatically close the door when it is released.

Although this invention has been disclosed and illustrated with reference to particular applications, the principles involved are susceptible of numerous other applications which will be apparent to persons skilled in the art. The invention is, therefore, to be limited only as indicated by the scope of the appended claims.

I claim:

1. A hydraulic door closer, including a piston housing, a piston chamber defined by the housing, the piston chamber being filled with a hydraulic fluid, a valve member disposed in the piston chamber, said valve member having an opening extending axially therethrough, first and second ports extending radially through the valve member, each port providing a communication between the opening in the valve member and the piston chamber, the second port being spaced from the first port, a piston mounted on the valve member and movable relative thereto in a longitudinal direction, said piston fitting said piston chamber to prevent the flow of fluid from one side to the other thereof, first and second stops on the valve member to limit the longitudinal movement of the piston, the second stop being longitudinally displaced relative to the first stop, the piston leaving open the first and second ports when positioned against the first stop to permit the flow of fluid to the opposite side of the piston through both ports and blocking one of the ports when positioned against the second stop to permit the flow of fluid through only the other port, the piston being displaced against the first stop upon movement of the valve member in a first direction and being displaced against the second stop upon movement of the valve member in a second direction, a piston rod extending through the housing in slidable relationship thereto, the internal end of the rod being adjustably threaded to the valve member for movement therewith longitudinally of the housing, a first bracket, the external end of the piston rod being pivotably connected to the first bracket, a second bracket, the piston housing being pivotably connected to the second bracket, the first bracket being adapted to be attached to a door and the second bracket being adapted to be attached to the door jamb to produce a movement of the valve member in the first direction upon opening

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the door and to produce a movement of the valve member in the second direction upon closing the door, and spring means operative upon the opening of the door to produce a force in a direction to close the door upon its release.

2. A hydraulic door closer as recited in claim 1 wherein the spring means is a coil spring positioned in the piston chamber between the valve member and the piston housing.

3. A hydraulic door closer, including a piston housing 10 for defining a piston chamber having a substantially square cross section in the transverse direction of the housing, first and second end walls for sealing the opposite ends of the housing, the piston chamber being filled with a hydraulic fluid, a valve member disposed in the piston 15 chamber and movable relative to the housing in a longitudinal direction, an opening extending through the valve member in a longitudinal direction, first and second ports extending through the valve member in a transverse direction, each port providing a communication between the 20 opening in the valve member and the piston chamber, the second port being longitudinally displaced relative to the first port in the direction of the second end wall of the housing, means on the valve member to prevent it from rotating within the piston chamber, a piston mounted on 25 the valve member and movable relative thereto in a longitudinal direction, the piston being substantially square in shape to cooperate with the walls of the piston chamber, first and second stops on the valve member to limit the longitudinal movement of the piston, the second stop being 30 longitudinally displaced relative to the first stop in the direction of the second end wall of the housing, the piston leaving open the first and second ports when positioned against the first stop to permit the flow of fluid to the opposite side of the piston through both ports and blocking 35 one of the ports when positioned against the second stop to permit the flow of fluid through only the other port, the piston being displaced against the first stop upon movement of the valve member towards the second end wall of the housing and being displaced against the second stop 40 upon movement of the valve member towards the first end wall of the housing, a piston rod extending through the second end wall of the housing in slidable relationship thereto, the internal end of the rod being screwed into the opening in the valve member and being movable within 45 the opening upon its rotation to block the second port to the extent desired, a first bracket, the piston rod, near its external end, being pivotably and rotatably connected to the first bracket, means provided at the external end 50 of the piston rod to rotate the rod, a second bracket pivotably connected to the first end wall of the piston housing, the first bracket being adapted to be attached to a door and the second bracket being adapted to be attached to the door jamb to produce a movement of the valve member towards the second end wall of the housing upon opening the door and to produce a movement of the valve member towards the first end wall of the housing upon closing the door, said piston fitting said piston chamber to prevent the flow of fluid from one side to the other thereof, and spring means provided in the piston chamber between 55 the valve member and the second end wall for being placed under tension upon the opening of the door to produce a force in a direction to close the door upon its release.

4. A hydraulic door closer as recited in claim 3 wherein the means on the valve member to prevent it from rotating within the piston chamber in a pin extending towards a corner of the housing and the means provided at the external end of the piston rod to rotate the rod is a screw driver fitting.

5. A hydraulic door closer, including a piston housing, a piston chamber defined by the housing, first and second end walls for sealing the opposite ends of the housing, the piston chamber being filled with a hydraulic fluid, a valve member disposed in the piston chamber and movable

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relative to the housing in a longitudinal direction, an opening extending through the valve member in a longitudinal direction, first and second ports extending through the valve member, each port providing a communication between the opening in the valve member and the piston chamber, the second port being longitudinally displaced 5 relative to the first port, means on the valve member to prevent it from rotating within the piston chamber, a piston mounted on the valve member and movable relative thereto in a longitudinal direction, the piston being substantially square in shape to cooperate with the walls of the piston chamber, first and second stops on the valve member to limit the longitudinal movement of the piston, the second stop being longitudinally displaced relative 10 to the first stop, the piston leaving open the first and second ports when positioned against the first stop to permit the flow of fluid to the opposite side of the piston through both ports and blocking one of the ports when positioned against the second stop to permit the flow of fluid through 15 only the other port, the piston being displaced against the first stop upon movement of the valve member towards the second end wall of the housing and being displaced against the second stop upon movement of the valve member towards the first end wall of the housing, a piston rod 20 extending through the second end wall of the housing in slidable relationship thereto, the internal end of the rod being screwed into the opening in the valve member and being movable within the opening upon its rotation to block the second port to the extent desired, a first bracket, 25 the piston rod, near its external end, being pivotably and rotatably connected to the first bracket, means provided at the external end of the piston rod to rotate the rod, a second bracket pivotably connected to the first end wall of the piston housing, the first bracket being adapted to be attached to a door and the second bracket being 30 adapted to be attached to the door jamb to produce a movement of the valve member towards the second end wall of the housing upon opening the door and to produce a movement of the valve member towards the first end wall of the housing upon closing the door, and spring means being adapted to be placed under tension upon the opening of the door to produce a force in a direction to close the door upon its release.

6. A hydraulic door closer comprising a housing, said housing defining a chamber in which a piston may be reciprocated, a piston rod slidably engaging said housing and having one end thereof within said chamber, a valve adjustably threaded on one end of said rod within said chamber, said valve including a first radial hole and a second radial hole spaced from said first radial hole, said valve having an opening extending axially there-through and communicating with said radial holes, the end of said rod selectively closing a portion of one of said radial holes, and a piston slidably mounted on said 50 valve and adapted to move from a first position wherein it covers said second radial hole to a second position where it uncovers said second radial hole, said piston permitting continuous flow through said first radial hole.

7. The combination set forth in claim 6 including 60 means extending between said housing and said valve member for preventing relative rotation between said piston rod and said valve.

8. A hydraulic door closer comprising a housing, said housing defining a chamber in which a piston may be reciprocated, a piston rod slidably engaging said housing and having one end thereof within said chamber, a valve member having a radially extending port and an axial opening adjustably threaded on the end of said rod within said chamber, and means extending between said housing and said valve member tending to prevent rotation 70 of said valve member and thereby maintain the adjusted relation between said rod and said valve member.

9. A hydraulic door closer comprising a housing having a polygonal cross section, said housing defining a 75 chamber in which a piston may be reciprocated, a piston

rod slidably engaging said housing and having one end thereof within said chamber, a valve threaded on one end of said rod with said chamber, said valve including a first radial hole and a second radial hole longitudinally spaced from said first radial hole, said valve having an opening extending axially therethrough and communicating with said radial holes, the end of said rod selectively closing a portion of one of said radial holes, and a piston having a polygonal cross section slidably mounted on said valve and adapted to move from a first position wherein it covers said second radial hole to a second position where it uncovers said second radial hole, said piston permitting continuous flow through said first radial hole.

10. The combination set forth in claim 9 including means for selectively and releasably clamping the other end of said piston rod exteriorly of said housing for maintaining the relative rotational position of said rod relative to said valve.

11. A hydraulic door closer, including a piston housing for defining a piston chamber having a substantially square cross section in the transverse direction of the housing, first and second end walls for sealing the opposite ends of the housing, the piston chamber being filled with a hydraulic fluid, a valve member disposed in the piston chamber and movable relative to the housing in a longitudinal direction, an opening extending through the valve member in a longitudinal direction, first and second ports extending through the valve member in a transverse direction, each port providing a communication between the opening in the valve member and the piston chamber, the second port being longitudinally displaced relative to the first port in the direction of the second end wall of the housing, means on the valve member to prevent it from rotating within the piston chamber, a piston mounted on the valve member and movable relative thereto in a longitudinal direction, the piston being substantially square in shape to cooperate with the walls of the piston chamber, first and second stops on the valve member to limit the longitudinal movement of the piston, the second stop being longitudinally displaced relative to the first stop in the direction of the second end wall of the housing, the piston leaving open the first and second ports when positioned against the first stop to permit the flow of fluid to the opposite side of the piston through both ports and blocking one of the ports when positioned against the second stop to permit the flow of fluid through only the other port, the piston being displaced against the first stop upon movement of the valve member towards the second end wall of the housing and being displaced against the second stop upon movement of the valve member towards the first end wall of the housing, a piston rod extending through the second end wall of the housing in slidable relationship thereto, the internal end of the rod being screwed into the opening in the valve member and being movable within the opening upon its rotation to block the second port to the extent desired, a first bracket, the piston rod, near its external end, being pivotably and rotatably connected to the first bracket, means provided at the external end of the piston rod to rotate the rod, a second bracket pivotably connected to the first end wall of the piston housing, the first bracket being attached to a door and the second bracket being attached to the door jamb to produce a movement of the valve member towards the second end wall of the housing upon opening the door and to produce a movement of the valve member towards the first end wall of the housing upon closing the door, spring means operative upon opening of the door to produce a force in the direction to close the door upon its release, said means on the valve member to prevent it from rotating within the piston chamber comprising a pin extending toward a corner of the housing.

12. The combination set forth in claim 11 including a spring housing, said spring comprising a clock type spring

in the spring housing and wound around the body of the body of the D-bolt, an internal washer positioned between the second bracket and the body of the D-bolt, and a nut on the threaded portion of the D-bolt to tighten the washer against the second bracket and the body of the D-bolt to prevent any rotation of the bolt on the bracket, the first bracket being adapted to be attached to a door and the second bracket being adapted to be attached to the door jamb to produce a movement of the valve member in the first direction upon opening the door and to produce a movement of the valve member towards the first end wall of the housing upon closing the door, the clock spring being placed under tension upon the opening of the door to produce a force in a direction to close the door upon its release.

13. A hydraulic door closer comprising a housing, said housing defining a chamber in which a piston may be reciprocated, a piston rod slidably engaging said housing and having one end thereof within said chamber and the other end thereof externally of said chamber, a valve member having a radially extending port and an axial opening communicating with the radially extending port, said valve member being adjustably threaded on the one end of said rod within said chamber, the end of said rod being adjacent said radial port to selectively restrict said radial port, means for releasably clamping one of said housing and said other end of said piston rod exteriorly of said housing, and means for clamping the other of said housing and said other end of said piston rod, thereby maintaining the relative rotational position of said rod to said valve member.

14. A hydraulic door closer comprising a housing, said housing defining a chamber in which a piston may be reciprocated, a piston rod slidably engaging said housing and having one end thereof within said chamber and the other end thereof externally of said chamber, a valve member having a radially extending port and an axial opening communicating with the radially extending port, said valve member being adjustably threaded on the one end of said rod within said chamber, the end of said rod being adjacent said radial port to selectively restrict said radial port, means for clamping said housing and preventing rotation thereof relative to said piston rod, and means for releasably clamping the other end of said piston rod exteriorly of said housing for maintaining the relative rotational position of said rod relative to said valve member and said housing.

15. A hydraulic door closer comprising a housing, said housing defining a chamber in which a piston may be reciprocated, a piston rod slidably engaging said housing and having one end thereof within said chamber and the other end thereof externally of said chamber, a valve member having a radially extending port and an axial opening communicating with the radially extending port, said valve member having means thereon cooperating with the interior of said casing to form a piston, said valve member being adjustably threaded on the one end of said rod within said chamber, the end of said rod being adjacent said radial port to selectively restrict said radial port, means for releasably clamping one of said housing and said other end of said piston rod exteriorly of said housing, and means for clamping the other of said housing and said other end of said piston rod, thereby maintaining the relative rotational position of said rod to said valve member.

16. A hydraulic door closer comprising a housing, said housing defining a chamber in which a piston may be reciprocated, a piston rod slidably engaging said housing and having one end thereof within said chamber and the other end thereof externally of said chamber, a valve member having a radially extending port and an axial opening communicating with the radially extending port, said valve member having means thereon cooperating with the interior of said casing to form a piston, said valve member being adjustably threaded on the one end

of said rod within said chamber, the end of said rod being adjacent said radial port to selectively restrict said radial port, means for clamping said housing and preventing rotation thereof relative to said piston rod, and means for releasably clamping the other end of said piston rod exteriorly of said housing for maintaining the relative rotational position of said rod relative to said valve member and said housing.

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