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HYDRAULIC HOLD OPEN MECHANISM FOR HINGED MEMBERS

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2 Sheets-Sheet 1

Fig. 1.

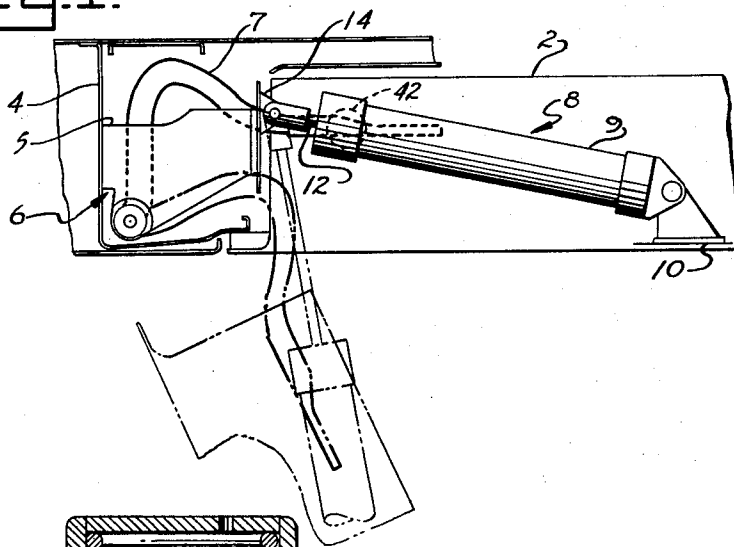
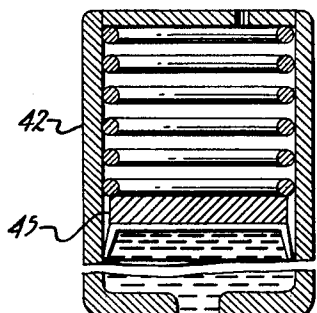
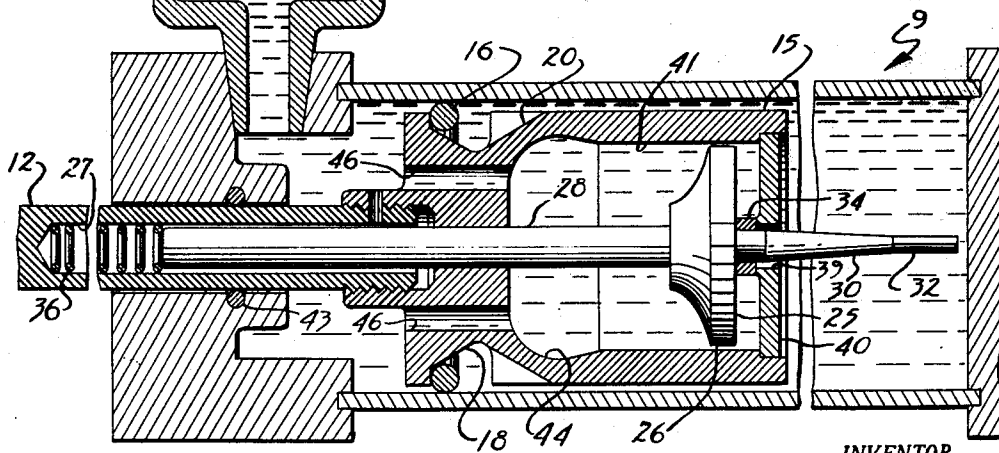


Fig. 2.



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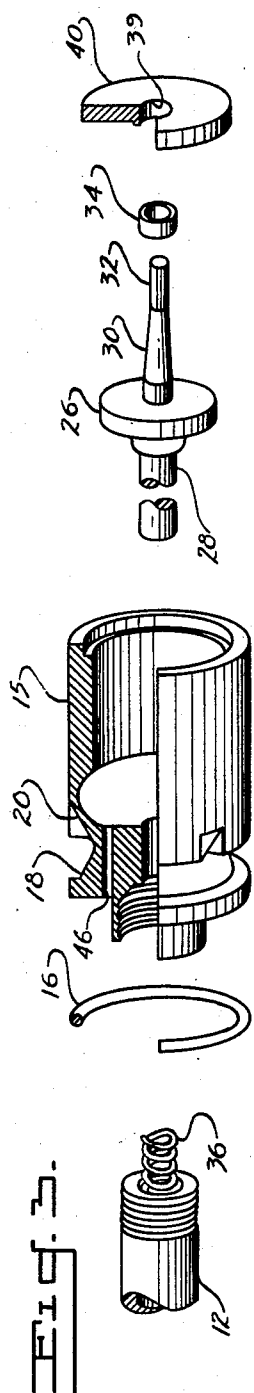
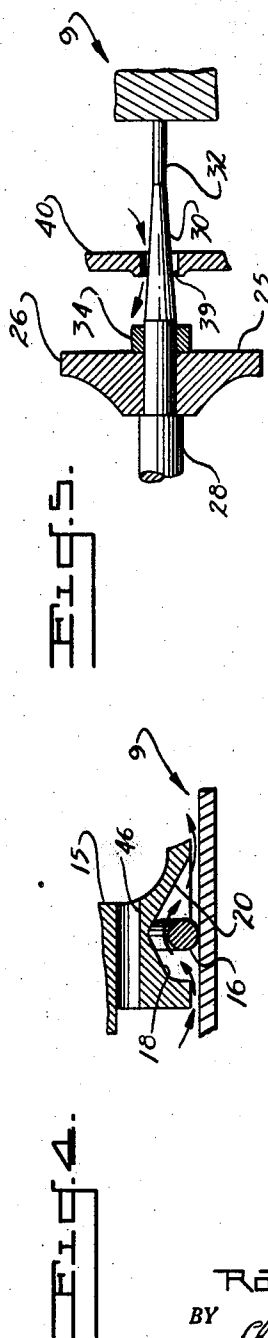
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HYDRAULIC HOLD OPEN MECHANISM FOR
HINGED MEMBERS

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This invention relates to a hydraulic "hold-open" device for hinged members and has for a general object to provide means for holding a hinged member from movement in one direction of travel against pressures under a predetermined value and to permit movement thereof at greatly reduced pressures once said predetermined pressure is applied to commence movement of said hinged member in the desired direction.

The invention will be described in connection with its utility as a universal door holder and specifically with respect to a hold-open device for automobile doors although it will be readily understood that the structure could easily be used in a great variety of other specific applications. By the term universal is meant the action of the device in automatically holding the door against movement in one direction at any position to which the hinged member, as a door, may be moved. In other words an automobile door may automatically be held against closing movement in any open position desired.

Other objects and advantages are to provide a device in which opening movement of a door may be accomplished without any positive restraint in order to place the door at a desired position in which the restraint against initial closing movement of a door may be calibrated at a predetermined value and thereafter closing motion continued in an essentially unimpeded manner; in which interruption of the closing motion of a door will automatically result in reestablishing a hold-open action at the point of interruption and in all positions except when the door is closely adjacent its closed condition; in which the release of a door from an open position will be smoothly accomplished without any jerky motion and during which a metered decreasing resistance will take place for smooth closing action; and in which both the opening and closing movements of a door may, however, be made sufficiently restrictive so as to check excessive opening rates, as for example, when a door may be blown open by a strong wind and to check excessive closing rates as when forces might be applied to otherwise slam a door towards its shut position.

These and other specific objects and advantages will be understood from the following disclosure of an embodiment of the invention and the novelty thereof pointed out in the appended claims.

In the drawings,

Fig. 1 is a representation of the hinged mounting of an automobile door with the device of this invention mounted thereon;

Fig. 2 is a longitudinal sectional view of the device shown in Fig. 1;

Fig. 3 is an exploded view in perspective showing the parts of the piston assembly shown in Fig. 2; and

Figs. 4 and 5 are fragmentary views on an enlarged scale showing details of construction.

Referring to the drawings Fig. 1 represents an automobile door 2 supported for hinged movement about a body frame pillar 4 on hinges such as the one shown at 6. Hinge 6 is of a conventional design for automobile doors

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and comprises a box type hinge member 5 fixed to the pillar 4 and on which the usual goose neck 7 is pivoted for hinging movement of the door 2 to which it is attached. Motion of the door 2 on hinge 6 is controlled by the hydraulic mechanism at 8. A cylinder 9 is pivotally attached to the door 2 by a mounting bracket 10 and a piston rod 12 is attached to the body pillar portion 4 by a bracket 14.

The device 8 functions to permit opening movement of the door to a fully open position as shown in phantom in Fig. 1, and to do so in an essentially unimpeded manner. It is, however, arranged to hold the door open against pressures below a certain value tending to swing it in a closing direction and at any position to which it may be moved between the fully open and the closed position. In the case of an automobile door, and as specifically disclosed herein, the mechanism is preferably designed so that when near the extreme closed position means are provided to prevent a holding action so as to permit latching the door 2 without interference. The device is designed to resist such closing movements from any open position in the absence of a predetermined force applied to close the door, but once the initial hold of the device is "broken" continued closing motion may be accomplished at greatly reduced pressures. In the event closing movement ceases before the door is shut the device will automatically operate to again impose a hold open action in which the initial closing force must be applied before further movement can again proceed.

In the sectional view of the cylinder 9 (Fig. 2) a piston 15 is shown attached to the inner end of the piston rod 12. Cylinder 9 is filled with suitable hydraulic fluid, such as a low viscosity oil, and is sealed at the end opposite the piston rod 12. Piston 15 is cup-shaped and the cylindrical outer wall thereof is annularly spaced from the inner wall of the cylinder to form a passage therebetween. Adjacent the rod end of the piston in the base section of the cup an annular groove 18 is formed in which an O-ring seal 16 is positioned. Groove 18 is provided, as shown, with a shallow portion toward the rod end of the piston and, as will be appreciated, is adapted to force the seal 16 outwardly into sealing contact with the cylinder 9 in the normal manner when pressure is exerted on the fluid at the right side of piston 15. Seal 16, however, will ride free without sealing when pressure is exerted on fluid in the cylinder at the left side of piston 15. To fully insure against any chance sealing action in the latter case, several circumferentially spaced longitudinal grooves or passages 20 are formed in the wall of the piston for passage of fluid from the deeper end of the groove 18 as will be readily seen from Fig. 4. A check valved passage means is thus provided for free flow of fluid from the left hand side of the piston to the right hand side thereof and for sealing against a reverse flow of fluid through the same. Thus the piston can readily be moved towards the rod end of the cylinder in an essentially unimpeded fashion as for opening movement of the door shown in Fig. 1.

Movement of piston 15 by flow through the annular passage between cylinder and piston for closing movement of a door, as toward the right hand end of the cylinder, is thus blocked. For such reverse flow from the right to the left hand end of the cylinder a second valve means is provided. Yieldable pressure receiving means of this latter valve serve to impart the hold-open action desired. In the absence of pressures above a certain predetermined value in the cylinder on the right hand side of the piston a hinged door will not swing towards its closed position. If a closing force is exerted on the door of sufficient magnitude to generate a pressure on the right side of the piston of a value greater than the predetermined value the door will close.

As shown, a plate 40 is permanently fixed in the open

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end of the cup-shaped wall of piston 15 to form an interior cylindrical chamber 41. Plate 40 is provided with a central inlet opening 39 having an inturned lip as best shown by Fig. 5. The opening is of a restricted area as will be described and within the chamber 41 is a movable valve disk 26 fixed on a supporting rod 28. The rod and disk are longitudinally movable in the cylinder 41 with passage for fluid past the disk afforded by an annular spaced relation between the edge of the disk and the chamber wall. As will be noted, piston rod 12, slidably extending through the end wall of cylinder 9 with a sealing ring at 43, is threaded into the base of the cup-shaped piston 15 on the axis thereof. This attached end portion of rod 12 is formed with an elongated socket 27 in the blind end of which is positioned a compression spring 36. Seated against spring 36 is the end of supporting rod 28 which is telescopically received in socket 27. Rod 28 extends axially at its other end beyond the valve disk 26 and through central opening 39 of plate 40. Against the face of the valve disk 26 and on rod 28 is a washer or collar 34 adapted for seating against plate 40 to close off central opening 39 in the closed position of the valve. Outwardly of the collar the stem of rod 28 is formed with a tapering reduced portion 30 and a reduced tip portion 32 as will be described.

Outlet passages 46 at annularly spaced intervals in the base portion of the piston 15 are provided for free flow of fluid from the chamber 41 to the rod end of the cylinder. It will also be noted that the cylindrical chamber 41 is formed with an enlarged end section as at 44.

It will also be seen from Fig. 2 that the valve disk 26 and its supporting stem assembly (which acts as an auxiliary piston valve) is urged by spring 36 to a seated position against plate 40. The central opening is thus closed by collar 34 and rod 28. In the absence of any fluid pressures at the right hand end of the cylinder the opening 38 remains closed. When the fluid at this end is under pressure by urging the piston 15 to the right, pressure will be exerted against the annular area of the collar blocking opening 39. This area is, of course, but a very small fractional portion of the area subject to fluid pressures at that end of the piston. Accordingly spring 36 is calibrated to require fluid pressures of a certain value at the right hand end of the cylinder in order to unseat the collar 34 and initiate a closing movement. Once fluid begins to flow through opening 39 it will be appreciated the pressure thereof will be transmitted also against the active face 25 of the disk 26. Since the area of the face 25 receiving such pressures is equal to a substantial fractional portion of the area of piston 15 receiving such pressures, greatly reduced fluid pressures will serve to maintain the valve unseated against the urging of spring 36. Thus, once the valve is "broken" by initial forces of a predetermined value tending to move piston 15 toward the right hand end of the cylinder, continuing movement of the piston and reverse flow of fluid may be accomplished by applying substantially lesser pressures to overcome spring 36.

It will be noted movement of piston 15 toward the right hand end of the cylinder moves the inner end portion of rod 12 into the interior of the cylinder. Accordingly an expansion chamber 42, provided with a spring loaded disk 45 and in communication with the rod end of the cylinder, receives the fluid displaced by rod 12.

In order to prevent a sudden release of pressures and a consequent jerky motion of the hinged member being moved when the pressures are raised sufficiently to "break" open the valve, the metering stem portion 30 of rod 28 serves to control the admission of fluid to the active or pressure receiving face of valve disk 26. The proportions of the metering stem 30 and its fit inside the opening 39 of plate 40 are such that an appreciable motion of a door occurs (and at a gradually decreasing resistance) before the valve disk reaches the full extent of

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its stroke and is positioned in the enlarged section 44 to permit the relatively unrestricted flow through the enlarged section and through passages 46.

It may also be noted that, as in the case of the automobile door 2, the piston, when the door nears a closed position, will be in close proximity to the end of cylinder 9 and the release stem portion 32 of the rod 28 may contact the end wall of the cylinder (see Fig. 5). Valve disk 26 will thus be mechanically held in open position to prevent the holding action which would otherwise occur. In an automobile door this will permit latching the door without impediment where closing movement of the door may be interrupted near the closed position.

While passages 20 and the clearance between piston 15 and the wall of cylinder 9 may be so sized that relatively free flow of fluid may occur at normal rates of opening a door, they may also be made sufficiently restrictive to somewhat check excessive opening movement. This might be desirable in a case where the door could be blown open by a strong wind. Correspondingly, passages such as the plate opening 39, the enlarged chamber portion 44, and passages 46 may be of a size to impede the otherwise possible slamming of a door to shut position.

Having thus described the invention, what I claim as novel and desire to secure by Letters Patent of the United States is:

1. Hydraulic mechanism for permitting movement of a hinged member in a given direction only when hydraulic pressure within said mechanism exceeds a predetermined value and comprising a piston rod for attachment to one of a pair of hinged members, a fluid filled cylinder slidably receiving in one end thereof said rod and attachable to the other member, a piston fixed to the rod and slidable in said cylinder, check valved passage means associated therewith for permitting flow of fluid in one direction from a first side of the piston to an opposite second side and preventing reverse flow in the opposite direction, second valved passage means associated with said piston for permitting said reverse flow of fluid including a valve having means yieldably urging the same to prevent said reverse flow until pressure of said predetermined value is impressed on fluid in said second side of the piston to automatically open said valve, and means responsive to fluid pressures in said second side substantially below said predetermined value, once said valve is unseated, for maintaining said yieldably urged means ineffective and permitting continued movement of said hinged member in said given direction once it has been started.

2. Hydraulic mechanism for permitting movement of a hinged member in a given direction only when hydraulic pressure within said mechanism exceeds a predetermined value and comprising a piston rod for attachment to one of a pair of hinged members, a fluid filled cylinder slidably receiving in one end thereof said rod and attachable to the other member, a piston fixed to the rod and slidable in said cylinder, check valved passage means associated therewith for permitting flow of fluid in one direction from a first side of the piston to an opposite second side, second valved passage means associated with said piston for the reverse flow of fluid from the second to the first side of said piston, said latter means including a chamber having an outlet for free communication with said first side of the piston and a valved inlet opening communicating with said second side thereof, a valve movable in said chamber to open and close said inlet opening, the area of said valve blocking said opening when in closed position being a small fractional portion of the entire area of said piston exposed to fluid pressures at said second side thereof, fluid pressures developed in said second side by movement of said piston tending to move said valve away from said closed position and said valve when unseated having a surface area equal to a substantial portion of said aforementioned entire exposed area of the piston, said

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surface area disposed to be acted on by fluid pressures to keep said valve open and yieldable means normally urging said valve to closed position, said yieldable means being calibrated to resist initial valve opening fluid pressures below a predetermined value on said second side of the piston whereby said yieldable means will be ineffective to seat said valve at substantially lower fluid pressures once said valve has been unseated.

3. Hydraulic mechanism as in claim 2 in which the exterior wall of said piston is spaced from the interior wall of the cylinder to form said first-named passage means and a check valve is provided therefor by an annular groove formed in the wall of the piston and a sealing ring riding in said groove, said groove having a shallow portion at the side facing said first side of the piston to force said ring against the cylinder wall in the presence of fluid pressures at said second side of the piston.

4. Hydraulic mechanism as in claim 2 in which said valve for said second passage means is in the form of a piston having a pressure receiving face opposed to said inlet opening and being movable in said chamber, said piston valve being carried by a supporting rod extending at one end through the wall of said chamber opposite said inlet opening and at its other end through the inlet opening.

5. Hydraulic mechanism as in claim 4 in which said supporting rod extension through said inlet opening is of a reduced tapered conformation for controlled metering of fluid through said opening to the pressure receiving face of said valve on unseating said valve.

6. Hydraulic mechanism as in claim 4 in which said movable piston valve and chamber are cylindrical with the valve being of a lesser diameter than the interior diameter of the chamber, and a collar surrounding said rod extension of the inlet opening for positioning against the pressure receiving face of the valve, said collar seating against the inlet opening in closed position of the valve, and, with said extension, closing off the same.

7. Hydraulic mechanism as in claim 4 in which said piston rod is attached to the wall of said chamber opposite the inlet opening and said valve piston supporting rod is telescopically received in a socket in the attached end of the piston rod, said yieldable means comprising a spring seated in said socket and bearing against the socketed end of said supporting rod.

8. Hydraulic mechanism for permitting movement of a hinged member in a given direction only when hydraulic pressure with said mechanism exceeds a predetermined value comprising a fluid filled cylinder attachable to one of a pair of hinged members, a piston slidable therein with a piston rod extending from the cylinder for connection to the other hinged member, said piston having a cup-shaped wall in annularly spaced relation to the cylinder wall with an annular groove cut therein having a shallow portion toward the base of the cup and an expandable sealing ring positioned in said groove for closing the annular passage between piston and cylinder on application of pressure at the open end side of the cup, a plate fixed across the open end of the cup having a central opening therethrough and forming a cylindrical

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chamber in the interior of the piston, an auxiliary piston valve disk in said chamber with the periphery thereof spaced from said chamber wall, said piston rod being fixed to said piston axially of the base thereof and having a socketed end portion with a valve supporting rod telescopically received therein and extending through the base of the cup, a spring seated in said socket urging said supporting rod toward the open end of the cup with said auxiliary piston valve fixed thereon, said supporting rod further extending through said plate opening with a collar fixed thereon engageable against the plate to close off said opening when urged thereagainst by spring, said rod beyond said collar having a tapering reduced end for metered control of fluid passing through the opening when the valve is urged away from said plate, said base of the piston having openings for free passage of fluid from the interior chamber thereof to the rod end of the cylinder, and an expansion chamber in communication with said rod end of the cylinder, the aforesaid spring being calibrated to resist hydraulic pressures under a predetermined value in the end of the cylinder opposite the rod end as applied through said restricted plate opening against said collar and to yield to greatly reduced pressures as applied against the face of said valve disk when said collar is unseated and fluid is passing through said plate opening.

9. The structure of claim 8 in which said tapered end of the supporting rod for the valve disk is engageable against the end of the cylinder when said piston is moved adjacent one limit of hinging movement, said spring for the valve disk thereby being rendered ineffective to close said opening.

10. Hydraulic mechanism for preventing movement of a hinged member in a given direction unless said member is urged in said given direction with a force sufficient to generate an hydraulic pressure within said mechanism which exceeds a predetermined value, said mechanism comprising a movable piston and fluid filled cylinder, a rod fixed to the piston and slidable in said cylinder and attachable to one of a pair of hinged members with the cylinder connected to the other member, first valve means for permitting movement of said piston for relative movement of said hinged members in one direction and preventing movement of said piston in the opposite direction, a second valve means actuated by fluid pressure in said cylinder for enabling said piston to be moved in said opposite direction and including means for yieldably resisting actuation of said second valve means until said fluid pressure exceeds said predetermined value and means responsive to fluid pressures substantially lower than said predetermined value for maintaining said second valve in an actuated condition.

References Cited in the file of this patent

UNITED STATES PATENTS

55	1,239,510	Nordquist	Sept. 11, 1917
	2,119,625	Hasuo	June 7, 1938
	2,624,566	Caramelli	Jan. 6, 1953

FOREIGN PATENTS

60	1,074,257	France	Mar. 31, 1954
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