

May 1, 1956

W. M. MacNERLAND

2,743,475

DOOR CONTROL

Filed June 27, 1952

2 Sheets-Sheet 1

Fig. 2

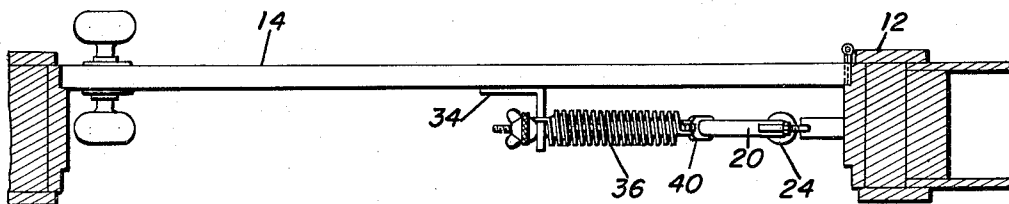


Fig. 1

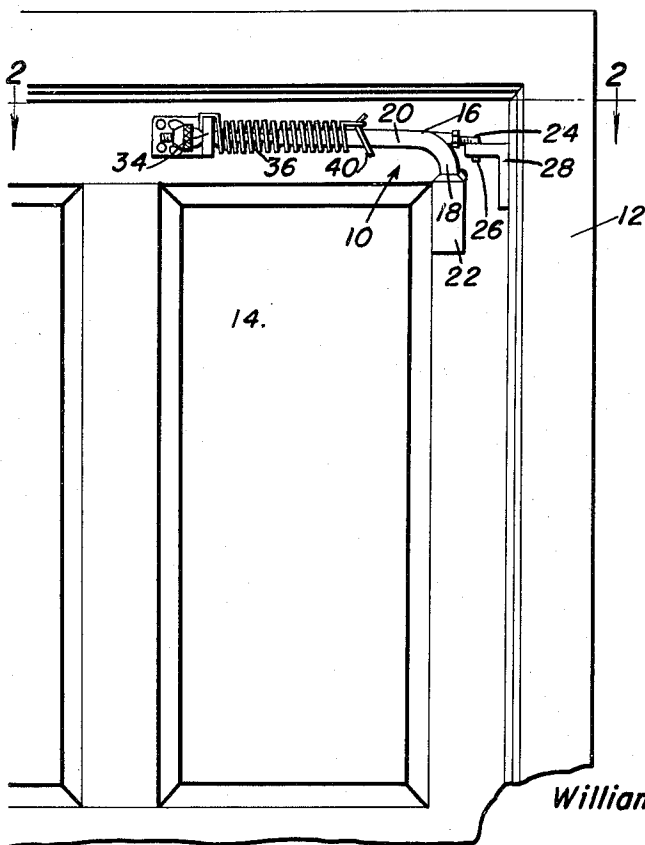
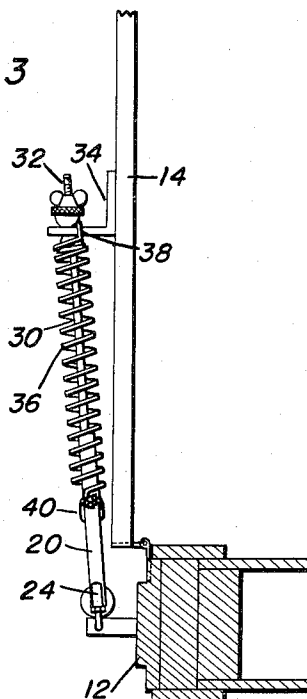


Fig. 3



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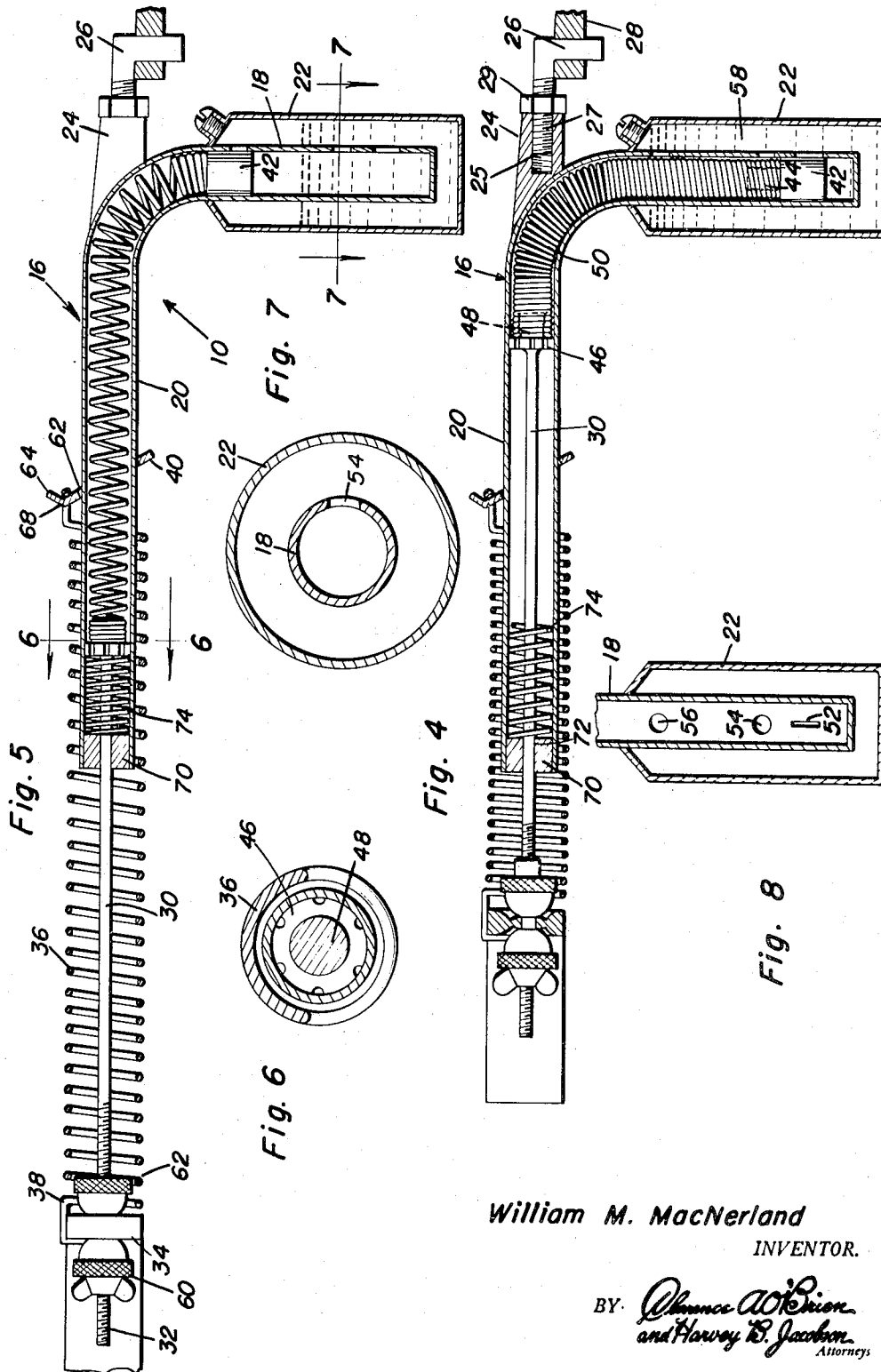
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DOOR CONTROL

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12 Claims. (Cl. 16—51)

The present invention relates to door closing and checking devices and more particularly relates to an improved door closing and checking device of the type having hydraulic means for checking the closing movement of a door.

The primary object of the invention is to provide a closing and checking device of the above mentioned type that utilizes a novel tube and fluid reservoir arrangement eliminating the necessity for packing glands and preventing loss of the hydraulic fluid.

Another object of the invention ancillary to the primary object is to provide a door closing and checking device of the hydraulic type utilizing a hydraulic cylinder having angularly related sections whereby the hydraulic fluid reservoir may be vertically disposed and which may operate without a needle valve or piston packing.

A further object of the present invention is to provide a door closing and checking device of the hydraulic type having a novel means for controlling the action of the hydraulic cylinder piston.

A still further object of the present invention is to provide a door closing and checking device of the hydraulic type wherein the door closing or tensioning means are disposed exteriorly of the device whereby this means can be adjusted, removed and replaced without tools.

A final object of the present invention to be mentioned specifically is the provision of a practical and efficient means for positively closing a door and checking the closing movement of the door to prevent slamming of the same.

Various other features and objects of the present invention, not specifically mentioned hereinabove, will become apparent from the following description with reference to the accompanying drawings, wherein:

Figure 1 is a side view of the door closing and checking device mounted in operative position on a door and door frame;

Figure 2 is a top view of the door closing and checking device mounted in its operative position taken substantially along section line 2—2 of Figure 1;

Figure 3 is a top view of the door closing and checking device mounted for operation similar to Figure 2 but showing the door in open position;

Figure 4 is an enlarged side view in section of the door closing and checking device showing the arrangement of the elements of the device in its closed position;

Figure 5 is a side view with parts being shown in section similar to Figure 4 but showing the arrangement of the elements when the device is in open position;

Figure 6 is a sectional view of a portion of the device taken substantially along section line 6—6 of Figure 5;

Figure 7 is an enlarged sectional view of another portion of the device taken substantially along section line 7—7 of Figure 5; and

Figure 8 is an enlarged side view of the hydraulic fluid reservoir and a portion of the hydraulic cylinder with parts being shown in section of the device showing the ports in the hydraulic cylinder.

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Referring now more specifically to the accompanying drawings wherein like numerals are used to designate like parts throughout the specification, attention is first directed to Figures 1—3 wherein the numeral 10 designates the door closing and checking device in its entirety, the numeral 12 indicates a door frame, and the numeral 14 indicates a door mounted for swinging movement on the frame 12.

The door closing and checking device 10 comprises generally a hydraulic cylinder 16 in the form of an L-shaped tube having angularly related sections 18 and 20 with section 18 forming a vertically extending portion or inner end and section 20 forming a horizontally extending portion or outer end. Secured to and concentrically surrounding section 18 of the cylinder 16 is a hydraulic fluid reservoir 22. A horizontal arm 24 is secured at one end to cylinder 16 adjacent the junction of sections 18 and 20. Depending from the free end of arm 24 is a pin 26. The free end of the arm 24 is provided with an internally threaded bore 25 (Fig. 4) and the pin 26 has a threaded end 27 received in this bore. An actuating nut 29 is threaded on the end 27 of pin 26 and seats against the free end of arm 24, rotation of the nut 29 extending or retracting the pin 26 to vary the distance of the cylinder 16 from the door jamb.

A bracket 28 is mounted on the door frame 12 adjacent the hinged side of the door 14. Pin 26 is rotatably received in an aperture (unnumbered) of bracket 28 whereby the hydraulic cylinder 16 is horizontally swingable about the bracket 28.

Slidably disposed in the horizontal portion of the tube 16 is a plunger rod 30 having a free end 32 extending longitudinally exteriorly of the tube. An L-shaped bracket 34 is adjustably secured to the free end 32 of the plunger rod 30 and interconnects the end of the plunger rod with the door 14. Closing or tensioning means in the form of coil spring 36 concentrically surrounds a portion of tube section 20 and the exteriorly extending portion of plunger rod 30. One end of the coil spring 36 is attached to bracket 34 as at 38 and the other end of the coil spring 36 is attached to an adjustable clamping ring 40, which ring is slidably disposed on section 20 of the cylinder 16.

With reference to Figures 2 and 3, the utility of the tensioning means 36 in the operation of the door closing and checking device 10 will be clearly apparent. As the hydraulic cylinder 16 and its associated fluid reservoir 22 are swung horizontally about the bracket 28 upon opening of the door 14, the plunger 30, by virtue of its connection to the bracket 34, secured to the door 14, will be longitudinally extended from the section 20 of the cylinder 16. When this longitudinal extension occurs, the coil spring 36 will be tensioned to a much greater degree than when the door 14 is in its closed position as shown in Figure 2. Thus, when the door 14 is released from its opening position as shown in Figure 3, the coil spring 36 will tend to return the plunger rod 30 within the section 20 of the cylinder 16.

Referring now to Figures 4—8, the internal construction and various other constructional details not fully explained above may be clearly observed.

Slidably disposed within section 18 of the tube 16 is a piston 42 having a boss 44 thereon. A plunger head 46 having a boss 48 thereon is secured to the end of plunger rod 30 disposed within the horizontal section 20 of the cylinder 16. Resilient means in the form of coil spring 50 is interposed between plunger head 46 and piston 42 within the cylinder 16 and has its ends threaded on bosses 48 and 44 to cause simultaneous but varied speed movement between the plunger rod 30 and the piston 42. It is this novel arrangement between plunger rod 30, piston 42 and resilient means 50 that permits the hydraulic

cylinder 16 to be L-shaped, whereby the fluid reservoir 22 may be vertically disposed eliminating the necessity for packing glands and a needle valve check arrangement.

To check the closing of the door 14, longitudinally spaced ports 52, 54 and 56 are provided in the wall of vertical portion 18 of the cylinder 16 to communicate the interior of the cylinder with the fluid reservoir 22. As will be noted in Figure 8 of the drawings, the lowermost port 52 comprises a narrow, elongated slot while the central port 54 and the upper port 56 consist of circular apertures with the diameter of aperture 56 being slightly greater than that of aperture 54. It is to be noted that while the rectangularly slotted and circular configurations of the ports are the preferred configurations, they may be of other shapes, since their basic utility, as will become apparent, lies in the fact that they are of progressively greater size.

When the reservoir 22 is filled with oil 58 or other hydraulic fluid, as shown in Figure 4, this fluid 58 will flow into the interior of section 18 of the tube 16 through the ports 52, 54, and 56. Thus, when the device 10 is in its closed or inoperative position, as shown in this figure, the piston 44 will be disposed adjacent the lower end of section 18 of the cylinder 16. When the device 10 is in its open or operative position, as evidenced in Figure 5, the piston 42 will be disposed at the upper end of section 18 adjacent the top of the fluid reservoir 22. As the piston 42 rises in section 18, the volume of fluid will be displaced from section 18 into the reservoir 22 due to the openings or ports 54 and 56, and the closing spring 36 will be tensioned and resist opening of the door. As the tension in spring 36 is decreased by closing the door, piston 42 slides toward the bottom of the section 18, the displacement of the fluid from the section 18 into the reservoir 22 will become progressively harder due to the progressively smaller openings 56, 54 and 52. By this arrangement, it can be seen that as the door is closed and piston 42 slides toward the bottom of the section 18, the resistance to the downward movement of the piston 42 becomes progressively greater thereby slowing down the inward movement of the plunger rod 30 within the section 20 of the cylinder 16 and consequently slowing the closing action of the door.

To adjustably secure the free end 32 of the plunger rod 30 to the bracket 34, this free end 30 is threaded and thumb screws 60 and 62 are threaded thereon with the bracket 34 being secured therebetween.

To permit easy adjustability of the tension on spring 36, the clamping ring 40 need only be biased from its clamping position on the section 20 of the tube 16 and moved to another selected position. To permit such releasable clamping action, the clamping ring 40 is provided with an opening 62 of greater diameter than the outer diameter of cylinder 16 and includes a peripheral lug 64 disposed angularly to the major plane thereof. The end 68 of the tensioning spring 36 is secured to the lug 64. Thus, when the end 68 of the tensioning spring 36 is secured to the lug 64, the ring 40 will be pulled into angular relationship with the section 20 and will accordingly bite into the wall thereof and thereby be clamped in place.

Thus it will be seen that three means for varying the closing speed of the door are provided, the first being the adjustable pin 26 and arm 24, the second being the adjustable connection of the plunger rod 30 to the bracket 34 and the third being the adjustment provided by the ring 40 connected to the closing spring 36.

To guide the plunger rod concentrically within the section 20 of the tube 16, a plug 70 closes the end of section 20. Further, the plug 70 is provided with a central aperture 72 through which the plunger rod is slidably guided.

To prevent slamming of the plunger head 46 against the plug 70, a coil spring 74 concentrically surrounds the

plunger rod 30 and is interposed between plug 70 and plunger head 48.

Although not clearly appearing in the drawings since the door control is shown only in completely open and closed position, the spring 50 is loosely wound adjacent piston 42 and closely wound adjacent plunger head 46 whereby the initial door-closing shock is absorbed by the hydraulic fluid.

Further, the door closing speed of the door control will remain substantially constant regardless of temperature changes since temperature changes decreasing or increasing the viscosity of the hydraulic fluid will likewise cause spring 50 and plunger rod 30 to expand or contract whereby the degree of closing of port 54 is correspondingly varied.

From the foregoing description, it is believed that the construction and operation of the door closing device will be clearly apparent. However, since numerous modifications and changes will readily occur to those skilled in the art after a perusal of the foregoing description and the accompanying drawings, it is not desired to limit the invention to the exact construction shown and described and all suitable modifications and changes may be resorted to falling within the scope of the appended claims.

Having described the invention, what is claimed as new is:

1. A door closing and checking device comprising a fluid reservoir, a tube having an inner end disposed in said reservoir and having an outer end disposed exteriorly thereof, the inner end of said tube having longitudinally spaced openings therein communicating the interior of the tube with the fluid reservoir, a piston slidable within the inner end of said tube, a plunger rod slidable within the outer end of said tube and having a free end extending exteriorly of said tube, resilient means in said tube interconnecting said plunger rod and said piston, mounting means adjustably connected to the free end of said plunger rod for attaching said rod to a door, means for attaching said tube to a door frame and adjustable tensioning means mounted exteriorly of said tube interconnecting said tube and said mounting means, said tensioning means urging said plunger rod toward said piston whereby the piston will displace fluid within the tube, said tube being substantially L-shaped, said inner and outer ends of said tube being angulated with respect to one another, said adjustable tensioning means comprising a stop element concentrically surrounding said tube, a coil spring concentrically surrounding said tube and being connected at one end to said stop element and at its other end to said mounting means.

2. A door closing and checking device comprising a fluid reservoir, a tube having an inner end disposed in said reservoir and having an outer end disposed exteriorly thereof, the inner end of said tube having longitudinally spaced openings therein communicating the interior of the tube with the fluid reservoir, a piston slidable within the inner end of said tube, a plunger rod slidable within the outer end of said tube and having a free end extending exteriorly of said tube, resilient means in said tube interconnecting said plunger rod and said piston, mounting means adjustably connected to the free end of said plunger rod for attaching said rod to a door, means for attaching said tube to a door frame and adjustable tensioning means mounted exteriorly of said tube interconnecting said tube and said mounting means, said tensioning means urging said plunger rod toward said piston whereby the piston will displace fluid within the tube, said tube being substantially L-shaped, said inner and outer ends of said tube being angulated with respect to one another, said adjustable tensioning means comprising a coil spring concentrically surrounding said tube and having one end thereof connected to said mounting means, a washer element concentrically surrounding said tube, the other end of said coil spring being attached to one edge of said washer element whereby the element will frictionally abut the wall of the tube.

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3. A door closing and checking device comprising an L-shaped tube including vertical and horizontal portions, a fluid reservoir mounted on and concentrically surrounding said vertical portion, a piston slidably disposed in said vertical portion and a plunger rod slidably disposed in said horizontal portion and having a free end terminating exteriorly thereof, resilient means interconnecting said plunger rod and said piston, the vertical portion of said tube having ports therein communicating the interior of the tube with the fluid reservoir whereby movement of the piston displaces fluid in the tube, tensioning means concentrically surrounding the horizontal portion of said tube and being connected at one end to said free end of said plunger rod for urging the rod toward the piston, and adjustable means clamping the other end of said tensioning means on said tube.

4. A door closing and checking device comprising an L-shaped tube including vertical and horizontal portions, a fluid reservoir mounted on and concentrically surrounding said vertical portion, a piston slidably disposed in said vertical portion and a plunger rod slidably disposed in said horizontal portion and having a free end terminating exteriorly thereof, resilient means interconnecting said plunger rod and said piston, the vertical portion of said tube having ports therein communicating the interior of the tube with the fluid reservoir whereby movement of the piston displaces fluid in the tube, tensioning means concentrically surrounding the horizontal portion of said tube and being connected at one end to said free end of said plunger rod for urging the rod toward the piston, and adjustable means clamping the other end of said tensioning means on said tube, said ports being of different sizes to vary the resistance encountered by the piston in displacing fluid from the tube as the plunger rod is urged toward the piston.

5. A door closing and checking device comprising an L-shaped tube including vertical and horizontal portions, a fluid reservoir mounted on and concentrically surrounding said vertical portion, a piston slidably disposed in said vertical portion and a plunger rod slidably disposed in said horizontal portion and having a free end terminating exteriorly thereof, resilient means interconnecting said plunger rod and said piston, the vertical portion of said tube having ports therein communicating the interior of the tube with the fluid reservoir whereby movement of the piston displaces fluid in the tube, tensioning means concentrically surrounding the horizontal portion of said tube and being connected at one end to said free end of said plunger rod for urging the rod toward the piston, adjustable means clamping the other end of said tensioning means on said tube, and a bracket adjustably secured to said free end of said plunger rod, said tensioning means comprising a coil spring having one end thereof secured to said bracket.

6. A door closing and checking device comprising an L-shaped tube including vertical and horizontal portions, a fluid reservoir mounted on and concentrically surrounding said vertical portion, a piston slidably disposed in said vertical portion and a plunger rod slidably disposed in said horizontal portion and having a free end terminating exteriorly thereof, resilient means interconnecting said plunger rod and said piston, the vertical portion of said tube having ports therein communicating the interior of the tube with the fluid reservoir whereby movement of the piston displaces fluid in the tube, tensioning means concentrically surrounding the horizontal portion of said tube and being connected at one end to said free end of said plunger rod for urging the rod toward the piston, adjustable means clamping the other end of said tensioning means on said tube, a plunger head on said plunger rod engaging said resilient means, and yielding means surrounding said plunger rod and contacting the end of the horizontal portion of said tube for opposing withdrawal of the plunger rod from said tube.

7. A door closing and checking device comprising an elongated, substantially L-shaped tube having first and second angularly related legs, a sliding piston within the first

leg of the tube for displacing fluid within the leg, a plunger rod slidably disposed within the second leg of the tube and having an inner end disposed within said second leg and an outer end projecting forwardly exteriorly of said second leg, a head on the inner end of said plunger rod centering the rod within the second leg of the tube, closure means on the free end of said second leg having a central aperture therein through which the plunger rod slidably passes, a coil spring disposed within said tube interconnecting said plunger head and said piston and urging the same toward one another, and attaching means connected to said outer end of said plunger rod for adjustably securing the same to a door and mounting means on said tube for securing the same to a door frame.

8. The combination of claim 7 including cushioning means disposed between said plunger head and said closure means within said tube.

9. A door closing and checking device including a tube comprising first and second legs angularly related to one another, means closing the ends of said tube, a plunger rod slidably disposed in said second leg and projecting exteriorly thereof for attachment to a door, a piston slidably disposed in said first leg for displacing fluid within the leg upon inward and outward movement of the plunger rod, and resilient means within said tube connecting said piston and plunger rod for cooperating movement toward and away from one another during the operation of the device.

10. A door closing and checking device including a tube comprising first and second legs angularly related to one another, means closing the ends of said tube, a plunger rod slidably disposed in said second leg and projecting exteriorly thereof for attachment to a door, a piston slidably disposed in said first leg for displacing fluid within the leg upon inward and outward movement of the plunger rod, and resilient means within said tube connecting said piston and plunger rod for cooperating movement toward and away from one another during the operation of the device, said first leg having fluid by-pass ports therealong and means for returning by-passed fluid to said first leg.

11. A door closing and checking device comprising a tubular housing including a vertically disposed first section and a second section angularly related thereto, mounting means on said housing for securing the same to a door frame, and door closing and checking means carried by said housing, said door closing and checking means including a dashpot assembly carried by said first housing section, a plunger assembly carried by said second housing section, and resilient means interconnecting said assemblies whereby they move toward and away from one another during the operation of the device.

12. A door closing and checking device comprising a tubular housing including a vertically disposed first section and a second section angularly related thereto, mounting means on said housing for securing the same to a door frame, and door closing and checking means carried by said housing, said door closing and checking means including a dashpot assembly carried by said first housing section, a plunger assembly carried by said second housing section, and resilient means within said housing interconnecting said assemblies, said dashpot assembly including a piston slidably disposed in said first section, said resilient means within said housing interconnecting said piston and plunger assembly for cooperative movement toward and away from one another during the operation of the device.

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