

Jan. 13, 1948.

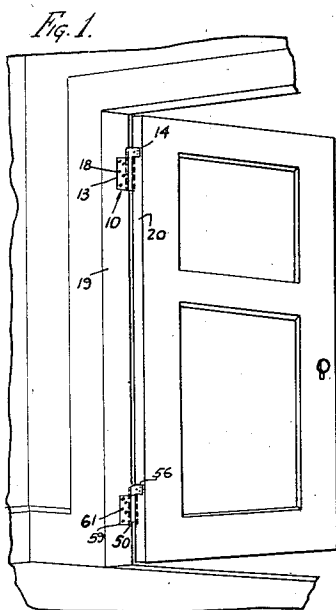
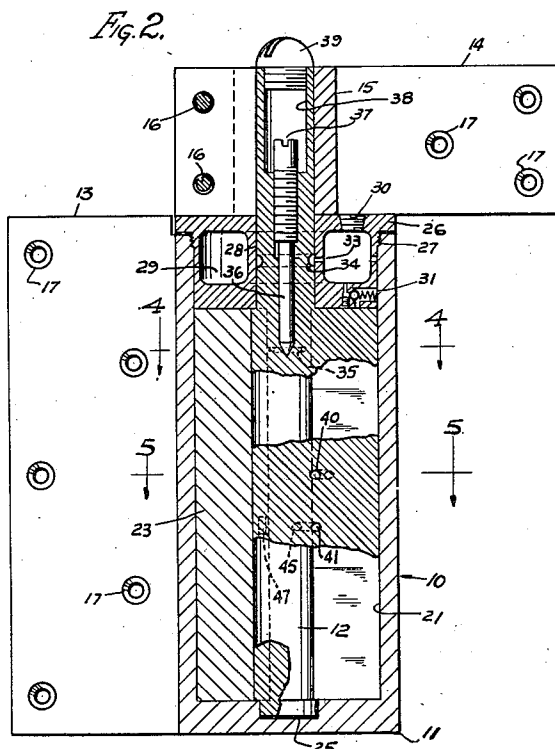
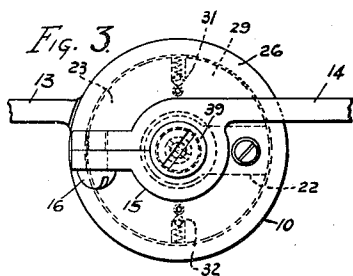
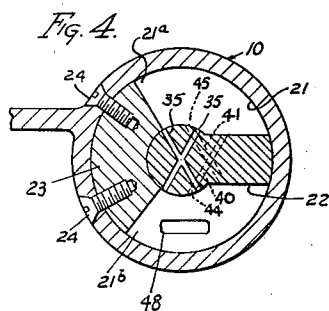
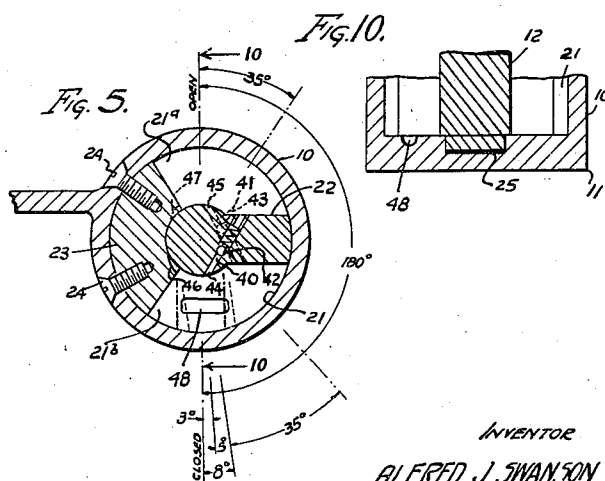
A. J. SWANSON

2,434,524

DOOR CHECKING HINGE

Filed Oct. 6, 1944

2 Sheets-Sheet 1



INVENTOR
ALFRED J. SWANSON

by *James A. Hartmann*
ATTORNEY

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Fig. 6.

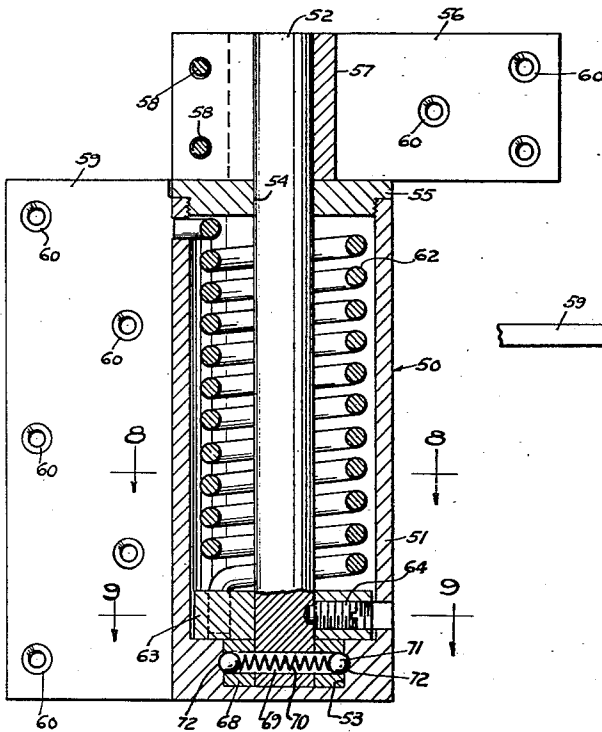


Fig. 7.

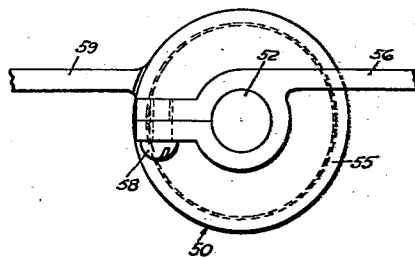


Fig. 8.

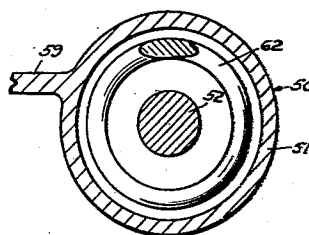
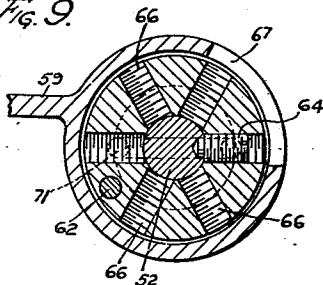


Fig. 9.



INVENTOR
ALFRED J. SWANSON

By *James R. Hartmann*
ATTORNEY

UNITED STATES PATENT OFFICE

2,434,524

DOOR CHECKING HINGE

Alfred J. Swanson, Los Angeles, Calif.

Application October 6, 1944, Serial No. 557,388

8 Claims. (Cl. 16—54)

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This invention relates to a door checking hinge, and to a combination of an hydraulic door checking hinge and a closer spring hinge with a swinging door to control the movement thereof in hand opening and automatic closing.

One object of the invention is to provide a door checking hinge. Another object is to provide a hinge for a hand operated door which controls the relative rates of movement of the door throughout its movement. Another object is to provide a spring closer hinge to cooperate with said checking hinge. Still another object is to provide in combination with a hand operated swinging door, a movement-controlling hinge and a closer hinge. These and other objects are attained by my invention which will be described below, and will be understood from the description and the accompanying drawings in which

Fig. 1 shows a perspective view of a hand operated door in a door casing, hinged with a checking hinge and a closer hinge of my invention;

Fig. 2 is a vertical cross-section view of my checking hinge, the leaves or attaching members being shown in elevation;

Fig. 3 is a top view of Fig. 2;

Fig. 4 is a cross-sectional view taken on the line 4—4 of Fig. 2;

Fig. 5 is a cross-sectional view taken on the line 5—5 of Fig. 2;

Fig. 6 is a vertical cross-sectional view, partly in elevation, showing my spring closer hinge;

Fig. 7 is a top view of the same;

Fig. 8 is a cross-sectional view taken on the line 8—8 of Fig. 6;

Fig. 9 is a cross-sectional view taken on the line 9—9 of Fig. 6;

Fig. 10 is a fragmentary cross-sectional view taken on the line 10—10 of Fig. 5.

Referring to Figs. 1 to 5, my door checking hinge 10 consists in general of an hydraulic cylinder casing 11 enclosing the shaft 12 of the hinge. One attaching member or leaf 13 is fastened to the casing 11 or made an integral part thereof, and the other leaf 14 is non-rotatably attached to the shaft 12 by means of the split clamp 15 with its clamping screws 16. Both leaves 13 and 14 are provided with holes 17 for use in mounting the hinge by screws 18 on the door jamb 19 and the back edge of the door 20. The casing 11 contains an hydraulic working chamber 21 in which operates a rotary piston or wing 22 attached to or integral with the shaft 12, thus dividing the working chamber into two parts 21a and 21b. A fixed partition or dam 23 is attached to the casing 11 by countersunk head

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bolts 24, the partition filling a little less than one-half the circular working space.

The working chamber 21 is closed by the integral bottom portion of the casing 11 which is provided with a hole 25 forming a lower bearing for the shaft 12. The other end of the working chamber 21 is closed by a top cap 26, threaded into the cylindrical wall of the casing at 27, and is provided with a center bearing hole 28 in which the shaft 12 may rotate. The cap 26 is provided with an annular reservoir 29 for reserve hydraulic fluid, with a filling hole and threaded plug 30 accessible from the outside for putting fluid into the reservoir and working space. The wall of the reservoir 29 adjacent the working chamber 21 is provided with two check valves 31 and 32, one being provided in each part 21a and 21b of the working chamber. These check valves 31 and 32 are arranged to allow fluid to be drawn into the working space from the reservoir under reduced pressure in the working space, and to prevent the opposite movement under compression. In order to provide for any leakage of fluid around the shaft 12 in the upper bearing 28, holes 33 are made in the reservoir wall adjacent the shaft 12, and the shaft is provided with a groove 34 coinciding with the holes 33. Any leakage of fluid from the working chamber 21 around the shaft 12 at the bearing 28 is thus retained in the reservoir, and fluid will not leak out of the device.

A controlled by-pass for fluid is provided by the holes 35 passing from one side of the piston 22 to the other through the axis of the piston shaft 12, at which point a needle valve 36 threaded into the shaft 12 lengthwise of said shaft is provided, the stem of the needle valve having a slotted end 37 projecting into a cavity 38 in the upper end of the shaft where it is accessible for adjustments by removing the screw cap 39. This by-pass adjustment permits the regulation of the checking action of the device.

The controlled variable checking action on the door movement is provided by the crossed check-valved holes through the piston near the shaft or in the shaft 12. One hole 40 is provided leading from the face of the piston in the working space 21a to the surface of the shaft 12 at a position where it is adjacent the fixed partition 23 when the piston 22 is approaching the end of its motion at the closed position of the door; while the other hole 41 is provided from the opposite side of the piston 22 in the working chamber 21b to the shaft surface where it is adjacent the fixed partition 23 when the piston 22 is approaching the end of its motion at 180° from the closed

position of the door. These holes 40 and 41 are provided, respectively, with check valves 42 and 43 which allow the fluid to pass from one side of the piston to the other at all times except when the ends in the shaft-contacting surface of the dam 23 restrict or close off one or the other inlets 44 and 45 of the holes 40 and 41. Tapering grooves 46 and 47 are cut in the fixed partition 23 in its wall which contacts the shaft end of the piston, at elevations coinciding with the inlets 44 and 45 of the piston holes 40 and 41, so that the free movement of the piston toward the end of its stroke in either direction is gradually throttled down to a full check. In the last few degrees of travel before the position of complete closure of the door, it is advantageous to provide for a release of all checking effects, and this is accomplished by providing a relief groove 48 in the bottom surface of the working chamber so disposed that just before the piston reaches the end of its travel corresponding to a closed door, the pressure of the hydraulic fluid is quickly relieved through the groove under the piston.

The acceleration of the checking action brought about by the tapering grooves 46 and 47 may be varied as to its rate by the rate of change of cross-sectional area of the groove, and the angular length of the effect by the length of the groove, and these may be selected to fit the conditions for a particular hinge use. The grooves 46 and 47 are exaggerated in scale in the drawings, to more clearly show the structure. The relief groove 48 may be placed so that it becomes effective at any desired position of travel of the piston. In the drawings, particularly Fig. 5, as illustrative of one set of conditions, the checking action is arranged to begin at 43° ahead of the closed door position; at 8° before the closed door position the checking action is of full magnitude and continues for 5 degrees; and in the last three degrees before closure, the checking is entirely relieved through the bottom groove 48. At the open-door end, the checking is gradually increased to a full check at the full open (180°) door position of the piston.

The spring closer hinge 50 shown particularly in Figs. 1 and 6 to 9, consists of a casing 51 having a cylindrical cavity, a shaft 52 mounted in a bearing 53 in the casing bottom, and a bearing 54 in a closing cap 55 threaded into the top of the casing 51, the shaft 52 protruding through said cap for attachment of one leaf 56 of the hinge by the attachment clamp 57 with clamping screws 58. The other leaf 59 of the hinge is integral with or attached to the casing 51. The leaves 56 and 59 are provided with holes 60 for screws 61 for attachment to the door edge 20 and door jamb 19.

An actuating coil spring 62, which may be in any desired form and cross-section, is provided around the shaft 52 inside the casing 51, the upper end of the spring being attached to the casing 51, and the lower end to a collar 63 rotatable on the shaft 52. A set screw 64 is provided to hold the collar 63 on the shaft 52, this set screw being operable through a hole 65. Other holes 66 are provided at spaced intervals around the collar, and a slot 67, slightly wider than the interval between two adjacent holes is provided in the casing wall, so that the tension of the spring 62 may be adjusted by first loosening the set screw 64 and then moving the collar 63 by a pin inserted in one end of the holes 66 through the slot 67, after which the set screw 64 is reset to hold the collar 63 from rotation on the shaft 52.

Also, on the shaft 52, preferably below the collar 63 is affixed a bushing 68 through which is provided a diametrically disposed hole 69, with an expanding spring 70, and steel balls 71 at either end of the spring, which engage depressions 72 in the inside casing wall adjacent said balls. This arrangement provides a detent or means for holding the door open at any selected position, particularly at the full open position, the compression of spring 70 being selected to provide the necessary static resistance.

By using the combination of my door checking hinge and the spring closer hinge in combination on a hand operated swinging door, I provide a door mounting which is self-closing and will not slam, and will close the door rapidly or slowly as desired, and further will close the door completely shut against a spring latch, where this is provided on the door. There is also provided a detent device which will hold the door wide open, or at any other selected position for which the device has been set. Since a door is always mounted with a minimum of two hinges, it is possible to provide the checking hinge and the closer hinge of similar outside design, and of inconspicuous proportions and appearance, so that my invention may be used for door control in homes and other places where conspicuous accessory closers and checks are objectionable in appearance. The checking hinge and the closer hinge may be adjusted for varying weights of doors and conditions of service required.

While I have described and illustrated my invention by a particular embodiment, I do not wish to be limited to the details shown, but restrict my invention only insofar as required by the state of the art and the spirit of the appended claims.

I claim:

1. An hydraulic checking hinge comprising two hinge leaves, an hydraulic cylinder attached to one of said leaves, a fixed partition defining a segmental working space in said cylinder, a rotary piston in said working space, a shaft for said rotary piston rotating therewith and attached to the other hinge leaf, a non-pressured liquid reservoir adjacent said cylinder, one-way conduits between said reservoir and said cylinder, said one-way conduits being disposed to at times admit liquid to said cylinder from said reservoir on one or the other side of said piston, conduit means adjacent the upper end of said shaft adapted to return to said reservoir any liquid passing up said shaft from said cylinder, said shaft serving as a hinge pin and having bearing contact with said partition, means adapted to at times convey fluid freely from each side of said piston to an opposite side within the working space, and at other times to restrict the free flow of fluid therethrough, whereby to control the resistance to movement of said hinge at selected positions.

2. An hydraulic checking hinge comprising two hinge leaves, an hydraulic cylinder attached to one of said leaves, a fixed partition defining a segmental working space in said cylinder, a rotary piston in said working space, a shaft for said rotary piston rotating therewith and attached to the other hinge leaf, a non-pressured liquid reservoir adjacent said cylinder, one-way conduits between said reservoir and said cylinder, said one-way conduits being disposed to at times admit liquid to said cylinder from said reservoir on one or the other side of said piston, conduit

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means adjacent the upper end of said shaft adapted to return to said reservoir any liquid passing up said shaft from said cylinder, said shaft serving as a hinge pin and having bearing contact with said partition, two one-way fluid passages in said piston adapted to convey fluid from one side of said piston to an opposite side within the working space, the inlets of said passages at times being cut off in the contact surface between said piston and the contact surfaces on which it moves in said cylinder, and tapering grooves in said contact surfaces coacting with the inlets of said passages.

3. A hydraulic checking hinge comprising two hinge leaves, an hydraulic cylinder attached to one of said leaves, a fixed partition defining a segmental working space in said cylinder, a rotary piston in said working space, a shaft for said rotary piston rotating therewith and attached to the other hinge leaf, a non-pressured liquid reservoir adjacent said cylinder, one-way conduits between said reservoir and said cylinder, said one-way conduits being disposed to at times admit liquid to said cylinder from said reservoir on one or the other side of said piston, conduit means adjacent the upper end of said shaft adapted to return to said reservoir any liquid passing up said shaft from said cylinder, said shaft serving as a hinge pin and having bearing contact with said partition, two one-way fluid passages in said shaft to convey fluid from one side of said piston to an opposite side within the working space, the inlets of said passages at times being cut off in the contact surface between said partition and said shaft, and two tapering grooves in said partition coacting with the inlets of said passages.

4. An hydraulic checking hinge comprising two hinge leaves, an hydraulic cylinder attached to one of said leaves, a fixed partition defining a segmental working space in said cylinder, a rotary piston in said working space, a shaft for said rotary piston rotating therewith and attached to the other hinge leaf, a non-pressured liquid reservoir adjacent said cylinder, one-way conduits between said reservoir and said cylinder, said one-way conduits being disposed to at times admit liquid to said cylinder from said reservoir on one or the other side of said piston, conduit means adjacent the upper end of said shaft adapted to return to said reservoir any liquid passing up said shaft from said cylinder, said shaft serving as a hinge pin and having bearing contact with said partition, two one-way fluid passages in said shaft adapted to convey fluid from each side of said piston to an opposite side within the working space, the inlets of said passages at times being cut off in the contact surface between said partition and said shaft, two tapering grooves in said partition surface coacting with the inlets of said passages, and means to relieve the fluid pressure for a selected interval when said passages are completely cut off by contact with the surface of said partition.

5. An hydraulic checking hinge comprising two hinge leaves, an hydraulic cylinder attached to one of said leaves, a fixed partition defining a segmental working space in said cylinder, a rotary piston in said working space, a shaft for said rotary piston rotating therewith and attached to the other hinge leaf, a non-pressured liquid reservoir adjacent said cylinder, one-way

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conduits between said reservoir and said cylinder, said one-way conduits being disposed to at times admit liquid to said cylinder from said reservoir on one or the other side of said piston, conduit means adjacent the upper end of said shaft adapted to return to said reservoir any liquid passing up said shaft from said cylinder, said shaft serving as a hinge pin and having bearing contact with said partition, two one-way fluid passages in said shaft adapted to convey fluid from each side of said piston to an opposite side within the working space, the inlets of said passages at times being cut off in the contact surface between said partition and said shaft, two tapering grooves in said partition surface coacting with the inlets of said passages, a by-pass conduit through said shaft for fluid from one side of said piston to the other, and a valve with operating stem extending along the axis of said shaft to a position accessible from outside for throttling said by-pass conduit.

6. In an hydraulic checking hinge having a cylinder, a shaft, a fixed partition, and a rotary piston, with the shaft serving as a hinge pin, two one-way check-valved fluid passages in said shaft adapted to convey fluid from each side of said piston to an opposite side, and two grooves in a contact surface between the fixed partition and the rotary piston coacting with said one-way passages to gradually check the movement of said piston in the latter part of its stroke in either direction.

7. In an hydraulic checking hinge having a cylinder, a shaft, a fixed partition, and a rotary piston, with the shaft serving as a hinge pin, two one-way check-valved fluid passages in said shaft adapted to convey fluid from each side of said piston to an opposite side, two tapered grooves in the contact surfaces between the fixed partition and the rotary piston coacting with said one-way passages adapted to gradually check the movement of said piston in the latter part of its stroke in either direction, and valved fluid by-pass means adapted to vary the over-all effective checking action of the fluid in said one-way passages.

8. In an hydraulic checking hinge having a cylinder, a shaft, a fixed partition, and a rotary piston, with the shaft serving as the hinge pin, two one-way check-valved fluid passages in said shaft adapted to convey fluid from each side of said piston to an opposite side, and two tapered grooves in the contact surface of the fixed partition with the rotary piston coacting with said one-way passages adapted to gradually check the movement of said piston in the latter part of its stroke in either direction.

ALFRED J. SWANSON.

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