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SELF-CLOSING DOOR HINGE

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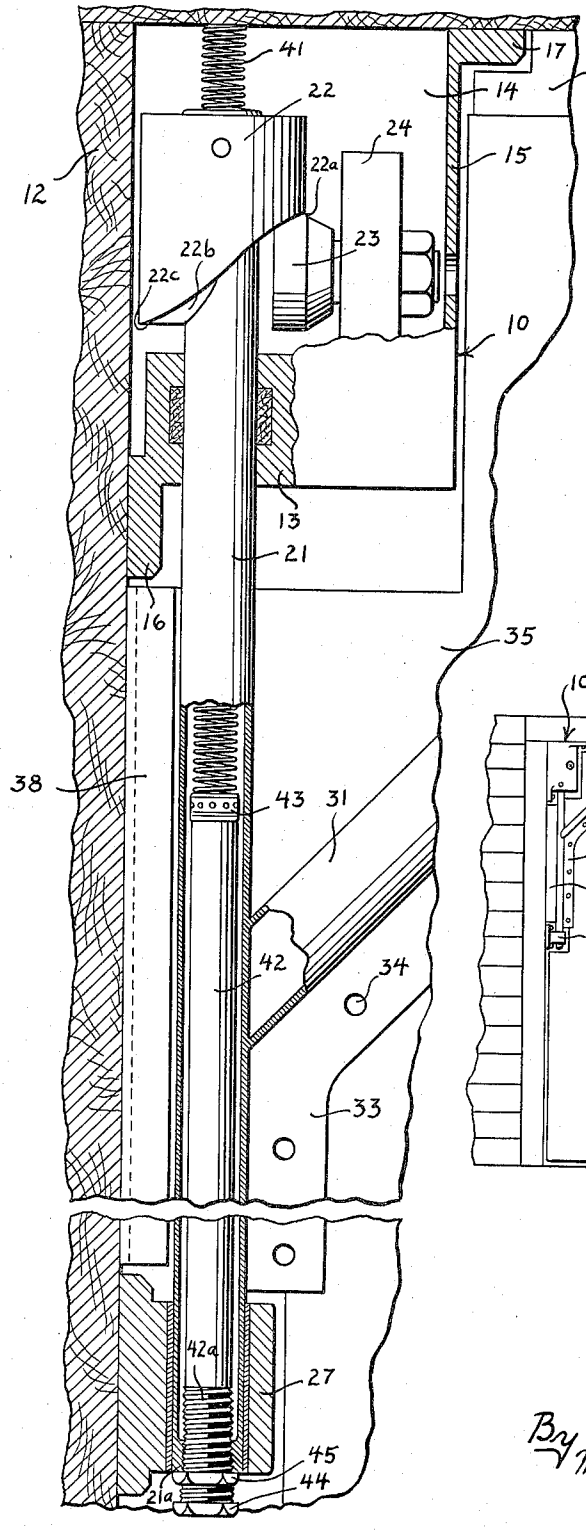
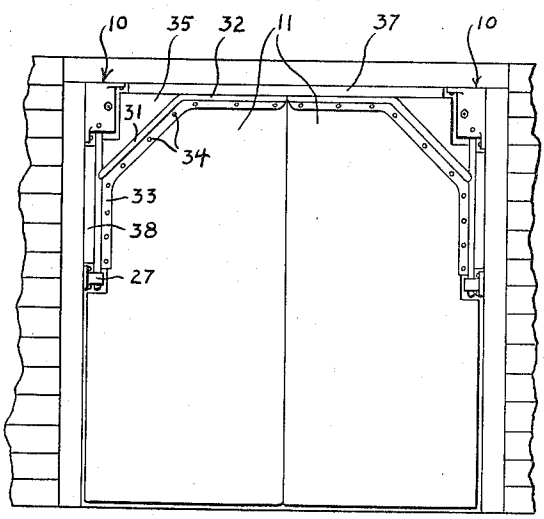


Fig. 2

Fig. 1



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SELF-CLOSING DOOR HINGE

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This invention relates to door fixtures and particularly to a self-closing door hinge.

The present invention is an improvement over the self-closing door hinge disclosed in our Patent No. 2,718,026, issued September 20, 1955. The door hinge in that patent is of the gravity-operated type and includes a door support shaft and cam and follower means for raising the shaft as the door is swung away from its closed position whereby the weight of the door is operative through the cam and follower means to normally return the door to its closed position. Such gravity-operated hinges work well with conventional doors which are relatively heavy. However, some difficulty is encountered when using gravity-operated hinges with relatively light weight doors. When such light weight doors are subjected to drafts, the doors tend to swing open and do not provide a tight closure for the door opening.

An important object of this invention is to provide an improved self-closing door hinge for use with light weight doors which overcome the aforementioned difficulties.

A more particular object of this invention is to provide a cam-operated self-closing door hinge having a vertically slidable and rotatable door support shaft, cam means engageable with the shaft for moving the same axially when the door is moved away from a closed position, and spring means engageable with the shaft for yieldably urging the same in a direction to return the door to its closed position.

Another object of this invention is to provide a self-closing door hinge in accordance with the foregoing object in which the spring is completely enclosed within the hinge structure and wherein provision is made for adjusting the spring to enable accurate control of the force applied to the door to close the same.

These, together with various ancillary objects and advantages of this invention will be more readily appreciated as the same becomes better understood by reference to the following detailed description when taken in connection with the accompanying drawings wherein:

Figure 1 is a front elevational view of a door and frame structure having the operator of the present invention mounted thereon; and

Fig. 2 is an enlarged fragmentary vertical sectional view through the door operator and illustrating the same mounted on a door frame.

The self-closing door hinge of the present invention is specifically adapted for use with relatively light weight doors to assure proper closing of the doors when the latter are subjected to drafts and the like. In the specific embodiment illustrated herein, the door hinges, designated generally by the number **10**, are utilized to swingably support flexible rubber doors **11**.

The door hinges **10** are adapted to be mounted in the upper corner of a door frame **12** to swingably support the doors **11** thereon. The hinge **10** includes a housing having a bottom wall **13**, opposed side walls **14** and an arcuate end wall **15**. Mounting flanges **16** and **17**

are provided on the bottom wall and on the upper edge of the end wall and are arranged to be secured by suitable fasteners (not shown) to the door frame.

A door support shaft **21** is slidably and rotatably supported in the bottom wall **13** of the housing and a cam member **22** is rigidly secured to the upper end of the shaft **21**, internally of the housing. The cam member **22** has a cam track formed thereon including a seat **22*a*** and an annular cam surface **22*b*** which curves downwardly from the seat to a low point on the cam member designated **22*c***. A roller **23** is mounted on an arm **24** for rotation about an axis perpendicular to the shaft **21** and engages the cam track on the cam **22** to support the latter thereon. In the closed position of the door, the seat **22*a*** of the cam track rests on the roller **23** and as the door is swung away from its closed position, the cam rides upwardly on the roller to thereby raise the shaft **21**.

The shaft **21** extends downwardly from the housing and is slidably and rotatably supported at its lower end in a lower bearing **27**, also conveniently attached to the frame **12**. The door **11** is attached to the shaft for movement therewith. A brace arm is provided for attaching the flexible rubber door to the shaft **21** and, as best shown in Figure 1, the brace arm includes an angulated tubular member having a portion **31** attached to the shaft below the housing and extending upwardly and outwardly therefrom and a horizontally extending portion **32** which projects to the free edge of the door. A flange **33** is welded to the shaft **21** and to the portions **31** and **32** of the support arm to enable attachment of the flexible rubber door **11** thereto, as by fasteners **34**. A plate **35** is welded to the portion **31** of the arm and extends upwardly therefrom to at least partially close the opening between the arm and the door hinge housing. As is apparent from Fig. 2, the plate **35** is notched to receive the door hinge housing and sufficient clearance is provided between the plate and the bottom of the door hinge housing and also between the plate and the top of the door frame to permit raising and lowering of the door as the latter swings between its open and closed positions. A resilient sealing gasket **37** is affixed to the top of the door frame and is arranged to engage the door when the latter is in its closed position to thereby seal the interface between the door frame and the top of the door. A similar sealing gasket **38** is attached to the side of the door frame and extends between the frame and the shaft **21** to seal the interface therebetween.

The aforedescribed door construction is relatively light in weight and the force applied by such doors to the cam and roller operator is frequently insufficient to maintain the doors in a closed position, when the doors are subjected to drafts or winds. In accordance with the present invention, provision is made for increasing the force supplied to the cam and roller arrangement for returning the door to its closed position. As best shown in Fig. 2, the shaft **21** is of tubular construction and is open at the upper end thereof. An elongated compression spring **41** extends into the upper portion of the tubular shaft **21** and the upper end thereof abuts against a fixed stop, such as the top of the door frame. The other end of the spring engages a member carried by the shaft **21** so as to apply the axial thrust of the spring **41** to the shaft in a direction to urge the shaft downwardly and thereby increase the force supplied to the roller and cam arrangement to return the door to its closed position. As shown in Fig. 2, a rod **42** is disposed in the lower portion of the shaft and a thrust bearing **43** is interposed between the end of the rod and the adjacent end of the spring **41** so as to apply the axial thrust of the spring to the rod without causing any twisting or torsion in the spring, as the rod is rotated

relative thereto. The lower end of the rod **42** is preferably adjustably attached to the shaft **21**, to enable adjustment of the closing force applied to the door, and for this purpose the lower end of the rod **42** is externally threaded as indicated at **42***a* and is received in an internally threaded boss **21***a* on the lower end of the shaft **21**. A head **44** is provided on the shaft to facilitate turning and adjustment thereof and a lock nut **45** is threaded on the portion **42***a* and arranged to engage the end of the shaft **21**, to lock the rod in a preselected adjusted position relative thereto.

From the foregoing it is apparent that the spring **41** will urge the shaft **21** and the door **11** downwardly to thereby increase the force applied to the roller and cam arrangement to return the door to its closed position. The thrust washer **43** applies the axial thrust of the spring **41** to the shaft **21**, without imparting the torsion of the spring thereto. It is additionally to be noted that the spring **41** and rod **42** are compleely enclosed within the shaft **21** and the housing and the arrangement is such that the overall size of the self-closing door hinge is not increased by the addition of the spring arrangement for closing the same.

We claim:

1. A self-closing door hinge comprising a hinge bracket adapted for attachment to a door frame, a vertically disposed tubular door support shaft slidably and rotatably mounted in said bracket, cam and follower means operatively connecting said shaft and bracket for moving said shaft axially upwardly when said shaft is turned in either direction from a preselected angular position thereof, an elongated compression spring extending into the upper end of said shaft, a rod mounted in the lower portion of said shaft for adjustment longitudinally thereof, and a thrust bearing interposed between said rod and said spring to rotatably interconnect the same whereby said spring is operative to yieldably urge said shaft downwardly and thereby normally return said shaft to said preselected angular position.

2. The combination of claim 1 wherein said rod is threadedly connected to said shaft, and means for selectively locking said rod to said shaft in a preselected adjusted position thereof.

3. A self-closing door hinge comprising a housing having a bottom wall, opposed side walls and an end wall adapted for attachment to a door frame, a tubular door support shaft slidably and rotatably mounted in said bottom wall and extending therebetween, a cam on said shaft in said housing, a roller mounted on said housing and engageable with said cam and operative to move said shaft axially upwardly as the shaft is rotated from a preselected angular position thereof, an elongated spring extending into the upper end of said shaft, a rod extending upwardly into said shaft from the lower end thereof, and a thrust bearing interposed between said spring and said rod for rotatably interconnecting said spring and shaft and for applying the spring pressure to the shaft to urge the shaft downwardly and thereby normally return the shaft to said preselected angular position.

4. A self closing door hinge comprising an elongated door support shaft, a door secured to said shaft and movable therewith, a first hinge bracket adapted for attachment to a door frame and slidably and rotatably supporting the upper end of said shaft, a second hinge bracket adapted for attachment to a door frame and slidably and rotatably supporting the lower end of the shaft, cam and follower means operatively connecting said shaft and said first hinge bracket for moving said shaft axially upwardly as it is turned in either direction from a preselected angular position thereof, a coil spring disposed axially of said shaft to be guidably supported thereby and having one end adapted to engage a stationary abutment, an adjustable stop connected to the lower end of said shaft for adjustment relative to the shaft in a direction axially thereof, a thrust bearing rotatably connecting the other end of said spring to said adjustable stop to apply the spring pressure to said shaft to urge the shaft axially downwardly and thereby normally return the shaft and door to said preselected angular position.

5. A self closing door hinge comprising, upper and lower hinge brackets adapted for attachment to a door frame, an elongated tubular door support shaft mounted for vertical sliding and rotary movement in said upper and lower hinge brackets, a door attached to said shaft for movement therewith, cam and follower means on the upper end of said first shaft and said upper hinge bracket for moving said shaft axially upwardly when the shaft is turned from a preselected angular position thereof, spring means extending into the upper end of said shaft to be substantially enclosed thereby and adapted for engagement at its upper end with the door frame, and means connecting the other end of said spring to said shaft whereby the spring yieldably urges the shaft downwardly and supplements the weight of the door to normally return the shaft to a preselected angular position.

6. A self closing door hinge comprising, upper and lower hinge brackets adapted for attachment to a door frame, an elongated tubular door support shaft mounted for vertical sliding and rotary movement in said upper and lower hinge brackets, a door attached to said shaft for movement therewith, cam and follower means on the upper end of said first shaft and said upper hinge bracket for moving said shaft axially upwardly when the shaft is turned from a preselected angular position thereof, spring means extending into the upper end of said shaft to be substantially enclosed thereby and adapted for engagement at its upper end with the door frame, an adjustable stop attached to said shaft adjacent its lower end, and a thrust bearing interposed between said stop and the lower end of said spring whereby the spring yieldably urges the shaft downwardly and supplements the weight of the door to normally return the shaft to a preselected angular position.

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