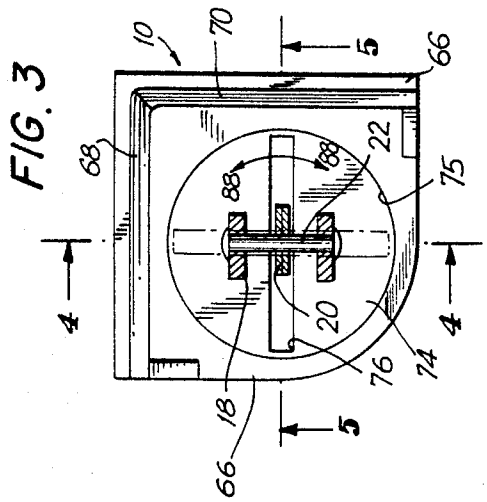
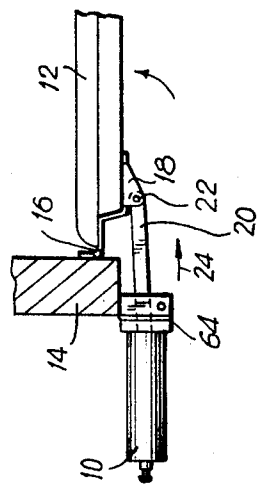
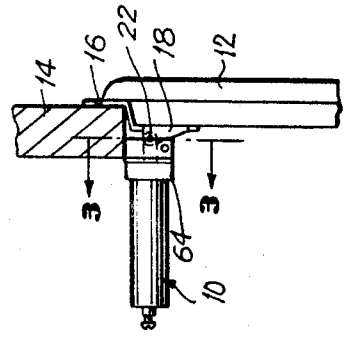
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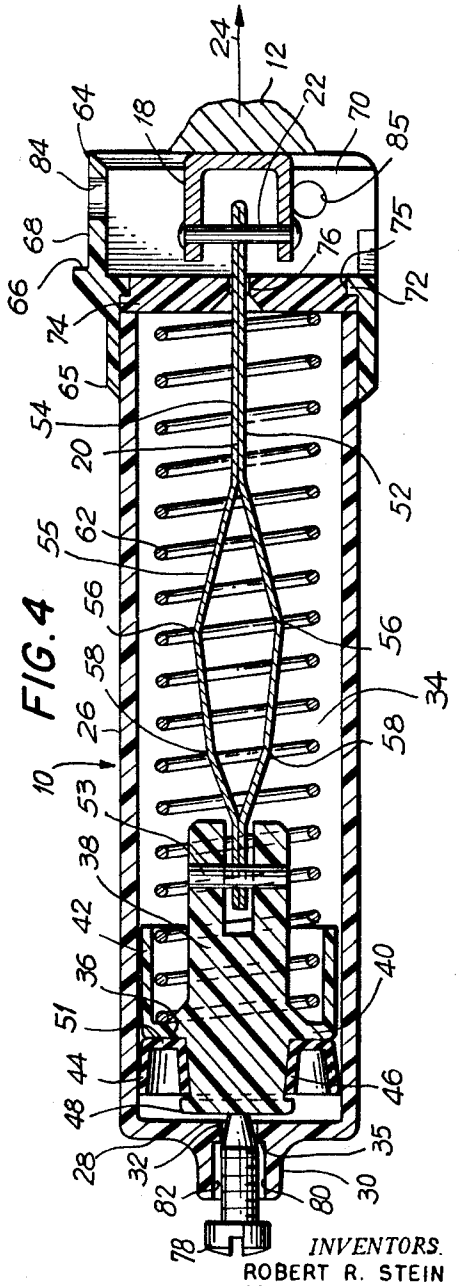
DOOR CLOSER AND HOLDER

Filed Nov. 16, 1966 2 Sheets-Sheet 1









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DOOR CLOSER AND HOLDER

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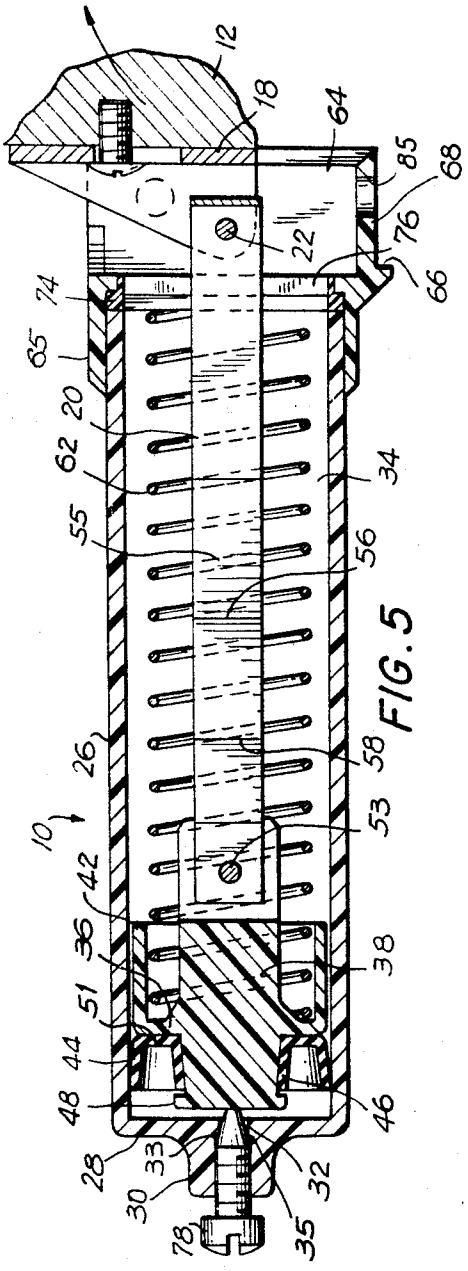


FIG. 5

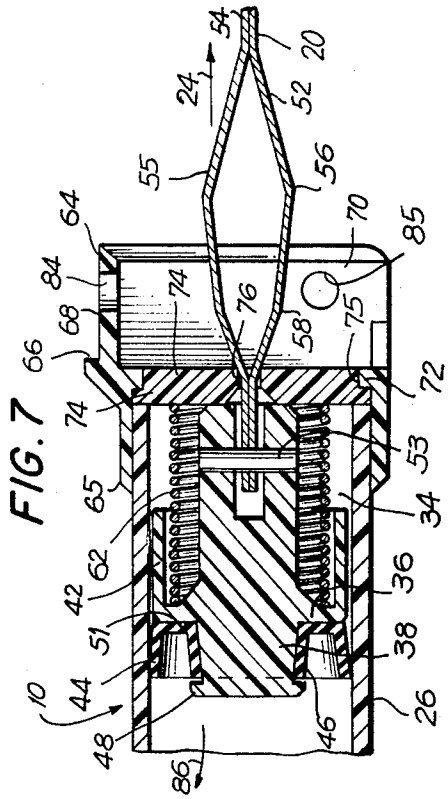


FIG. 7

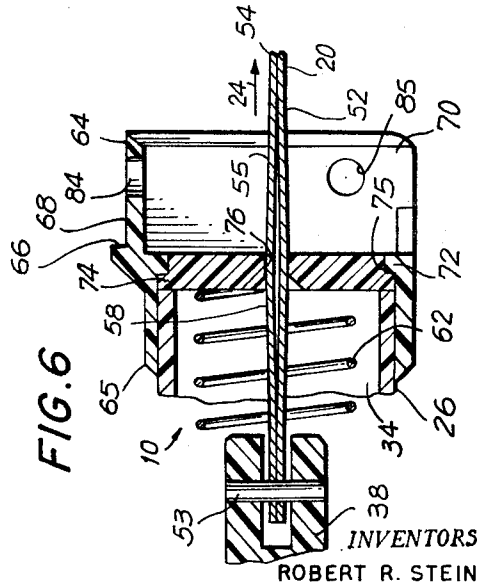


FIG. 6

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DOOR CLOSER AND HOLDER

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11 Claims. (Cl. 16—49)

ABSTRACT OF THE DISCLOSURE

A self-contained door closer and holder, having a longitudinally movable arm passing through an opening in one end in response to the opening of the door to which it is attached. The arm is continually urged in door closing position. Intermediate of the ends of the arm is a resiliently compressible portion, which frictionally engages the edges defining the opening in the one end, so as to maintain the arm in fixed position with respect to the one end when the arm is stopped in the opening and which overcomes the closing force exerted on the arm. The door automatically closes at a predetermined rate once a closing movement has begun.

This invention relates to a new and improved door closer and door holder, and more particularly to mechanism incorporating a door closer and a door holder in a self-contained, compact unit.

The present invention is particularly suited for use in connection with cabinet type doors, and is generally concealed from view, and which releasably holds open the door in any one of a plurality of selected positions over a relatively wide door angle, but which yields to an application of a small closing force applied to the door to close the door positively, but quietly.

Therefore, it is an object of the present invention to provide a door closer device to control the speed of closing of the door and to reduce the opening speed of the door after the door has swung through a predetermined arc.

It is a further object of the present invention to provide an apparatus for limiting the opening movement of a door to desired maximum open position and for holding the door open in any one of a plurality of selected positions over a predetermined angle of opening.

It is a still further object of the present invention to provide an apparatus to enable a door to be held in a selected open position throughout a predetermined angle of door opening, but which will yield upon the application of a relatively slight closing force applied against the door, so as to close the door automatically.

Another object of the present invention is to provide a door closer and door hold apparatus which operates without the aid of detents and with a minimum of noise and vibration.

Still another object of the present invention is to provide an apparatus for holding a door in a selected open position and which upon application of a slight closing force on the door provides for self-closing of the door at a controlled rate of speed, so that the door will close quietly but positively.

A further object of the present invention is to provide a door closer and door hold apparatus which is compact and self contained, which is durable in use, positive in

operation and which can be made and assembled inexpensively.

Other objects and advantages of the present invention will become apparent by reference to the following description taken in connection with the accompanying drawings, in which:

FIGURE 1 is a plan view of apparatus constructed and installed in accordance with the present invention;

FIGURE 2 is a plan view of apparatus similar to FIGURE 1, showing the door in open position;

FIGURE 3 is a cross sectional view taken along line 3—3 of FIGURE 1;

FIGURE 4 is a cross sectional view taken along line 4—4 of FIGURE 3;

FIGURE 5 is a cross sectional view taken along line 5—5 of FIGURE 3;

FIGURE 6 is a fragmentary sectional view, showing the connecting arm of FIGURE 4 during opening of the door; and

FIGURE 7 is a fragmentary sectional view similar to FIGURE 6, illustrating the position of the connecting arm and hold-open device in maximum door hold-open position.

The apparatus of the present invention is adapted to be used with a door member hingedly supported from a cabinet wall. The device is mounted on the cabinet wall and is operatively connected to the door through a connecting arm and bracket. The apparatus controls the rate of the opening movement of the door after a predetermined arc and limits the maximum open position, maintains the door in any one of a plurality of selected hold-open positions from the maximum open position continuously through a predetermined angle, and closes the door automatically when the door is given a slight closing push.

Referring now to the drawings, and more particularly to FIGURES 1 and 2, the door closer and door holder of the present invention, referred to generally by reference numeral **10**, is illustrated operatively connected to a door **12** which is hingedly mounted to a cabinet wall **14** by means of a hinge **16**. While a cabinet door is illustrated, other doors may be used.

Mounted, such as by means of screws or the like, on the interior surface of door **12** is a bracket **18**. The operative cooperation between door **12** and closer mechanism **10** is effected by a connecting arm **20**. One end of arm **20** is pivotly mounted to bracket **18** by means of a pin **22**. As seen in FIGURES 1 and 2, when door **12** is opened and rotated in a counter-clockwise direction, connecting arm **20** attached to door **12** is urged generally outwardly in a direction indicated by arrow **24**, and extends from the front end of device **10**.

Referring to FIGURES 4 and 5, door closer and door holding device **10** has a generally tubular housing **26**, having a closed rear end **28**. Longitudinally extending outwardly from closed end **28** is a boss **30**. Boss **30** has an axially extending orifice **32** communicating with chamber **34** within housing **26**. Orifice **32** has a larger diameter portion **33**. The intersection of portion **33** and smaller diameter portion **32** forms a transverse surface **35**. Slidably disposed within chamber **34** is a piston **36**. Piston **36** has an elongated body **38** with an outward radially extending rib **40** disposed between its ends. Integrally connected to the outer end of rib **40** is a cylindrical sleeve **42** facing frontward and away from end **28**. The outer diameter of sleeve **42** is substantially equal to the inner diameter of

the interior or chamber 34 of housing 26. Snugly mounted about the end of body 38 facing end 28 of housing 26 is a sealing washer 44, shown as a cup washer.

As shown, washer 44 has an inner sleeve 46, which is seated on a mating surface of piston body 38. As seen, the seat on body 38 is tapered downwardly to form a transverse end rib 48, which abuts the end of washer sleeve 46 to hold washer 44 in fixed position. The outer sleeve of washer 44 is tapered outwardly to sealingly engage the inner surface of housing 26. The base 51 of washer 44 abuts rib 36 of body 38 and is supported thereby. The other end of body 38 is bifurcated and receives there between the end of connecting arm 20. Arm 20 is pivotally connected to the bifurcated arms of body 38 by a pin 53.

Connecting arm 20 is formed advantageously of a pair of flexible strips 52 and 54 of suitable width and thickness. The portion of strips 52 and 54 which are remote from piston 36 are superimposed. A predetermined distance from the end of arm 20 adjacent door bracket 18, strips 52 and 54 separate outwardly and rearwardly in a generally straight line 55 for a predetermined distance and then are directed rearwardly and inwardly, forming an apex or high point 56. From apex 56, strips 52 and 54 continue inwardly in a generally straight line for further predetermined distance to point 58 and then converge inwardly until strips 52 and 54 again become superimposed between the bifurcated arms of body 38. The spaced apart portion of connecting arm 20 can be yieldingly flexed towards each other. Connecting arm 20 is of a length that when piston 36 abuts end 28 of housing 26, door 12 is fully closed. Concentrically disposed within housing 26 and about connecting arm 20 and body 38 of piston 36 is a compression spring 62. One end of spring 62 is received within the recess formed between piston sleeve 42 and piston body 38 and abuts against piston rib 40. Spring 62 has a larger inner diameter than the diameter of apex 56 of arm 20.

Fixedly mounted in any convenient manner to the other end of housing 26 is a mounting jacket 64. Jacket 64 has a generally cylindrical sleeve 65 which slidably receives the mating end of housing 26. Integrally connected to sleeve 65 is an outwardly directed flange 66. Extending longitudinally from flange 66 is a pair of generally perpendicular walls 68 and 70 joined along one edge. Jacket 64 has interiorly directed, a radial rib 72. Rotatably mounted across the end of housing 26 and within sleeve 65 is a disk or end plate 74 having an outer diameter slightly smaller than the inner diameter of sleeve 65. Disk 74 has an undercut portion 75 which cooperatively mates with rib 72 so as to be held in position. Passing through disk 74 is a slot 76, which is axially aligned with arm 20. Slot 76 is of a width greater than the width of connecting arm 20 and has a height slightly greater than the superimposed thickness of arm 20. Slot 76 is tapered outwardly facing chamber 34. The other end of spring 62 abuts disk 74. Spring 62 is of a length to continuously urge piston 36 into contact with closed end 28 of housing 26.

Threaded in opening 33 in boss 30 is an adjusting screw 78. Advantageously, adjusting screw 78 is self-threading. The end of screw 78 is uniformly tapered inwardly to form a seal with transverse surface 35. A pair of opposed transverse slots 80 and 82 in boss 30 communicate with and extend the length of opening 33 so that adjusting screw 78 can vary the size of orifice 32 and thus control the rate of escape of air from within volume 34 to the outside.

In assembled relation either wall 68 or 70 of jacket 64 abuts wall 14 and flange 66 engages an edge of wall 14 to position device 10 on the inside wall of cabinet 14. Door bracket 18 is mounted on the inner surface of cabinet door 12 and is operatively connected with arm 20 by pin 22. Spring 62 continuously urges piston 36 towards closed end 28, which is the closed door position. Since piston 36 is operatively connected to door 12 by means of connecting arm 20 and door bracket 18, spring 62 effectively urges door 12 into closed position.

When door 12 is opened, connecting arm 20 is moved outwardly from chamber 34 in the direction of arrow 24 shown in FIGURES 2 and 6. As arm 20 moves in the direction of arrow 24, its flat portion freely passes through opening 76 in disk 74 and permits door 12 to open at a relatively rapid rate. Once inclined surface 55 of the spaced apart portion of arm 20 engages disk 74, the spaced apart arms are yieldably urged towards each other in passing through the opening 76 which reduces the opening speed of door 12, thereby preventing sudden openings which could damage the door or cabinet if the door banged into an adjacent wall. The maximum opening of door 12 is limited by the length of travel of piston 36 in chamber 34, as seen in FIGURE 7. Once the spaced apart portion of arm 20 is beyond the restraining limits of disk 74, strips 52 and 54 spring apart and again form the inclined surfaces. Rearward inclined surface 58 cooperating with disk 74 effectively maintains door 12 in its maximum open position. If door 12 is stopped at any open position corresponding to the spaced apart portion of arm 20 rearward of apex 56 being in slot 76, the restraining or binding force exerted on disk 74 by the inclined surfaces and static friction is sufficient to overcome the return force of the compressed coil spring 62 tending to urge piston 36 and connecting arm 20 to move in closing direction indicated by arrow 86 in FIGURE 7 and maintain door 12 in its open position. Once apex 56 passes through slot 76 into chamber 34 or door 12 is given a closing push, the door 12 will automatically close by reason of the biasing action of spring 62 being greater than the sliding friction. In moving in the door closing direction 86, piston 36 is moved toward end wall 28 of housing 26 by action of spring 62. Sealing washer 44, in moving in the direction 86, expands and forms a seal with the inner surface of housing 26, thereby trapping air in the volume defined by piston seal 44, the walls of housing 26 and end 28. Screw 78 is adjusted so as to allow a selectable controlled quantity of air to escape through orifice 32. The pressure exerted on the air by seal 44 moving towards end 28 forces the air through this orifice and out through slots 80 and 82. The controlled flow of air through orifice 32 controls the rate of return movement of piston 36 and hence the rate of the closing of door 12. The flow of air through orifice 32 is controlled by adjusting screw 78.

Having two walls 68 and 70 of jacket 64 permits the use of device 10 with either left hand or right hand opening doors. Disk 74 is freely rotatable with respect to housing 26 so as to allow arm 20 to be rotated when device 10 is used with either left or right hand opening of the door, as indicated by arrow 88 in FIGURE 3. Spaced apart portions of the connecting arm 20 prevents the door being opened violently and acts to provide for a uniform opening movement of the door by absorbing any large opening force. Door 12 will remain in open position corresponding to any position along arm 20 from when apex 56 passes through opening 76 in disk 74 until piston 36 abuts disk 74. As shown in FIGURE 6, door 12 will remain in the partially open position corresponding to the relative position of arm 20 in slot 76.

To close door 12 merely requires a slight closing force applied to the door which is sufficient to overcome the static frictional force and resultant force of the tapered surface acting on disk 74 and permit coil 62 to urge the door shut. The sliding frictional force and the resultant force acting on disk 74 by spaced apart portion of arm 20 is not sufficient to overcome the closing force exerted on piston 36 by spring 62. If a greater angle of maintaining the door open is desired, apex 56 can be moved closer to disk 74 and the flat portion of arm 20 shortened. Also, greater holding power can be obtained by having arms 52 and 54 spaced apart a greater distance, or using materials having greater frictional properties.

Advantageously, housing 26, piston 36, jacket 64 and

disk 74 are made of tough plastic material. Disk 74 must be able to resist the frictional force and sliding movement of arm 20 over a long period of time without greatly enlarging the thickness of opening 76. Connecting arm 20 is preferably made from a single strip of spring steel folded over on itself at the flat end. However, if desired, arm 20 may be made of separate pieces joined together by adhesives, welding, brazing or the like. Also, certain plastic materials could be used having the desired resilience and long life needed, such as polypropylene.

While the door closer and holder was shown mounted to the frame or wall, if desired it could be mounted on the door and the bracket mounted on the wall or door frame. The present device may be used with a variety of sized doors. If necessary, the closing force exerted by the spring could be increased.

In the preceding description it is seen that the present invention provides a novel door closer and door holder construction in which any objectionable noise and feel of a spring press detent snapping into and out of openings is eliminated and instead provides a continuous range throughout a predetermined angle for maintaining the door in open position and which merely requires a slight closing touch on the door to automatically close the door gently, but positively, and without any jarring noise. Further, the present invention is self-contained and does not require a separate track on the door. Important savings in manufacturing and assembling costs are realized in the simplified construction of the components of the device. Since the device is self-contained, it can be quickly and easily assembled in cabinets with a minimum of time and labor costs and without the need for complicated fastening and adjusting procedures.

While one embodiment of this invention has been shown and described, it will be understood that numerous details of the construction may be altered or omitted without departing from the spirit of the invention as defined by the following claims.

We claim:

1. A door closer and holder for controlling the closing of and retaining in selected open position a door comprising a housing having a chamber therein with closed ends, one of said ends having an opening therethrough, a connecting arm disposed within said chamber and extending through said opening in said one end, said arm adapted to be operatively connected to said door and being longitudinally movable in said chamber in response to the opening and closing movements of said door, means continuously urging said arm into door closing position, means limiting the opening movement of said arm with respect to said housing to a maximum open door position, and means intermediate of the ends of said arm extending transversely outwardly from the longitudinal axis a distance to cooperate with said one end during passage through said opening in said one end for releasably holding said arm in selected positions with respect to said one end, whereby said door is retained in open position corresponding to the position of said arm with respect to said one end.

2. A door closer and holder as described in claim 1, wherein said means intermediate the ends of said arm is resilient and frictionally engages said one end in releasably holding said arm in selected position.

3. A door closer and holder as described in claim 1 wherein said resilient means is a generally outwardly bowed portion of said connecting arm which is resiliently compressible and cooperates with one said end when passing through said opening to frictionally hold said arm in selected position responsive to said bowed portion being stopped in this position, said holding force being readily overcome by a closing force, applied to said arm.

4. A door closer and holder as described in claim 1 further including means for controlling the speed of said door returning to closed position.

5. A door closer and holder as described in claim 4 wherein said control means includes a piston operatively movable within said chamber and operatively connected to said connecting arm, and adjustable valve means mounted on said other housing end and communicating with said chamber, whereby closing movement of said piston in said chamber towards said other end forces air at a selectable rate from said chamber through said valve means to control the speed of said door closing.

6. A door closer and holder as described in claim 1 wherein said resilient means is a pair of flexible arms angled outwardly forming a forward inclined surface to an apex and a rearward inclined surface, said forward surface facing said one end and said rearward surface facing said other end, said pair of arms being yieldingly compressed in passing through said opening in said one end, said arms from said apex through said rearward surface frictionally cooperating with said one end to releasably hold said door in selected open position corresponding to the relative position of said spring arms engaging said one end, whereby opening said door to a selected open position corresponding to a position where said rearward inclined surface engages said one end retains said door in the selected open position until a closing force is applied to said door to overcome the door holding force.

7. A door closer and holder as described in claim 4 wherein the means urging said connecting arm closed is a compression spring concentrically mounted about said arm and engaging said piston and said one end, and said piston includes a cup washer facing said other closed end and sealingly cooperates with said chamber during closing movement of said piston.

8. A door closer and holder as described in claim 4, wherein said adjustable valve means includes a pair of concentric openings, end to end having different diameters, with the smaller diameter opening being adjacent said chamber, and a valve for selectably controlling the air passing through said opening, said valve comprising a threaded screw with a uniform beveled end which cooperates with said smaller diameter opening for controlling the flow of air from said piston chamber through said opening.

9. A door closer and holder as described in claim 1 wherein said one end of said housing is an end disk rotatably mounted on said housing for closing said one end of said chamber.

10. A door closer and holder as described in claim 9, further including a jacket receiving said one end of said housing and rotatably holding said end disk in position, said jacket having a pair of transverse surfaces extending parallel to the axis of said housing and joined along one longitudinal directed edge to mount said door closure and holder on one of said surfaces corresponding to a left or right hand door opening.

11. A door holder for holding a door in selected open position comprising a pair of surfaces spaced apart a predetermined distance, an arm adapted to pass between said surfaces and adapted to be operatively connected at one end to said door, said arm intermediate of its ends having a pair of resilient strips angled outwardly in opposite directions forming forward inclined surfaces and rearwardly inclined surfaces, said forward inclined surfaces facing said spaced apart surfaces and terminating at an apex, said resilient arms from said apex to said rearwardly inclined surface being generally inwardly tapered and being greater in width than the distance between said spaced apart surfaces, said pair of arms being yieldingly compressed in passing through said spaced apart surfaces and from said apex through said rearward inclined surfaces frictionally binding said spaced apart surfaces and holding said arm in fixed relationship therewith so as to hold said door in selected open position, corresponding to the relative position of said arms engaging said spaced apart surfaces, whereby opening said door to selected open position at which the corre-

sponding position of said arm is rearward of said apex retains the door in selected open position.

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