

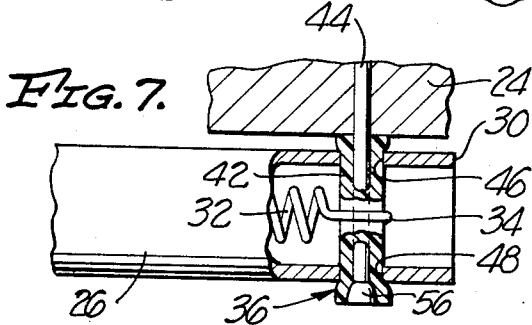
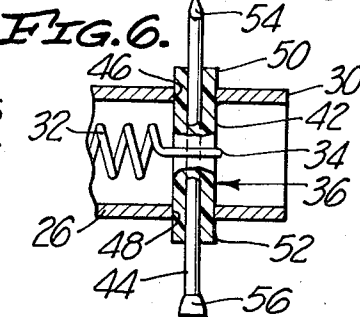
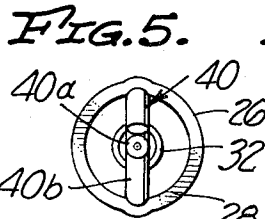
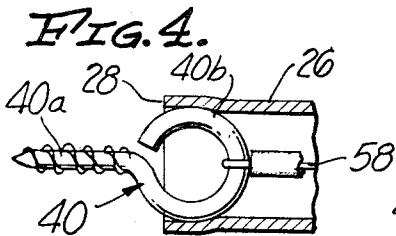
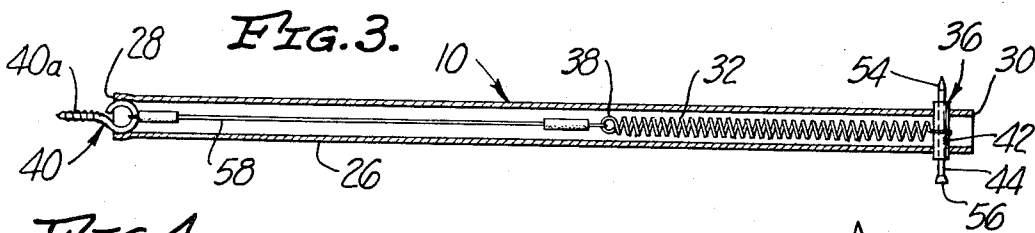
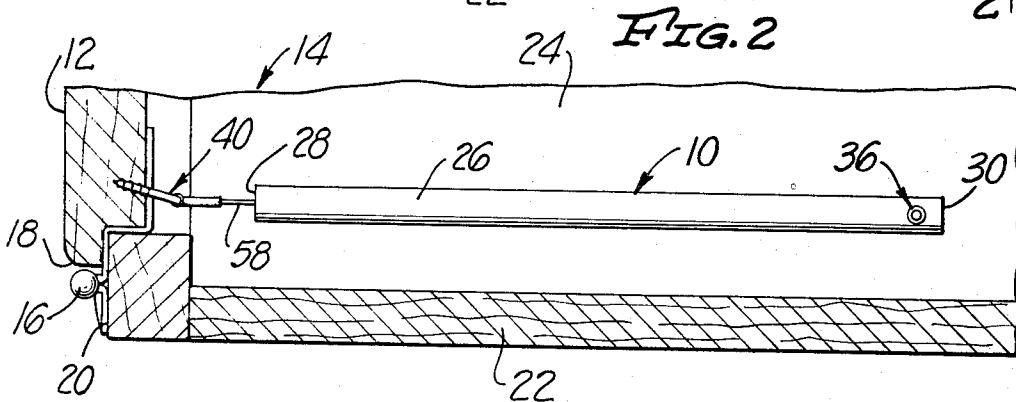
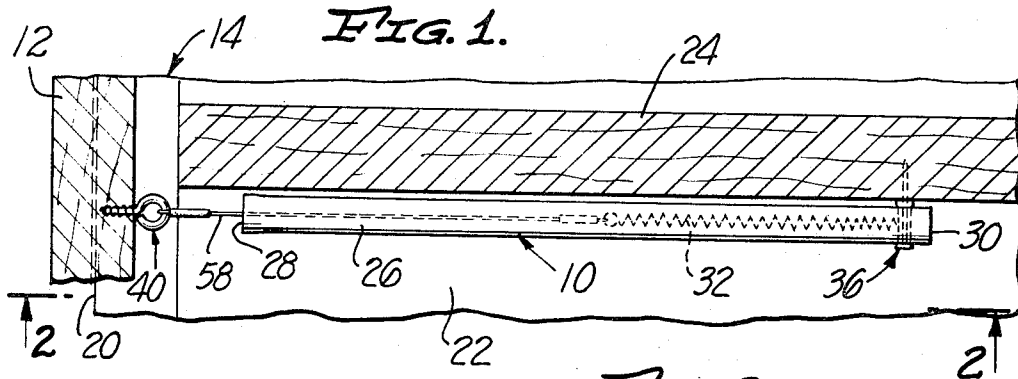
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3,409,341

AUTOMATIC DOOR CLOSER

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3,409,341

AUTOMATIC DOOR CLOSER

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ABSTRACT OF THE DISCLOSURE

An automatic door closer, about pencil size, including a horizontally extending tubular member for connection by a vertical pivot to a cabinet shelf and housing a coil spring secured at one end to the pivot and connected at an opposite end to and holding an eyelet-type screw in an open forward end of the tubular member for connection to a door of the cabinet adjacent its hinged edge.

The present invention relates to apparatus for closing doors and, more particularly, to a novel device for automatically and slowly closing lightweight doors such as those employed on kitchen cabinets and the like.

Automatic door closers for heavy, large doors are well known. Such closers commonly include springs mounted in telescoping tubes with dash pots connected by special mounts to the casings around, and back sides of, the doors to be automatically closed.

Possibly due to the complexity of their construction or to their expense and difficulty of installation requiring special tools, such automatic door closers have not heretofore been applied to lightweight doors such as those employed on kitchen cabinets and the like. Instead, various forms of catches, latches, and magnetic contacts are presently employed to hold shut kitchen cabinet doors and physical manpower is necessary to both open and completely close such doors.

In order to eliminate the need for such conventional latches, catches, and magnetic devices, which have limited lives and require periodic servicing and replacement, and to eliminate the need for manually closing lightweight kitchen cabinet doors and the like, it is an object of the present invention to provide a simple, long lasting automatic door closer which may be rapidly and easily installed in a cabinet without the use of special tools.

Another object of the present invention is to provide an automatic door closer of the foregoing character which is compact and which may be installed in out-of-the-way portions of a kitchen cabinet so as not to interfere with normal use of the cabinet and so as not to create a safety hazard for those using the cabinet, as is true of many conventional door latches and the like.

Another object of the present invention is to provide an automatic door closer of the foregoing character which will (1) permit a lightweight door to stand open at about 90° or more from its normally closed position (2) automatically slowly close the door upon movement or positioning of the door to an angle of less than about 90° from its closed position, and (3) gently hold the door in its closed position.

A further object of the present invention is to provide an automatic door closer of the foregoing character which is of a simple inexpensive construction capable of being rapidly produced in large quantities.

Still another object of the present invention is to provide an automatic door closer which is also a tool for attaching the closer to a cabinet door and which comprises a tubular member having a lightweight coil spring disposed therein and connected at one end to a pivot extending through the tubular member and connected at its other end to an eyelet-type screw such that the screw is fixedly held in one end of the tubular member enabling the tubu-

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lar member to function as a driver for the screw into the back of a cabinet door adjacent its hinged edge, the pivot being designed for connection to a horizontally extending member such as a shelf within the cabinet.

A still further object of the present invention is to provide an automatic door closer of the foregoing character wherein the pivot comprises a plastic sleeve around a pin having pointed and enlarged opposite ends, the sleeve extending diametrically through the tubular member and therebeyond to expand laterally during connection of the pin to the shelf and to thereby lock the sleeve to the tubular member such that it acts as a spacer between the shelf and the tubular member and permits the tubular member to swing in a horizontal plane on the pivot during operation of said door closer.

Still another object of the present invention is to provide an automatic door closer of the foregoing character wherein the eyelet screw is connected to the spring by a flexible wire-like member.

A still further object of the present invention is to provide an automatic door closer of the foregoing character in a cabinet with the pin extending vertically into the bottom of a shelf and the eyelet-type screw secured to the back of the cabinet door adjacent its hinged edge and slanted at an angle rearward toward the hinged edge of the door.

The foregoing as well as other objects and advantages of the present invention may be more clearly understood by reference to the following detailed description when considered with the drawing which, by way of example only, illustrates one form of the automatic door closer including the features of the present invention.

In the drawing:

FIG. 1 is a fragmentary sectional side view of a cabinet incorporating the automatic door closer of the present invention;

FIG. 2 is a fragmentary sectional bottom view taken along the line 2—2 of FIG. 1;

FIG. 3 is a sectional side view of the automatic door closer illustrated in FIG. 1 prior to installation in a cabinet;

FIG. 4 is an enlarged fragmentary sectional side view of a forward end portion of the automatic door closer illustrated in FIG. 3;

FIG. 5 is an enlarged front view of the automatic door closer illustrated in FIG. 3;

FIG. 6 is an enlarged fragmentary sectional side view of a rear portion of the automatic door closer illustrated in FIG. 3; and

FIG. 7 is an enlarged fragmentary sectional side view of a rear portion of the automatic door closer illustrated in FIG. 1 as installed in the cabinet.

In the drawing, the automatic door closer is represented generally by the numeral 10 and in FIGS. 1 and 2 is shown connected to the vertical lightweight wooden door 12 of a cabinet 14. Hinges, such as 16, connect an edge 18 of the door 12 to a front 20 of the cabinet adjacent a side 22. Within the cabinet 14, is a horizontally extending member 24, here a shelf, to which the automatic door closer 10 is also connected.

Generally speaking, the automatic door closer 10 is adapted to normally hold the door 12 gently shut against the front of the cabinet 14. As the door 12 is swung open, the automatic door closer is extended such that when the door reaches an angle of about 90° to the front of the cabinet 14, the forces acting on the door are substantially balanced. Accordingly, the door will remain open by itself at about 90° or more from its normally closed position.

To close the door 12, it is only necessary to move the door to less than about 90° from its closed position where-

upon the forces developed by the door closer 10 will automatically return the door to the closed position. Such movement of the door to a position where it will automatically close may be accomplished either by gripping and manually moving the door to an angle of less than 90° from its closed position or by momentarily exerting a light force on the door sufficient to swing it to the less than 90° angle.

In the foregoing manner, the automatic door closer 10 eliminates the need for door catches, latches, and magnetic devices commonly employed in kitchen cabinets and the like and eliminates the need for manually closing and latching shut such cabinet doors.

The automatic door closer 10, accomplishes the foregoing, with a simple, inexpensive and lightweight construction which may be rapidly installed in the cabinet 14 with a minimum of effort and using only a lightweight hammer or similar nail driving tool.

In particular, in the illustrated form the automatic door closer 10 comprises a lightweight metal tubular member 26 having open front and rear ends 28 and 30 and housing a lightweight relatively weak coil spring 32. A rear end 34 of the spring 32 is connected to a pivot 36 while a forward end 38 of the spring is connected to an eyelet-type screw 40 to normally hold the screw tightly within the forward end of the tubular member as illustrated in FIG. 3. In this regard and as shown most clearly in FIG. 4, the material forming the tubular member 26 is slightly deformable and adapted to tightly grip the looped eyelet portion of the screw 40 and to hold it in place prior to assembly of the automatic door closer 10 in the cabinet 14. As will be described hereinafter, the spring held nature of the screw 40 in the forward end of the tubular member 26 permits the tubular member to function as a driver for the screw in assembling the automatic door closer 10 in the cabinet 14.

As illustrated most clearly in FIG. 6, the pivot 36 comprises a cylindrical plastic sleeve 42 and a pin 44. The sleeve 42 extends through diametrically opposite holes 46 and 48 in the tubular member 26 adjacent its end 36 with end portions 50 and 52 of the sleeve located outside the tubular member. The pin 44 is slidably gripped by and extends axially through the plastic sleeve 42 in a vertical plane including the looped end 40b of the eyelet-type screw 40 and includes exposed pointed and enlarged head ends 54 and 56 adjacent opposite ends of the sleeve.

The tubular member 26 is adapted to swing on the pivot 36 when secured to the shelf 24. In this regard, during connection of the door closer 10 to the shelf 24, the tubular member 26 is held under the shelf and the pin 44 is driven upwardly into the bottom of the shelf. As this occurs the under surface of the shelf 24 engages the end portion 50 of the plastic sleeve 42 and the enlarged head 56 engages the end portion 52. Further driving of the pin 42 into the shelf 24 causes the head 56 to move into and expand the end portion 52 into an annular flange while the end portion 50 is compressed between the bottom of the shelf 24 and the top of the tubular member 26 also to form an annular flange (see FIG. 7). The upper annular flange acts as a spacer between the tubular member 26 and the shelf 24 and combines with the lower flange to capture the tubular member on the plastic sleeve 42 while permitting the tubular member to swing in a horizontal plane on the sleeve under the shelf.

Preferably, the forward end 38 of the spring 32 housed within the tubular member 26 is connected to the eyelet-type screw 40 by a flexible wire-like member 58. The use of the wire 58 permits the spring 32 to be shielded within the tubular member 26 at all times, even during opening and closing of door 12. Furthermore, should the door be fully opened (to an angle approaching 180°), the wire 58 is adapted to engage the front 20 of the cabinet 14 and to bend in contact with the edge thereof as the door 12 swings to the fully open position.

As previously described, the automatic door closer 10

is a self-contained tool for hand attachment to the cabinet door 12. In this regard, to attach the door closer 10 to the cabinet 14, the installer first makes a starting mark or hole for the eyelet-type screw 40 by holding the tubular member 26 flat against the underside of the shelf 24 with the point of the pin 44 substantially normal to the door. The pointed end 54 of the pin 44 is then set against and pressed into the back of the door to form the starting mark. Preferably, the mark is about $\frac{5}{16}$ to $\frac{3}{8}$ of an inch from the hinged edge 18 of the door. Next, the pin 44 is driven into the back of the door 12 to a depth of about $\frac{1}{4}$ of an inch to $\frac{1}{4}$ of an inch and removed using a lightweight hammer or similar tool. Preferably, the hole formed by the pin 44 is slanted rearwardly toward the hinged edge 18.

Using the tubular member 26 as a driver for the eyelet-type screw 40, and using the extremities of the pin 44 as driver levers for the tubular member, the threaded forward end 40a of the screw is screwed into the slanted starter hole—the turning of the screw being stopped with the pin 44 extending vertically. Thus, as illustrated most clearly in FIG. 2, the looped head 40b of the screw 40 also extends vertically and rearwardly at an angle toward the hinged edge 18 of the door 12 with the forward end of the wire 58 looped therethrough.

Next, the tubular member 26 is pulled off of the eyelet-type screw 40 and moved rearwardly into the cabinet 14 and under the shelf 24 so that the front end 28 of the tubular member is about $\frac{1}{4}$ to 1 inch back of the front edge of the shelf. The pin 44 is then driven vertically into the underside of the shelf about an inch or so from the side 22 of the cabinet 14. As the pin 44 is driven into the shelf 24, the plastic sleeve 42 is deformed as illustrated in FIGS. 1 and 7 to securely connect the tubular member 26 to the sleeve 42 thereby preventing their separation should it be desired to remove and relocate the pin within the cabinet.

It is of course appreciated that once the eyelet-type screw 40 is connected to the door 12, movement of the tubular member 26 into the cabinet 14 causes the coil spring 32 to be extended and exert a closing force on the door. The further the tubular member 26 is moved into the cabinet 14 and secured to the under side of the shelf 24, the greater the closing force normally exerted on the door 12. Likewise, the further the eyelet-type screw 40 from the hinged edge 18 of the door 12, the greater the movement developed by the spring force in closing the door (the lever arm increasing as the eyelet-type screw 40 is connected further from the hinged edge 18).

From the foregoing, it is appreciated that the automatic door closer 10 may be rapidly and simply installed in any cabinet with the screw 40 being secured to the back of the cabinet's door adjacent its hinged edge. It is also appreciated that the automatic door closer 10 acts as a self-contained tool for attachment to the cabinet.

Once the automatic door closer 10 is assembled in the cabinet 14, the coil spring 32 continuously exerts a closing force on the door 12. As the door 12 is swung open, the coil spring 32 is further extended, increasing the closing force. However, as the door 12 swings on the hinge 16, the component of the closing force normal to the door decreases until when the door is about at an angle of 90° to the front of the cabinet, the forces acting on the door are substantially balanced and the door will remain open by itself.

When it is desired to close the door 12, it is only necessary to position the door at an angle of less than 90° from its closed position where the closing forces developed by the spring exceed the other forces acting on the door. Once moved to such a position, the spring force then slowly returns and gently holds the door in the closed position thus eliminating the need for catches, latches, or magnetic devices for locking the door closed. The slow closing feature results from use of a relatively weak, lightweight coil spring 32, the tension of which decreases as the door is closed, combined with the air

drag exerted on the rear face of the door 12 as it swings shut. The result thereof is automatic closing of the door 12 without slamming.

It is to be noted from the foregoing description that during the opening and closing of the door 12, the wire 58 remains connected to the looped portion 40b of the screw 40 at a point closest to the tubular member 26. This is due to the inclined nature of the screw and prevents wandering of the wire on the looped end 40b, which wandering might otherwise occur if the screw were, for example, normal to the door 12. It is also to be noted that the coil spring 32 remains spaced slightly from the inner walls of the tubular member 26 and does not develop friction noises during opening and closing of the door.

It is a further feature of the door closer 10 that the door 12 may be opened merely by a finger flip of the door—the door then coasting to a fully opened condition. A similar finger flip is all that is required to close the door.

While a particular form of automatic door closer has been described in some detail herein, changes and modifications may be made in the illustrated form without departing from the spirit of the invention. It is therefore intended that the present invention be limited in scope only by the terms of the following claims.

I claim:

1. In a cabinet including a vertical door hinged at one edge to a side of said cabinet and a horizontal shelf, top, or bottom member in said cabinet, the combination of:

a tubular member having front and rear ends;
a pivot connected to said tubular member adjacent said rear end and extending vertically into said horizontal member such that said tubular member is adapted for swinging motion in a horizontal plane on said pivot;

longitudinally extendable spring means in said tubular member and connected at a rear end to said pivot for swinging movement with said tubular member; and

connector means secured to an inside of said door adjacent said hinged edge thereof and connected to a forward end of said spring means.

2. The combination of claim 1 wherein said pivot comprises a pin extending vertically through said tubular member and having a pointed end embedded in said horizontal member, and a sleeve around said pin with upper and lower flanged upper ends outside said tubular member for locking said sleeve to said tubular member while permitting said tubular member to swing on said sleeve, one of said flanged ends bearing against said horizontal member.

3. The combination of claim 2 wherein said pin includes an enlarged head end in the other of said flanged ends of said sleeve for locking said pin to said sleeve.

4. The combination of claim 2 wherein said connector means comprises an eyelet-type screw inclined rearwardly toward said hinged edge of said door.

5. The combination of claim 4 further including a flexible member connected to a rearwardmost portion of

the eyelet of said eyelet-type screw and to said forward end of said spring means.

6. An automatic door closer for a cabinet including a vertical door hinged at one edge to a side of said cabinet, and a horizontal member in said cabinet, said closer comprising:

a tubular member having a front and a rear end;

a deformable plastic sleeve extending through diametrically opposite holes in a rear portion of said tubular member and outwardly therebeyond;

metal pin means slidably gripped by and extending through said sleeve with ends of said pin means extending beyond said sleeve, one of said ends being pointed for piercing said horizontal member to attach said tubular member to said horizontal member such that said tubular member is free to swing on said plastic sleeve, the other of said ends being of enlarged radial dimension for compressing an adjacent end of said sleeve upon axial movement or said pin into said horizontal member during attachment of said tubular member to said horizontal member, the opposite end of said sleeve being compressed by said horizontal member to lock said sleeve to said tubular member;

coil spring means in said tubular member and connected at one end to said plastic sleeve for swinging movement with said tubular member thereon; and

an eyelet-type screw connected to a forward end of said spring means and normally held thereby snugly in said front end of said tubular member whereby said tubular member defines a driver for said eyelet-type screw into said door adjacent said hinged edge.

7. The automatic door closer of claim 6 further including a length of flexible material connected to a rearwardmost portion of the eyelet of said eyelet-type screw and to said forward end of said coil spring means in said tubular member.

8. The automatic door closer of claim 6 wherein said tubular member is formed of a slightly deformable material to tightly grip said eyelet-type screw in said front end when said tubular member is used as a driver for said screw.

9. The automatic door closer of claim 6 wherein said pin means and the ends thereof extending beyond said sleeve define driving levers for said tubular member when functioning as a driver for said eyelet-type screw.

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