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DOOR CLOSERS

Filed Dec. 24, 1959

FIG.1

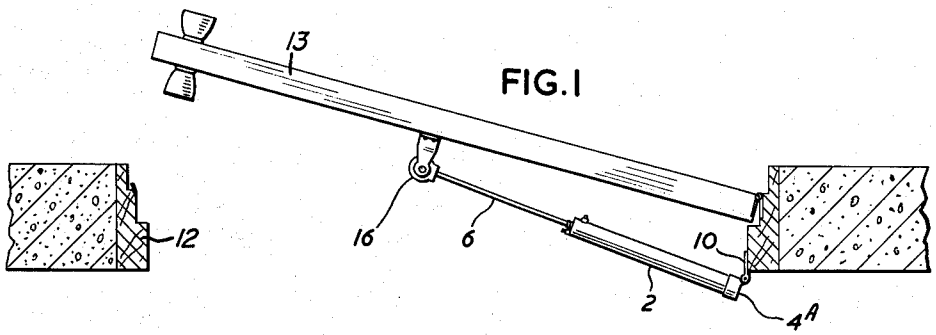


FIG.2

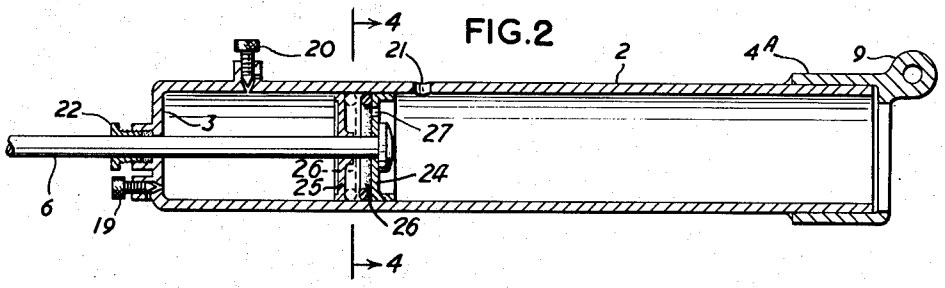
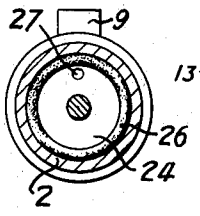


FIG.4



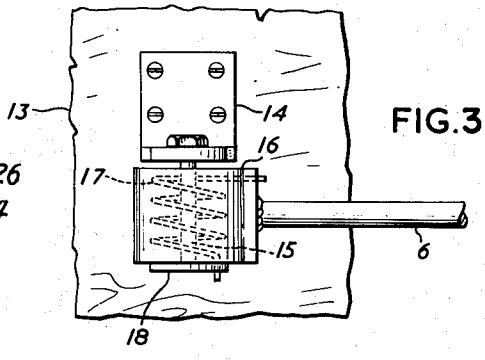


FIG.3

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DOOR CLOSERS

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Our invention relates to improvements in door actuating devices of the type generally used for automatically closing doors after they have been opened.

In general, the type of closing device over which this invention is an improvement, consists of a spring arrangement tending to swing the door closed, an air cylinder, a plunger moveable within the cylinder in synchronization with the door movement and compressing air within the cylinder as the door closes under the urge of the spring, the compressed air retarding the speed of movement of the door as it approaches the closed position, and a valve or some similar arrangement for permitting and controlling the escape of compressed air from the cylinder as the door approaches its closed position. In other words the compressed air within the cylinder provides a snub to retard the door against slamming as would occur if the door was closed by an unopposed spring.

It will therefore be quite apparent that under the action of the foregoing described type of door closer, a manually released open door, under the urge of its spring at maximum tension, will immediately swing to close at maximum speed until snubbed by the air being compressed within the cylinder, and therefore in situations where it is desired to keep the door open for even a relatively short period of time it is necessary to provide some type of manually actuated device for retaining the door in the open position and which must be manually released to permit the door to swing closed. Furthermore in this type of door closer the spring loses most of its energy when it has moved the door to the point of closure and wherein the air in the cylinder is at maximum compression. Therefore, if the escape of compressed air is not finely controlled the door either slams hard or lacks sufficient momentum to completely close and latch.

The object of our invention is therefore to overcome the before recited defects by providing a spring urged door closer having a cylinder and a door actuated plunger travelling therein, but in which the movement of the plunger creates a vacuum within the cylinder when the door is fully opened, the vacuum or suction retaining the door fully open for any desired period of time depending upon controlled entrance of air gradually reducing the suction upon the plunger which is under the pull of the door closing spring. In this arrangement the entrance of air to reduce the vacuum or suction can be controlled to hold the door fully open for a predetermined period, and thus, for example, enable a mother to have sufficient time to wheel a baby carriage through the door way before the door commences to close.

Another object of the invention is to so control the admission of air to the cylinder that in general circumstances wherein the door is not completely opened it will upon manual release immediately commence to close.

A further and important object of the invention is to permit a free flow of air into the cylinder immediately prior to the moment the door shuts and whereby the door is tightly closed and latched by the unopposed spring.

A still further object of the invention is to so control the expulsion of air from the closed end of the cylinder as the plunger moves toward such closed end upon the door being opened, that should the door be violently swung, as under the force of a high wind, air compressing in the cylinder under rapid plunger movement will,

due to its controlled expulsion, compress and provide a cushion against the door slamming open.

With the foregoing and other objects in view as shall appear our invention consists of a door closing device constructed and arranged all as hereinafter more particularly described and illustrated in the accompanying drawings, in which:

FIG. 1 is a plan view of the door closer attached to the inner face of a door which is partly open.

FIG. 2 is an enlarged longitudinal cross-sectional view through the cylinder of the door closer.

FIG. 3 is an enlarged view of a metal casing mounted upon a face of the door and housing a tensioned spiral door closing spring, and

FIG. 4 is a vertical cross-sectional view taken through the line 4—4, FIG. 2.

Like characters of reference indicate similar parts in the several views of the drawings.

Our door closer comprises a cylinder 2 open at one end and having a cylinder head 3 at its other end, and a plunger rod 6 extending through an air seal such as the stuffing box 22 in the cylinder head 3 and attached to a plunger, as shall be hereinafter described.

For mounting, the open end of the cylinder is secured within a ring 4A having a lug 9 pivotally mounted upon a bracket 10 arranged for fastening upon the door frame 12 or upon the adjacent wall. To provide the necessary spring tension for closing the door 13 we preferably use a standard type coiled spring unit such as shown in FIG. 3 and comprising an L-shaped bracket 14 attached to the face of the door and carrying a fixed depending spindle 15 upon which a casing 16 is turnably mounted. The casing contains a tensioned spiral spring 17, one end of the spring being anchored to the casing and the other end anchored to a flange 18 upon the lower end of the spindle 15. The end of the plunger rod 6 is attached to the casing 16 and whereby the spring is wound to increase its tension as the casing turns about the spindle under the swinging motion of the plunger rod and cylinder pivotally mounted upon the bracket 10 which is spaced away from the door hinge.

To provide the necessary arrangement for retaining the door open for a predetermined period and then closing the door, an adjustable air inlet needle valve 19 is mounted within the cylinder head 3 and a second adjustable needle valve 20 mounted within the cylinder wall a predetermined distance from the cylinder head. At a predetermined point intermediately of the length of the stroke of the plunger and in the vicinity of the end of its inward movement the cylinder contains an inlet air flow orifice 21. In order to retain the plunger rod 6 in alignment with the cylinder when the rod is extended, the cylinder is of greater length than the length of travel of the plunger.

The plunger comprises a pair of spaced apart rigid discs 24 and 25 freely fitting within the cylinder and mounted upon the end of the plunger rod 6, and between which is positioned an O-ring 26 of the standard type. The O-ring is formed of relatively soft rubber-like material and is of substantially the same outside diameter as the inside diameter of the cylinder 2. When the plunger is moved towards the closed end 3 of the cylinder the O-ring is pressed into the position shown in full lines and seals against the escape of air past the periphery of the disc 24, and conversely when the plunger is moved away from the closed end of the cylinder the O-ring is pressed into the position shown in dotted lines and seals against the entrance of air into the cylinder past the periphery of the disc 25. As it is necessary that air be permitted to escape at a predetermined speed as the door is manually opened moving the plunger towards the closed

end of the cylinder, the disc 24 contains an air escape orifice 27 of such a size that air has time to escape from the closed end of the cylinder past the periphery of the disc 25 and through the orifice 27 when the door is manually opened under a normal motion. If, however, the door should be violently swung upon, as by the force of a wind storm, the air in the closed end of the cylinder has not a free enough passage to be rapidly expelled under the accelerated speed of movement of the plunger, consequently the air compresses and forms a resilient snub against the door slamming open to its limit.

Operation

Opening of the door 13 causes the plunger rod 6 and cylinder 2 to swing about the bracket 10 with consequent coiling of the spiral spring 16 and movement of the plunger rod and plunger outwardly towards the sealed end of the cylinder, air escaping through the orifice 27 in the plunger. The bracket 14 is so positioned on the door, that upon the door being fully swung open the plunger is in very close proximity to the inner face of the cylinder head 3, so that upon release of the door a vacuum or greatly reduced air pressure is created between the plunger and the cylinder head as the O-ring 26 is pressed against the face of the plunger disc 25 upon retraction of the plunger. Entrance of air into the end space between the plunger and cylinder head 3 is controlled by the setting of the needle valve 19 and whereby the speed of outward movement of the plunger and consequent initial closing movement of the door is governed and over which period the door remains practically wide open. When the plunger moves outwardly a sufficient distance to uncover the needle valve 20 additional air is sucked through the valve behind the plunger thus allowing the door to accelerate in closing speed until the air inlet orifice 21 is uncovered just before the door completely closes and whereby the snub of air suction through the valves 19 and 20 is obviated and the door closed and latched under the free force of the spring. It will be apparent that any open door period and speed of closure may be obtained by adjustment of the needle valves 19 andn 20.

From the foregoing description is will be apparent that we have provided a door closer which accomplishes the objects of our invention, and while we have shown our invention in its preferred form it is to be understood that we may make any changes deemed desirable without departing from the scope of the invention as set forth in the appended claims.

What we claim as our invention is:

1. An automatic door closer, comprising in combination, a bracket for attachment to a door jamb, an elongated tubular cylinder closed at one end and open to the atmosphere at the other end and pivotally supported at its open end by the bracket, a plunger moveable within the cylinder, the face of the plunger remote from the closed end of the cylinder being constantly exposed to atmospheric pressure through the open end of the cylinder, a stuffing box in the closed end of the cylinder, a

plunger rod secured to the plunger and protruding through the stuffing box, a bracket for attachment to a door and to which the protruding end of the plunger rod is pivotally attached, a door closing spring urging the plunger away from the closed end of the cylinder, an adjustable valve controlling entrance of air into the vacuum created in the closed end of the cylinder as the plunger is withdrawn therefrom under the urging of the door closing spring, a second adjustable valve communicating with the interior of the cylinder and the atmosphere and positioned intermediately of the length of the path of travel of the plunger to permit additional air to enter the cylinder as the plunger is withdrawn past the second valve, and air flow control means within the plunger for permitting the escape of air from the portion of the cylinder between the plunger and the closed end of the cylinder as the plunger is moved towards the closed end against the resistance of the door closing spring, the plunger air flow control means permitting an air flow through the plunger in its movement towards the closed end of the cylinder and sealing against an air flow through the plunger in its movement away from the closed end of the cylinder, the plunge air flow control means comprising a pair of spaced apart discs freely fitting within the bore of the cylinder and mounted upon the plunger rod, a relatively soft rubber-like ring of substantially the same outside diameter as the inside diameter of the cylinder and positioned between the discs to alternately contact either of the opposing faces of the discs to provide an air seal between the contacted disc and the inner wall of the cylinder, the ring contacting the face of the disc remote from the closed end of the cylinder as the plunger moves towards the closed end of the cylinder and contacting the face of the disc adjacent to the closed end of the cylinder as the plunger moves away from the closed end of the cylinder, the disc remote from the closed end of the cylinder having an air escape orifice therein and through which air is expelled from the closed end of the cylinder under the movement of the plunger towards the closed end of the cylinder.

2. A door closer as defined in claim 1, wherein the orifice in the disc is of only sufficient size to permit free escape of air under normal speed of movement of the plunger towards the closed end of the cylinder when the door is manually opened but of insufficient size to permit free expulsion of air under plunger movement at a speed greater than such normal speed.

3. A door closer as defined in claim 2 wherein the cylinder contains an air inlet orifice past which the plunger moves and positioned in proximity to the extremity of the movement of the plunger away from the closed end of the cylinder.

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