April 2, 1963 L. F. MORAN ET AL 3,083,399

DOOR CLOSER

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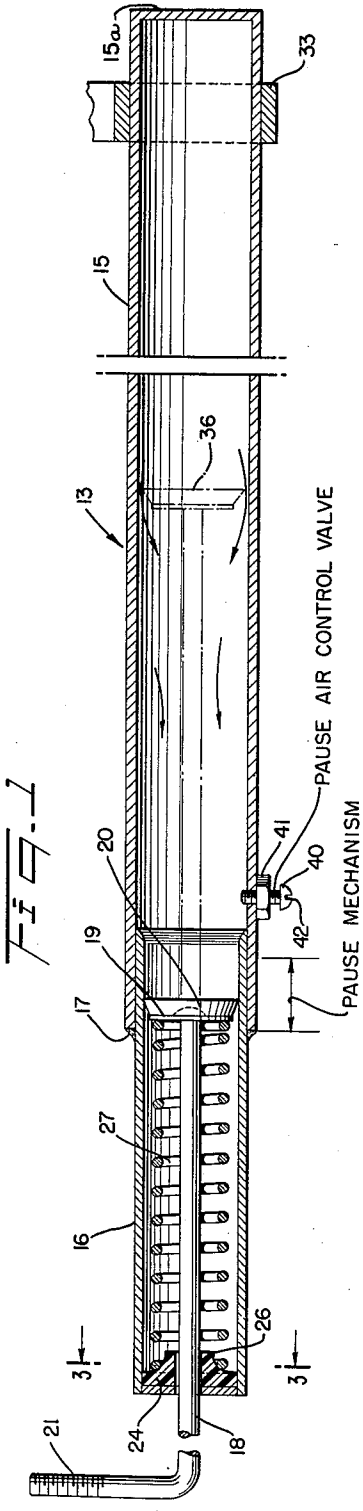

FIG. 1

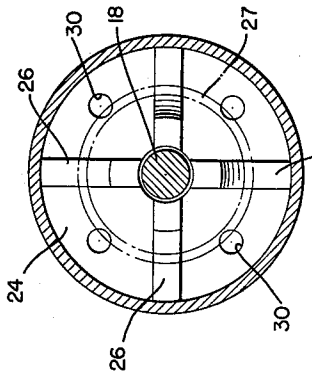

FIG. 3

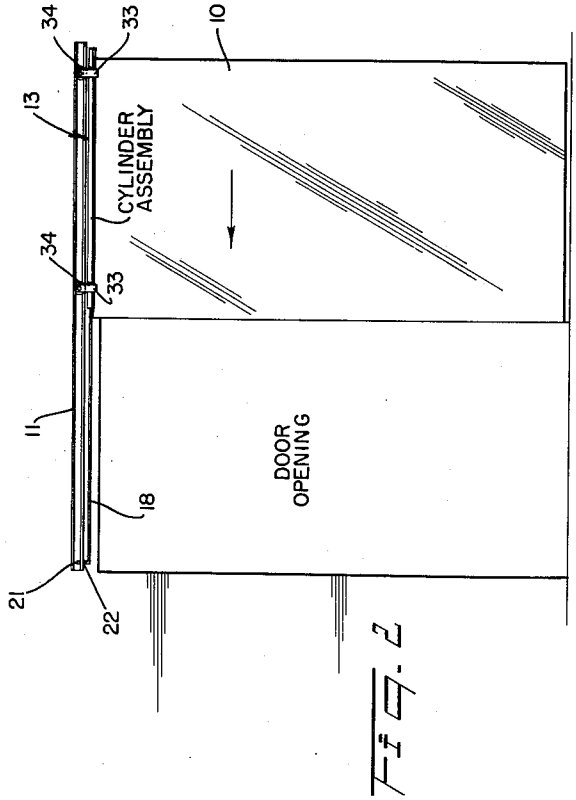

FIG. 2

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DOOR CLOSER

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This invention relates generally to door closers or closures and more particularly to door closing and checking devices by which the closing movement of the door is timed by the closure.

Door checks of the dashpot type in which the closing movement of the door is accelerated during the last portion of its closing movement to insure complete closing of the door are known. However, automatically time-delaying the closing of a door by the use of a mechanical automatic door check or closure in which a limited initial portion of the door closure movement is so controlled that the door is held substantially open and then the closure movement is accelerated during the remaining movement of the door, which constitutes substantially the full closing movement of the door, has never before been accomplished.

It is a principal object of the present invention to provide a pneumatic door closure automatically time-delaying the initial portion of the return stroke of the door closure so that subsequent to opening the door, the door remains open during a limited period or selected period of time and then is automatically firmly closed.

A feature of the mechanical automatic door closure, according to the invention, is that it functions to permit relative movement between a piston assembly and a cylinder assembly, containing the piston assembly and a compressible fluid, without compression of the fluid when the door is moved in a direction for opening the door. A mechanism is provided for automatically controlling relative movement between the piston and cylinder assemblies causing the cylinder assembly to carry out a variable pressure stroke to return the door to a fully closed position. This mechanism comprises a pause mechanism for causing the fluid pressure, during the pressure stroke, to be the greatest at the start of the pressure stroke and decrease very slowly during a limited initial portion of the stroke and subsequently decrease at an accelerated substantially constant rate thereby to automatically hold the door substantially open during a period of time corresponding to the limited initial portion of the stroke and then close it completely. The accelerated pressure decrease allows a door closing during the major portion of the closing operation.

Other features and advantages and objects of the door closure in accordance with the present invention will be better understood as described in the following specification and appended claims, in conjunction with the drawing in which:

FIG. 1 is a longitudinal sectional view of a door closer according to the invention;

FIG. 2 is a vertical view of a door provided with a door closure according to the invention and illustrates the door in an open position; and

FIG. 3 is a cross-sectional view taken along lines 3—3 of FIG. 1.

While the present invention will be described as being applicable to a sliding door, as for example, a fire-door, it will be understood that it is equally applicable to all types of applications for sliding doors such as those between a kitchen and a dining-room and is equally applicable to doors of frozen food cabinets.

According to the drawing a sliding door 10 is slidable along a track 11. The door is slidable in opposite directions in a linear path and is shown in FIG. 2 in an open position. The door 10 is provided with a door closure 13 according to the invention. For purposes of illustrating the invention the door is assumed to be a fire-door mounted for linear travel parallel to a wall, not shown, provided with a door opening. It will be understood by those skilled in the art that the door 10 can be mounted to slide into a space between the opposite sides of a wall, not shown, and the track 11 mounted in a recess above the door along with the door closure so that it is not visible.

The door closure comprises a cylinder assembly consisting of a cylinder barrel portion 15 having a closed-end 15*a* and an open opposite end to which is attached a coaxial extension 16 held in fixed position relative to the barrel portion 15, as for example, by a weld 17. The extension 16 has a lesser inner diameter than the cylinder barrel portion 15 and the interior thereof is in communication with the interior of the barrel portion 15.

A stationary piston rod 18 extends axially into the extension 16 and at one end thereof is mounted a piston assembly consisting of a piston 19 provided with a cupped packing member 20. An opposite end portion 21 of the rod 18 is bent and threaded into a fixed position in a threaded hole 22 in the track 11 so that the rod 18 is held in a fixed stationary position relative to the door.

A nylon bearing member 24 is mounted on one end of the extension 16 supporting the rod 18 to allow relative axial movement between the rod and the cylinder assembly consisting of the cylinder barrel portion 15 and extension 16. The bearing member 24 is strengthened by radial ribs 26 which provide a seat for a compression spring 27 mounted coaxial with the rod 18 and disposed between the bearing member 24 and the piston 19. The bearing member has a plurality of angularly spaced apertures 30 to provide communication between the interior of the cylinder assembly and the atmosphere.

The cylinder assembly is mounted by brackets 33 having rollers 34 for linear travel in conjunction with the door 10 along track 11 so that the door and cylinder assembly can be moved axially relative to the rod 18.

In operation the piston 19 and cupped packing member 20 are substantially in the position shown in solid lines in FIG. 1 when the door 10 is in an open condition in the manner shown in FIG. 2. In this position the compression spring 27 is housed entirely in extension 16 in a compressed state. The cupped packing member 20 is so dimensioned as to fit snugly in the extension 16 and is radially compressed inwardly so that a fluid-tight seal is formed between the marginal edge portions of the member 20 and the inner walls of the extension 16. The cupped packing member 20 is dimensioned to allow air-flow around its periphery whenever it is in the cylinder barrel portion 15 in the manner shown in its position 36 shown in dotted lines in FIG. 1.

When the door 10 is in a fully closed position the spring 27 is in a fully extended position with the piston 19 and the cupped packing member 20 disposed internally of the cylinder barrel portion 15 substantially at the closed end 15*a*. As the door is moved to the right for opening it the cylinder assembly moves with it and the spring 27 is compressed. During this door-opening movement the piston 19 and packing member 20 meet with no air resistance since air is evacuated out of the apertures 30 and air is allowed to flow around the packing member 20. When the piston 19 enters the extension 16 all of the air which is evacuated from the interior of extension 16 must move out through the apertures 30. The compressed spring 27 stores the energy put into opening the door and returns the door to a closed position as hereinafter described.

The cylinder assembly is provided with a pause air

control valve axially spaced from the extension 16 and consists of a threaded screw or member 40 mounted on the cylinder barrel portion 15. The member 40 allows air to bleed or flow slowly out of the cylinder assembly around the threads thereof. A lock nut 41 controls the extent to which the screw or member 40 is movable axially into and out of the cylinder barrel portion 15. The screw 40 is provided with a slotted head 42 for permitting easy axial adjustment. The axial adjustment of the screw 40 permits variation in the bleeding by virtue of the fit in the cylinder barrel portion since the slight taper of the threads is more or less effective in bleeding.

Once the door 10 has been opened and the piston 19 and member 20 are in the position shown in FIG. 1 the spring 27 tends to extend to cause relative movement between the cylinder assembly and the piston assembly. As the cylinder assembly moves toward the right, the piston assembly, since it is still housed in the extension 16, compresses the air in the cylinder barrel portion 15 so that the spring 27 meets resistance in the initial portion of the return stroke of the cylinder assembly. The bleeder or air control valve member 40 allows air to flow slowly out of the cylinder assembly so that the relative movement between the cylinder assembly and the piston assembly during the initial portion of the return stroke takes place very slowly so that the door is substantially held in a stationary position for a limited period of time.

As the air under pressure is evacuated from the cylinder assembly during the return stroke of the cylinder assembly the cylinder assembly moves to the right and eventually the piston assembly enters the cylinder barrel portion 15 and the air is allowed to flow around the piston assembly in the manner shown in position 36 so that the cylinder assembly then executes an accelerated closing stroke substantially throughout the full length of the closing movement of the cylinder assembly in closing the door.

It can be seen therefore that a longitudinal portion of the assembly in conjunction with the pause air control valve provides a pause mechanism so designated in FIG. 1. The door closure, according to the invention, provides a simple device usable for automatically closing doors that move along a linear path, as for example, a sliding door disposed between a dining area and a kitchen, allowing a house-wife to bring trays of food to her table without necessitating a second trip to close a standard type sliding door. Thus, the smoke, food and odors in an area of the kitchen are automatically eliminated from the dining room scene.

The invention can be applied to exterior sliding doors guarding against loss of either heat or air conditioning depending upon the application, due to someone thoughtlessly leaving a standard sliding door ajar thus effectively saving the cost of either heating or cooling air.

The door closure, according to the invention, can be installed easily on existing sliding doors as well as new ones. When the device is mounted on already existing sliding doors which travel on a track the cylinder assembly is mounted with brackets directly on the door, in the position shown, and the assembly and door travel depending from the existing track in known manner. The speed with which the door closes can be adjusted by predetermining the various parameters of the spring and the relative dimensions of the valve assembly to the inner diameters of the cylinder barrel portion.

While a preferred embodiment of the invention has been shown and described it will be understood that many modifications and changes can be made within the scope of the invention.

What we claim and desire to secure by Letters Patent is:

1. In a door closer, in combination, a cylinder assembly having a cylinder barrel portion closed at one end and a tubular coaxial extension of lesser inner diameter than the cylinder barrel portion in communication therewith, a piston rod extending coaxially into said extension and outwardly thereof, a bearing member disposed on said extension supporting said rod to allow relative axial movement between the rod and the cylinder assembly, a piston operable in said cylinder assembly connected to said rod, said bearing member having apertures providing communication between the interior of the tubular extension and the atmosphere, a compression spring disposed entirely in said tubular extension in a compressed condition when the door is substantially open and extending into said cylinder barrel portion in an extended condition when the door is closed, said spring being disposed between the piston and the bearing member for effectively automatically causing a return stroke of the cylinder assembly relative the piston for closing the door, a cupped packing member disposed on the piston, in operation said cupped packing member entering said extension when the door is substantially in a fully open position and entering the cylinder barrel portion closer in time to the start of the return stroke than the finish of said return stroke when the door is being closed, said cupped packing member fitting snugly in said tubular extension to substantially preclude air flow past it and the piston and dimensioned to allow air flow past it and the piston when the piston is disposed internally of the cylinder barrel portion, and an adjustable bleed air control valve disposed axially spaced from said tubular extension on said barrel portion for adjustably bleeding air out of the cylinder barrel portion when the cylinder assembly begins the return stroke under control of said compression spring, and said air control valve being disposed for cooperating with the spring and piston for controlling a very reduced speed of the return stroke of the cylinder barrel portion during a predetermined initial portion of the return stroke thereby to hold the door substantially open during said initial portion of the return stroke.

2. A mechanical automatic door closer for automatically closing a door movable in opposite directions along a linear path and between at least a substantially fully opened position and a fully closed position comprising, in combination, a cylinder assembly having a cylinder barrel portion closed at one end and a tubular coaxial extension of lesser inner diameter than the cylinder barrel portion in communication therewith, means for mounting the cylinder assembly for travel with the door, a stationary piston rod extending coaxially into said extension and outwardly thereof, a bearing member disposed on said extension supporting said rod to allow relative axial movement between the rod and the cylinder assembly, a piston operable in said cylinder assembly connected to said rod, said bearing member having apertures providing communication between the interior of the tubular extension and the atmosphere, a compression spring disposed entirely in said tubular extension in a compressed condition when the door is substantially open and extending into said cylinder barrel portion in an extended condition when the door is closed, said spring being disposed between the piston and the bearing member for effectively automatically causing a return stroke of the cylinder barrel portion relative the piston for closing the door, a cupped packing member disposed on the piston, in operation said cupped packing member entering said extension when the door is substantially in a fully open position and entering the cylinder barrel portion closer in time to the start of the return stroke than the finish of said return stroke when the door is being closed, said cupped packing member fitting snugly in said tubular extension to substantially preclude air flow past it and the piston and dimensioned to allow air flow past it and the piston when the piston is disposed internally of the cylinder barrel

portion, and an adjustable bleed air control valve disposed axially spaced from said tubular extension on said barrel portion for adjustably bleeding air out of the cylinder barrel portion when the cylinder assembly begins the return stroke under control of said compression spring, and said air control valve being disposed for cooperating with the spring and piston for controlling a very reduced speed of the return stroke of the cylinder barrel portion during a predetermined initial portion of the return stroke thereby to hold the door substantially open during said initial portion of the return stroke.

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