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DOOR CLOSER CONSTRUCTION

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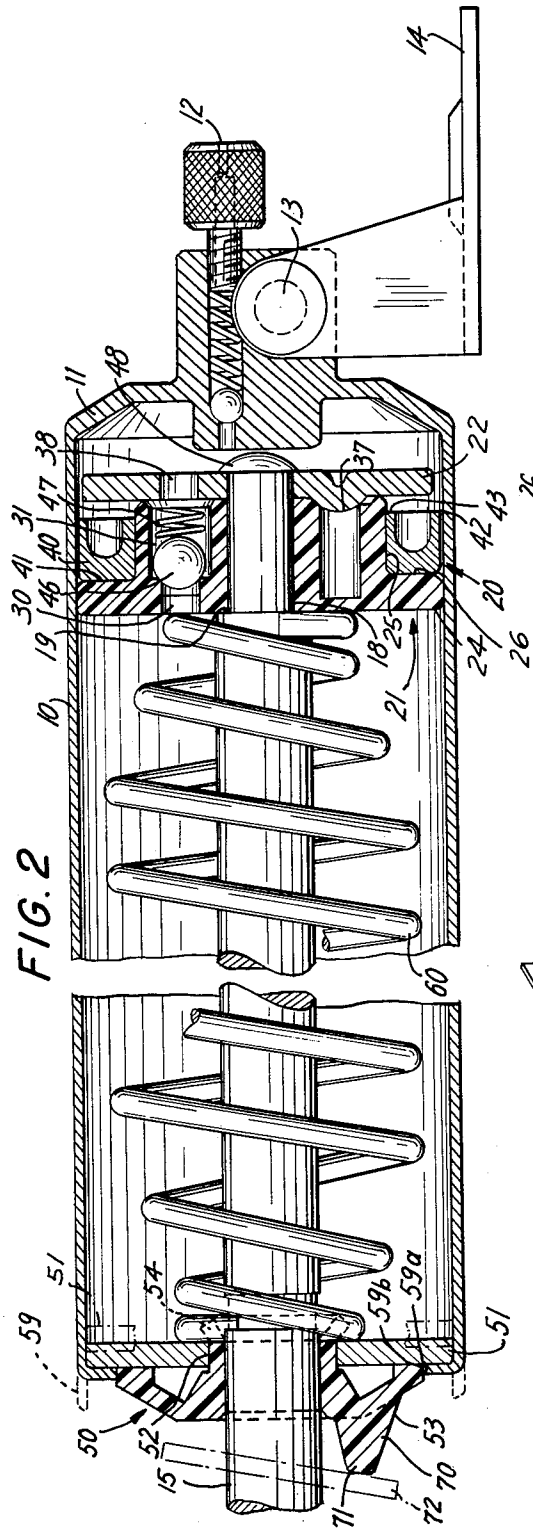


FIG. 2

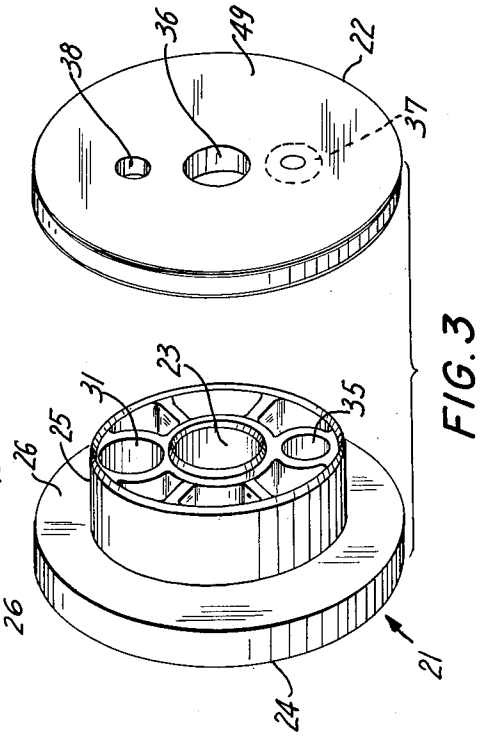


FIG. 3

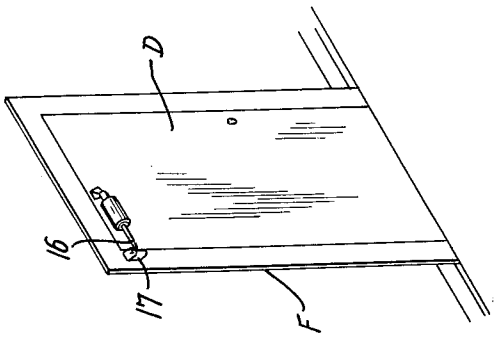


FIG. 1

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DOOR CLOSER CONSTRUCTION

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This invention relates to a door closer assembly, and more particularly to a door closer assembly comprising an air cylinder adapted to be mounted to a door and having reciprocably mounted therein a piston adapted to be operatively connected to a door frame. Upon opening of the door, a coil spring is biased between the piston and the cylinder, and when the door is released the expanding coil spring, acting through the piston and frame, causes the door to close. The closing movement of the door is dampened by providing a restricted bleed passage in the cylinder for limiting the speed with which air trapped by the piston in the cylinder during the opening of the door may be exhausted from the cylinder.

Still more particularly, this invention relates to an improved door closer and dampener assembly which may be economically produced, and to a novel method of assembling the same.

This invention further relates to an assembly of the type described having a hold open attachment which functions to maintain the door in partly open condition against the action of the closing spring, the said hold open attachment co-acting with the closer structure in a novel manner to eliminate faults encountered when similar hold open attachments are used with closer units heretofore known.

Accordingly, it is an object of this invention to provide a door closer and dampener assembly of the type previously described.

It is a further object of this invention to provide a simple but efficient assembly of the type described which may be manufactured inexpensively.

A still further object of this invention is to provide a novel, low cost door closer having highly economical methods of assembling the latter.

Still a further object of this invention is to provide a novel closer of the type described, with a hold open attachment of known type which functions, when combined with the closer, to eliminate serious problems encountered when similar hold open expedients were used with closers heretofore known.

To attain these objects and such further objects as may appear herein or be hereinafter pointed out, reference is made to the accompanying drawing, forming a part hereof, in which:

FIGURE 1 is a perspective view of an assembly in accordance with the invention as applied to a door and door frame;

FIGURE 2 is a horizontal section taken on the line 2—2 of FIGURE 1;

FIGURE 3 is an exploded pre-assembly view of elements of the piston head assembly of the door closer.

In accordance with the invention, an air cylinder **10** is provided at one cylinder head end **11** with a bleed assembly **12**. The end **11** of the cylinder **10** is pivotally secured at **13** to a bracket **14**, adapted to be mounted to the door D (see FIGURE 1). A piston rod **15**, reciprocably mounted within the cylinder **10**, is provided at its outer end **16** with a bracket **17**, adapted to be mounted to a door frame F.

The piston rod **15** is provided adjacent its inner end with a reduced cylindrical portion **18**, separated from the body of the rod **15** by an annular, forwardly directed shoulder **19**. A piston head assembly **20** is mounted against said forwardly directed shoulder **19**.

The head assembly **20** is of multi-part construction and

includes a rearward piston core member **21**, and a forward retainer washer member **22**. The piston core member **21**, which is preferably formed of molded plastic, includes an axial cylindrical aperture **23** adapted to be slid over cylindrical portion **18** of the piston rod **15**.

The core **21** includes a rearward cylindrical flange **24** having an outer diameter corresponding closely to the inner diameter of the cylinder **10**. The core **21** includes a forwardly directed, reduced cylindrical portion **25**, the forward face of the flange **24** defining a forwardly directed shoulder **26**.

The core **21** includes a longitudinal aperture **30** extending from the rear of said core, part way through the core, said aperture being joined by a larger aperture **31** extending rearwardly from the forward face of the said core.

A forwardly directed shoulder **32** is formed at the junction of the said two apertures **30**, **31**. A recess or aperture **35** extends rearwardly from the front face of the core, partially but not entirely through the said core **21**.

Retainer washer **22** is provided with a central boring **36**, of a diameter adapted to be received over the cylindrical end portion **18** of the piston rod **15**. The washer **22** is provided, in addition, with a rearwardly projecting portion **37** and a boring **38**, said projection and boring **37** and **38** being adapted, when the core and washer are sleeved over the cylindrical portion **18** of the piston rod **15**, to register, respectively, with recess **35** and aperture **31** of the said core **21**.

An annular, U-shaped gasket **40** of neoprene or the like is seated over the forward cylindrical portion **25** of the core **21**, the base **41** of said gasket in said seated position lying against the shoulder **26** of the core **21**, the branches **42**, **43** of said gasket being forwardly directed when the gasket is seated on the core as above indicated.

A ball **46** is inserted in aperture **31**, after which a coil spring **47** is inserted in said aperture behind the ball **46**.

Assembly of the piston head is completed by sleeving the washer **22** over the cylindrical portion **18** of the piston rod **15** in position whereby projection **37** enters recess **35**, in which position aperture **38** of the washer will register with aperture **31** of the bore.

With the parts thus positioned, the end **48** of the piston rod **15** may be swaged or otherwise formed outwardly against the outer face **49** of the washer **22**, thus imprisoning the ball **46** and spring **47** in aperture **31**, and securing the gasket **40** against removal in a forward direction from sylindrical portion **25** of core **21**.

An end closure cap **50** is provided by a novel assembly consisting of annular washer **51** of rigid metal conforming closely to the bore of the cylinder **10** and having a central aperture **52**, within which aperture there is secured a nylon bushing member **53**, serving the double purpose of providing a self-lubricating piston rod bearing and a yieldable spun metal edge seal. The bushing **53** is provided with an initially cylindrical neck portion **54**, which portion is passed through aperture **52** and substantially flared outwardly to the position shown in dotted lines, FIGURE 2, by striking said portion with a spreading tool, by heating and simultaneously spreading said portion or by employing other forming methods to which the cap material responds.

Assembly of the dampener is completed by passing the piston head **20** into the cylinder **10** through the open end **59** of said cylinder, said open end at this stage of assembly being in the dot and dash position shown in FIGURE 2, and the turned edges **59*a*** being shielded from view when forced against the periphery **59*b*** of the cap **50**.

Coil spring **60** is next sleeved over the piston rod **15** into position against the piston head **20**, after which the end closure cap **50** is similarly sleeved over the rod **15** and against the spring **60**. The spring **60** is maintained under compressive tension by forcing the end cap **50** to a

position within the cylinder **10**, final assembly being effected by subsequently spinning and turning the theretofore open end portions **59** of the cylinder **10** downwardly over the washer **51** as a cylindrical outlining form as well as a reinforcement, said latter operation being most conveniently carried out by spinning, raw edges being shielded from view by the cap, as previously described.

The cylinder **10** may be made of aluminum or a light metal suitable for impact casting to the form shown, and similarly suitable for spinning over the end reinforcement in the form of the washer **51**, as previously indicated.

It will be recognized that the end cap closure assembly construction herein provided makes possible and permits the use of a plastic bushing, with its inherent low friction coefficient advantages, and at the same time permits the spinning operation without reducing the diameter of the plastic bushing, by utilizing the rigidifying influences of the metallic washer member **51** as the support and reinforcement for spinning.

Similarly, the piston head provides a highly efficient air seal, as well as a ball check valve member at a minimum of cost. Moreover, the disclosed piston head assembly assures tight seal between the gasket **40** and the walls of the cylinder **10** on the forward reciprocal or compression stroke of the piston since, on such forward stroke, the outer branch **42** of the U-shaped annular gasket **40** tends to expand or be pushed against the said inner walls by the pressure developed between the piston head and the bleed end of the cylinder.

The novel structure and methods of assembly herein disclosed will tend greatly to reduce the cost of producing an efficient door closure and dampener assembly since, unlike assemblies heretofore known, the end cap closure is maintained in position wtihout resort to such expensive expedients as complemental threading between the cap and cylinder.

Upon opening the door, the piston is shifted toward the end cap **50**, air being permitted to enter end **11** of the cylinder through the passage **30**, around ball **46** and out passage **31**. The ball, in the course of the opening movement of the door, is dislodged from engagement with shoulder **32** against the pressure of spring **47**. By providing an air passage through the piston head effective on the opening stroke of the door, the inward flexing of branch **42** of gasket **40** is avoided. It will be recognized that without such passage, the gasket would be flexed inwardly when the door is opened to permit air to pass between the gasket and the inner wall of the bore, which inward flexion may result in ultimate reduction in air trapping efficiency on the return stroke of the piston.

When the opened door is released, the ball **46** is seated against shoulder **32**, preventing air passage through piston head **20**. The pressure in the end **11** of the cylinder tends to force the branch **42** into close engagement with the inner bore of the cylinder, to assure maximum dampening on the return stroke of the piston.

The gradual escape of air through adjustable bleed means **12** slows the closing movement of the door. The bleed means **12** is fully described in U.S. Patent No. 2,940,111 and functions as the piston head **20** shifts toward the end **11** of the cylinder during the closing of the door, to permit the gradual escape therethrough of air entrapped between the piston head **20** and the end **11**. While the bleed means **12** includes a spring seated ball interposed in the bleed passage, it will be understood that any known door closer bleed means may be employed, the invention herein not being restricted for use with or relating to any particular form of bleed.

As previously noted, the closure cap **50** is seated against turned ends **59***a* of the cylinder **10** by the action of the closer spring **60**, and it will be readily recognized that the cap **50** would be free to move to a position within the bore of the cylinder but for the aforesaid seating action of the spring. The cap construction thus is different from closer units heretofore known wherein the cap is either formed integrally with, or is non-movably secured to the end of the air cylinder, as by complemental threading or the like.

This distinction is important where the closer is provided with a hold open assembly which may be optionally engaged to maintain the door to which the closer is applied in open condition against the closing action of the closer spring.

Such hold open assemblies conventionally take the form of a lug, such as the lug **70**, affixed to the end cap and having a rounded, rearwardly directed nose **71**. A washer, such as the washer **72**, is sleeved over the piston rod with slight clearance. When it is desired to maintain the door in open or partially open condition, the door is first opened to the desired position and the washer is then slid along the piston rod into engagement with the nose of the end cap lug. The door may then be released, and the closer spring forces the lug eccentrically against the washer, tilting the latter and wedging the same against the rod to hold the door.

In conventional closer structures having such hold open units, an additional closing force applied to the door when the hold open mechanism is engaged, may result in slippage of the washer, bending of the hold washer, distortion or unseating of the closer support brackets, or even bending of the piston rod. Such additional closing forces may result from an attempt to close the door without releasing the washer, from accidental pressure applied to the door, or even from a strong gust of wind directed against the door.

The conventional hold back unit in combination with the novel closer assembly herein described and illustrated may be used without fear of damage occasioned by the application of a door closing force to the unit when the same is set in hold open position. The improved operation is due to the ability of the end cap **50** to shift to a position within the cylinder (as shown in dot and dash lines, FIGURE 2) when such force is applied.

Thus, while an additional closing force might damage a conventional closer assembly, the application of such a force to the assembly herein described would merely cause a slight inward movement of the piston and cap **50** as a unit further into the cylinder and no damage to the components could result. This movement would be buffered by the air remaining between the piston head **20** and the bleed end of the cylinder.

The closer is moved to the door release position in the conventional manner by opening the door slightly and at the same time sliding the washer **72** away from the cap **50**. The door may then be released and will be closed by the spring **60**, as previously described.

Having thus described the invention and illustrated its use, what is claimed as new and is desired to be secured by Letters Patent is:

1. A door closer assembly or the like comprising a cylinder having bleed valve means at one end, a centrally apertured closure member at the other end and a coil compression spring member within said cylinder having one end bearing against said closure member, a piston assembly contacting the other end of said spring and urged thereby toward said end of said cylinder having said bleed means comprising a cylindrical piston rod member having its outer end extending through said closure member and having a reduced cylindrical portion at its inner end section forming an annular shoulder at the junction of said section and said rod member, a piston core having an axial boring sleeved over said inner end section of said piston rod member with the portions of said core surrounding said boring seated against said shoulder, said core including a cylindrical rearward portion of a diameter providing a sliding fit with the inner periphery of said cylinder and a forward cylindrical portion of reduced diameter with respect to said rearward portion, a longitudinal passage being formed through said core, a valve seat formed in said passage, a flexible

annular gasket member seated on said forward portion of said core, said gasket having an inner diameter corresponding to the diameter of said forward portion of said core and an outer diameter corresponding to the inner diameter of said cylinder, a ball valve member loosely positioned in said longitudinal passage of said core forwardly of said valve seat, and a retainer washer carried by said inner end of said piston rod and seated against the inner face of said core, said retainer washer having an aperture aligned with said passage in said core and being of greater diameter than the diameter of said forward portion of said core.

2. A closer assembly in accordance with claim 1 wherein said gasket is U-shaped in cross section and said legs of said U are directed toward said bleed end of said cylinder.

3. A door closer assembly or the like comprising a cylinder having bleed valve means at one end, a centrally apertured closure member at the other end and a coil spring member within said cylinder having one end bearing against said closure member, a piston assembly contacting the other end of said spring and urged thereby toward said end of said cylinder having said bleed means, comprising a cylindrical piston rod member having its outer end extending through said closure member and having a reduced cylindrical portion at its inner end forming an annular shoulder at the junction of said inner end section and said rod member, a molded plastic piston core having an axial boring sleeved over said inner end section of said piston rod member, with the portions of said core surrounding said boring seated against said shoulder, said core including a cylindrical rearward portion of a diameter providing a sliding fit with the inner periphery of said cylinder, and a forward cylindrical portion of reduced diameter with respect to said rearward portion, a longitudinal passage being formed through said core, a valve seat formed in said passage, a recess formed in the inner face of said core in angularly spaced relation to said passage of said core, a flexible annular gasket member seated on said forward cylindrical portion of said core, said gasket having an outer diameter corresponding to the inner diameter of said cylinder, a ball loosely positioned in said longitudinal passage of said core forwardly of said valve seat, and a retainer washer carried by said inner end of said piston rod and seated against the inner face of said core, said washer having a projection portion extending into said recess of said core and an aperture aligned with said passage in said core and being of a diameter greater than the inner diameter of said gasket member.

4. A closer assembly in accordance with claim 3 wherein said aperture of said washer is of smaller diameter than the diameter of the adjacent portion of said passage, and a valve spring is interposed in said passage between said ball and said washer.

5. A door closer and damper assembly comprising a cylinder having bleed means at one end, and an end cap at the other end, said end cap being slidable within the bore of said cylinder, blocking means on said other end of said cylinder for retaining said cap in said bore, a piston rod slidably mounted in said cylinder with portions of said rod slidably extending through an aperture of said cap, a piston head on the inner end of said rod, compression spring means interposed between said cap and said head to bias said cap against said blocking means and said head toward said one end of said cylinder, a hold open portion on said cap, and hold open means slidably mounted on said rod to be shiftable into engagement with said hold open portion to secure said rod against relative movement with respect to said cap.

6. A door closer assembly comprising a cylinder, a piston head slidably mounted in said cylinder, air bleed means in one end of said cylinder, an inturned flange at the other end of said cylinder, an end cap having a central bushing slidably positioned within said cylinder adjacent said flange, a piston rod having one end secured to said piston head and the other end extending through said bushing of said cap, compression spring means biased between said cap and said head, urging said head to a limiting position adjacent said bleed end of said cylinder and forcing said cap against said flange, a lug extending rearwardly from said cap and positioned eccentrically with respect to the axis of said rod and a washer slidably carried by said rod and shiftable into engagement with said lug temporarily to secure said rod against relative movement with respect to said cap.

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