Oct. 23, 1962 F. V. McHALE 3,059,268

DOOR CLOSER

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FIG. 1

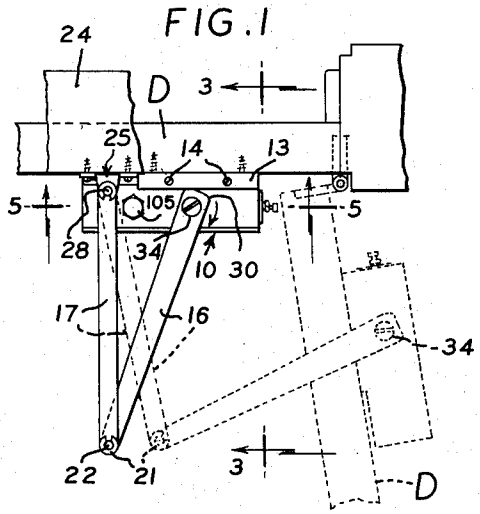
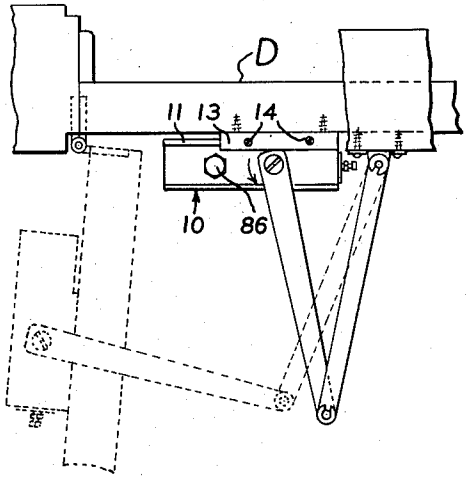


FIG. 2



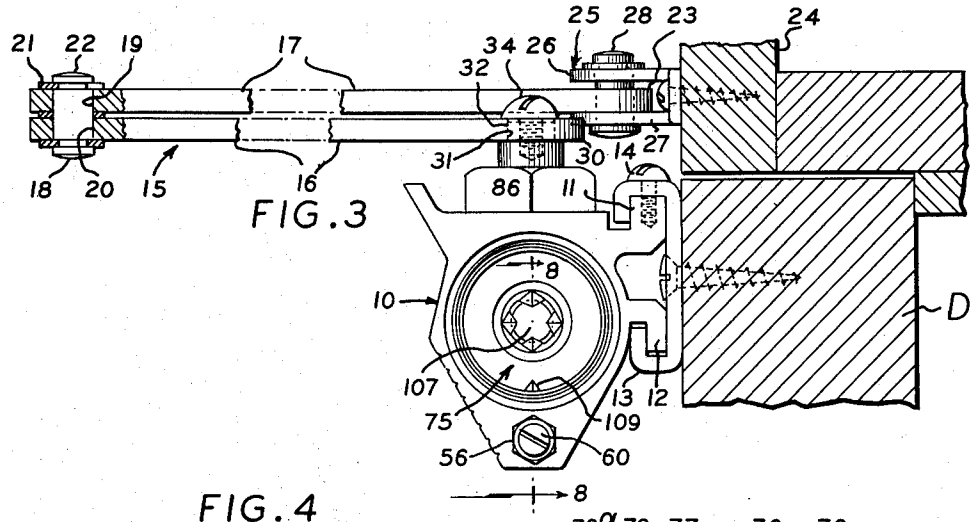
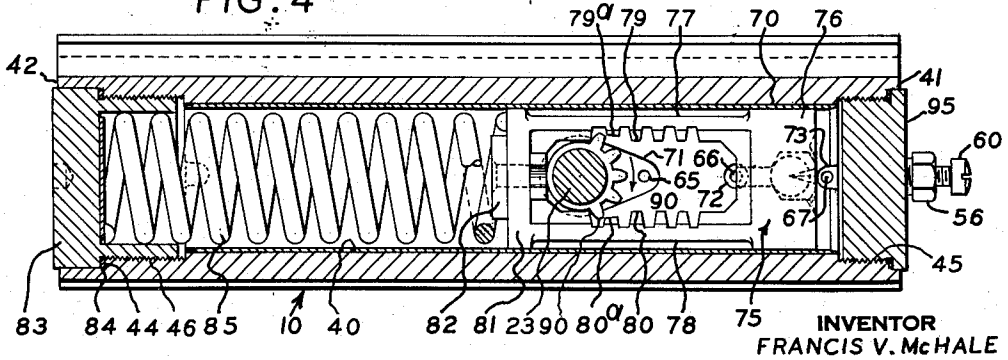


FIG. 3

FIG. 4



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FIG. 5

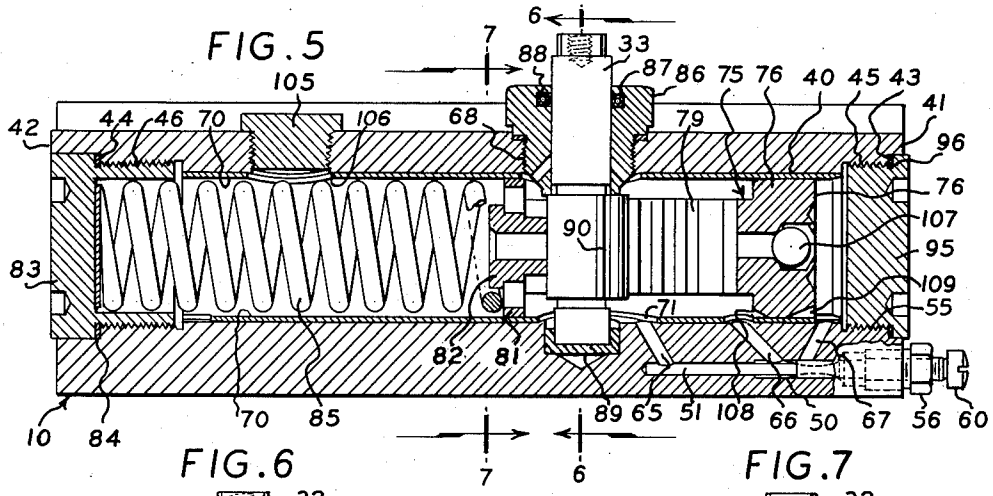


FIG. 6

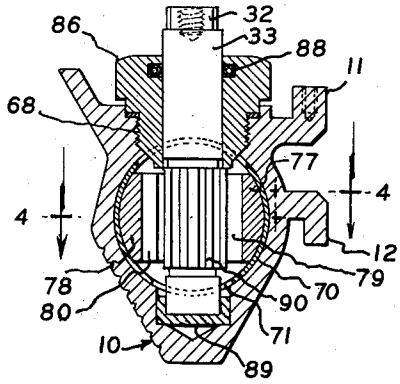


FIG. 7

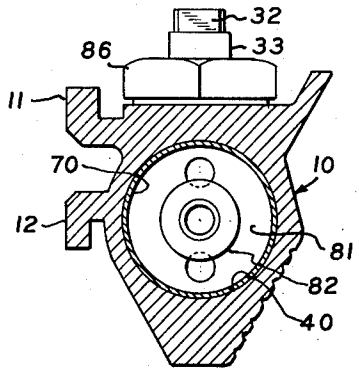
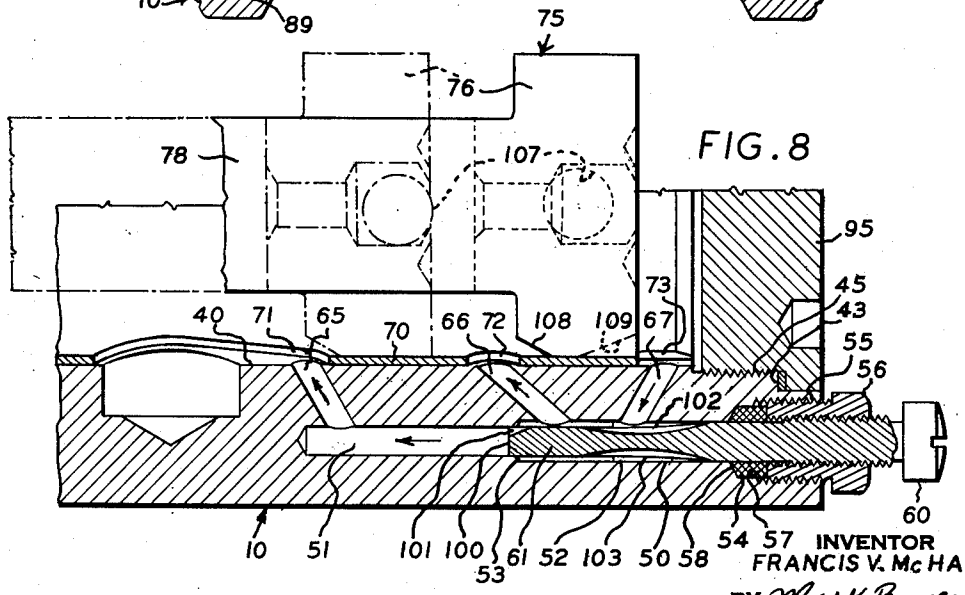


FIG. 8



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DOOR CLOSER

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2 Claims. (Cl. 16—62)

This invention relates to a door closer mechanism and more particularly to a door check and closer of the hydraulic type wherein a piston traveling in a cylinder bore biases a closer spring contained in the device upon opening of the door and dampens the closing action of the spring when the open door is released by hydraulic dampener means.

This invention still more particularly relates to a door closer device of the type described having a novel construction whereby use of relatively soft, poor bearing materials may be employed for the body or casing of the device, without sacrifice of the wearing properties or smooth operation required of such devices.

In hydraulic door closer devices of the type heretofore described, the use of aluminum or like relatively poor bearing metals has been avoided by reason of the excessive wear and other undesirable factors encountered when such metals are attempted to be used for door closers. Similarly, the cost of hydraulic door closers has, in the past, been relatively high, due in part to the extreme accuracy with which hydraulic by-pass and control ports must be located with respect to the internal bore of the hydraulic cylinder and to the difficulty of forming such precisely located ports internally of the said cylinder where accurate machining, such as drilling, is obviously difficult.

An understanding of the general operation of door closer and dampener devices will readily illustrate the difficulty of internal drilling operations so as to be able to use an extrusion, and the importance of providing such drilling with a degree of accuracy generally consistent with economical production.

The dampener assembly comprises generally a body portion having a cylindrical bore, an opening cut transversely of said bore to support a pinion shaft and bearing therefor and a secondary by-pass passage generally paralleling the cylindrical bore longitudinally displaced from and diametrically opposed to the pinion and bearing orifice. The diametric opposition of such passage to the orifice is dictated by the necessity for forming drill holes in the interior of the bore, joining the secondary passage by introducing drilling apparatus through the limited access provided by the orifice. It will be readily understood, accordingly, that the use of linearly acting drilling means through the orifice to form the side passages between the bore and the secondary passage will result in a restriction of the spacing of the orifices formed between the boring and the side passage by reason of the limited access of space through the pinion orifice.

Such side passages and particularly the precise point of junction of such side passages with the interior boring are critical factors in determining the operation of the closer mechanism.

As more fully set forth hereinafter, the criticality of such locations is engendered by the fact that the releasing speeds and final latching surge of the closing door are desirably effected at certain given points in the closing cycle of the door, and, as will be readily understood, variation in placement of the discharge points of the side passages in the magnitude of a sixteenth of an inch can result in variation in the release position of the door in the magnitude of several inches.

Accordingly, it is an object of my invention to provide a door closer and dampener assembly whereby the by-pass discharge ports are located with great precision within the bore of the assembly.

A further object of this invention is to provide a dampener assembly as heretofore described which may be made of aluminum alloy, magnesium alloy or like poor bearing but attractive appearing metals which may be made of extruded stock and effect economies in machine operations without loss of efficiency.

It is a further object of this invention to provide a dampener assembly wherein the discharge ports within the bore may be located with great precision, without necessitating the use of expensive drilling jigs or the like.

Still a further object of this invention is to provide a dampener assembly of the type described having internal discharge points effectively located at positions beyond those which may be reached by normal drilling operations conducted through the pinion orifice.

Still a further object of this invention is to provide a dampener assembly in a door closer of the type described wherein the side passages joining the boring to the secondary or by-pass passage may be provided with discharge ports which exit into the internal boring at points heretofore considered to be inaccessible to normal drilling operations.

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

FIGURES 1 and 2 are diagrammatic plan views of the general assembly of my invention applied, respectively, to the left hand opening and right hand opening doors;

FIGURE 3 is a side elevational view taken in the direction of the arrows 3—3 of FIGURE 1, in magnified condition and with a sealing cap of the body member omitted;

FIGURE 4 is a section taken on the lines 4—4 of FIGURE 6;

FIGURE 5 is a magnified section taken on the lines 5—5 of FIGURE 1;

FIGURE 6 is a section taken on the lines 6—6 of FIGURE 5;

FIGURE 7 is a section taken on the lines 7—7 of FIGURE 5;

FIGURE 8 is a greatly magnified section taken on the lines 8—8 of FIGURE 3.

Referring now to the drawings, in the diagrammatic FIGURES 1 and 2 the device is illustrated as applied to a door and door frame, the door, FIGURE 1, being a left hand swinging door and that of FIGURE 2 a right hand swinging door. The device comprises a body member **10** which may, in accordance with my invention, be made of aluminum or the like. The body is provided with longitudinally extending flanges **11** and **12**, which are slidable within the bracket **13**. The bracket is affixed to the door member D as by screws and is provided, in addition, with a pair of bolt members **14**, extending through the bracket **13** and tapped into the upper flange **11**, to prevent relative longitudinal movement of the body portion **10** and the bracket **13**.

Relative movement of the door to the door frame is imparted to the door closer mechanism by a linkage **15** which comprises a pair of link members **16**, **17**, pivotally joined at one end by a trunnion piece **18** which passes through apertures **19** and **20** of the arms **17** and **16**, respectively, and is retained thereon by a spring washer **21** which is engaged under the headed part **22** of the trunnion piece **18**. The end **23** of the link **17** is secured to the door jamb or frame **24** by a bracket **25**, screwed to the said frame, which bracket in turn is provided with legs **26**, **27**, within which the link end **23** is positioned and held by trunnion pin **28**, which pivotally secures the link **17** between the legs **26**, **27**.

The end **30** of the link **16** is provided with a generally

squared aperture 31, which is positioned over the squared end 32 of trunnion or pinion shaft 33 and maintained in such seated relationship by the headed bolt 34, which is threaded into the end of the pinion shaft 33.

The body 10, which may comprise a casting or a section of an extrusion, is provided with a longitudinally extending bore 40. The ends 41, 42 of the body 10 are formed with enlarged annular shoulder portions 43, 44, respectively, and threaded portions 45, 46 adjacent such annular shoulders.

As best seen in FIGURE 8, a secondary or by-pass bore 50, generally parallel to the longitudinal bore 40, is formed in the end 41 of the body 10. Such by-pass bore or passage 50 comprises borings of three graduated diameters, to wit, narrow inner boring 51 separated from the wider boring 52 by a shoulder 53 and end boring 54, internally threaded at 55 adjacent its outermost portion. A threaded plug 56 is engaged with threads 55 of the boring 54 and is tightened within said threaded portion 55 to compress a gland packing 57 against shoulder part 58 which divides the boring 54 from the smaller diametered boring 52.

A threaded metering pin 60 is adjustably secured within the cap plug 56 and is provided with an extended stem portion 61 which may be moved axially of the boring 50 by rotation of the said pin 60.

The by-pass passage 50 is joined by a plurality of side passages 65, 66, 67, for purposes which will appear hereinafter. The passages 65, 66 are formed or drilled in the body 10 by means of a drill or like tool extended through the aperture 68, which aperture subsequently forms the bearing support for the pinion shaft 33. The side passage 67 is similarly formed by drilling through the open end 41 of the body portion.

It will be readily recognized that the spacing of the ports 65, 66 as well as the location along the boring of such ports is dictated of necessity by the size of the aperture 68, an understanding of the positional limitations of such passages being necessary to a full understanding of applicant's contribution.

As best seen in FIGURE 8, the passage 65 joins the secondary or by-pass passage 50 at the narrowest boring part 51. The side passage 66 joins the wider boring part 52, preferably adjacent the annular shoulder part 53.

A liner member 70, of steel or some other wear-resistant metal or anti-frictional material, of tubular configuration, is snugly positioned within the boring 40, the outer diameter of the liner 70 being substantially identical to the dimensions of the boring, enabling the liner to be shrink-fit or otherwise positively frictionally secured in predetermined position within the boring. The liner 70 is provided with apertures 71, 72, 73, cut from the walls of the said liner and adapted in the fit position within the boring, to overlie the openings onto said boring of the passages 65, 66, 67, respectively. The openings 71, 72, 73, are, as indicated, of a size in excess of the size of the port openings 65, 66, 67 and are precisely positioned with respect to the liner 70 so that when the liner 70 is inserted into the boring in the desired position in said boring, the positions of the openings 71, 72, 73 will have supplanted entrance of the passages 65, 66, 67 as the effective position of the ports in the interior boring of the closer.

A piston 75, having a head 76 slidable in intimate contact within the liner 70, is provided with side pieces 77, 78, having inwardly directed rack faces 79, 80, respectively. A rear saddle part 81 spans the side pieces 77, 78 and is provided with a rearwardly extending boss 82 (see FIGURE 4). The end 42 is provided with a capping member 83 which may be threaded within the portion 46, sandwiching a gasket 84 against the shoulder 44 of the body 10, thus providing a sealing fit at the end 42. A coil spring 85 is biased between the end or saddle part 81, surrounding the boss 82 and seated in the cap 83, thereby normally forcing the piston 75 toward the right hand end of the body portion as viewed in FIGURES 4 and 5.

Into the orifice 68 there is threaded a packing gland 86 carrying, in an annular recess 87, a packing ring 88. Pinion shaft 33 is supported in the gland 86, a bearing cup 89 being formed in the body 10 diametrically opposed to the gland part 86, to form a lower support for the pinion shaft 33. A truncated pinion gear 90 is keyed to or integral with the shaft 33 to engage one or the other of the rack faces 79, 80, depending upon the direction of rotation of the link 16, the initial tooth of the racks 79, 80 being beveled or cut away, as shown at 79*a* or 80*a*, to permit such alternate rotation.

The end 41 of the body 10 is similarly provided with a sealing cap 95, threaded to mate with the portion 45 and to force the gasket member 96 against the shoulder 43 to provide a seal at the end 41.

Control of the closing speed of the door and a final latching impetus is provided by adjustment of the stem 60. This stem, which may be adjusted forwardly or rearwardly within the by-pass passage 50, is provided at its forwardmost end 100 with a small, V-shaped cutout part 101, which part coacts with the annular shoulder 53 to limit flow through the narrowest portion 51 of the by-pass passage 50, it being readily understood that advancing the stem 60 into closer proximity with the shoulder 53 will tend to limit the flow, and retracting the part 100 away from the shoulder 53 will augment the flow through the passage.

The stem member 60 is provided, in addition, with an opposed pair of linearly extending grooves 102, 103. When the stem 60 is turned so that the groove 102 or 103 is aligned with the passage 67, maximum flow through the bore part 52 is permitted, it being understood that when the part 60 is rotated so that the groove 102 or 103 is only partially in registry, flow is decreased through the said bore part.

The bore portion, prior to operation, is filled with oil or like hydraulic fluid through a plug member 105 threaded into the body portion 10 and aperture 106 formed in the liner 70 to lie in registry with the said plug.

With the assembly mounted on a door, as shown in FIGURES 1 and 2, opening of the door will cause the piston member 75 to be moved rearwardly or to the left, as seen in FIGURES 5 and 8, such movement of the piston being effected irrespective of the direction of rotation of the pinion shaft 33 by reason of the truncated gear and beveled toothed rack mechanism previously described. A ball check valve 107 formed in the piston head 76 permits withdrawal of the piston 75 and biasing of the spring 85 without appreciable resistance from the flow of hydraulic fluid through the piston head. The rearward and forward portions 108, 109, respectively, of the piston head 76 are beveled or chamfered, as seen in FIGURE 5, so that blockage of the passage 65 in the rearward position and of the passage 67 in the forward position of the piston will not occur.

The rearmost position of the piston head 76 in the bore is shown in dot and dash lines, FIGURE 8, it being apparent from inspection of such figure that a smooth, free flow clearance between the bevel 108 and the passage 65 through the aperture 71 is provided so that there will be no tendency of the piston member 75 to stick or remain in such rearward position, as would be the case if the passage 65 were blocked by the piston head at such position.

When the door is released, the spring 85 urges the rearwardly positioned piston 75 toward the closed or right hand position in the bore 40. The initial forward movement of the piston 75 causes the ball check valve 107 to close, effectively dividing the bore into two chambers, one to each side of the piston head 76. Further movement of the head 76 toward the end 41 may be accomplished only by forcing fluid trapped between the head and

such end through the restricted passages **66**, **67** and past the limiting flow point defined by the shoulder **53** and the groove **101** in the end **100** of the stem **60**. Such forward movement is normally quite slow and prevents sudden slamming or return of the door under the influence of the spring **85**, the speed of closing being controlled, as previously indicated, by rotation of the stem **60**.

As it is desirable to increase the speed of door closing as the door comes close to latched position, the passage **66** is provided. When the cutout or bevel **108** is in registry with, or forward of, the aperture **72** in the liner, fluid trapped between the piston head **76** and the end **41** is permitted, in addition to the prior mentioned route, to pass through the passage **67**, through the limiting grooves **102** or **103**, and rearwardly to the chamber behind the piston **76**, through the passage **66**. As the access provided by groove **102** or **103** is considerably greater than the access provided to the passage port **51** between the shoulder **53** and the bevel **101**, considerable acceleration of the door is encountered at such point. It will be readily recognized that the point during the closing cycle of the door at which latching acceleration is permitted is extremely critical since early release would result in premature and dangerous slamming of the door and release too late during the closing cycle would not permit sufficient speed for latching.

Due to the criticality in positioning of the effective point of discharge of the passage **66** to the interior of the liner **70** and to the difficulty of forming the passage **66** with the requisite accuracy by reason of the limiting access provided through the aperture **68**, the applicant has discovered the desirability of forming such passage **66** roughly positioned in the body **10** and accurately locating the effective port or point of discharge of such passage by means of sleeving the liner **70** into the interior of the bore. Since the aperture **72** in the liner **70** is formed prior to insertion of such liner in the bore and since accurate alignment of the liner **70** with respect to the bore is relatively easily accomplished, the necessity for accurate drilling of passage **66** is obviated, without compromising the quality of the door closer assembly.

While the instant application has illustrated the novel port extending and locating effect of providing a liner having a substantial thickness, with an extended aperture adapted to register with an end thrust or latching side passage in a door closer, it should be understood that the spirit of my invention encompasses the use of such duct extending aperture in connection with other discharge ports in door closers, regardless of the function of such discharge ports.

It will be readily recognized from the foregoing description that great economies in manufacture may be effected by dispensing with precision machining and drilling where such drilling is difficult to effect, and substituting a precision drilled casing or liner which may be formed exteriorly of the finished product without undue difficulty.

Likewise it will be understood that by extending the size of the apertures in the liner **70**, the side passages may be effectively ducted to or discharged at the interior of the bore of a door closer in positions which would be entirely inaccessible if an attempt were made to form the same through the limited drilling access provided in such door closer assemblies.

Having thus described my invention and illustrated its use, what I claim as new and desire to secure by Letters Patent, is:

1. A dampener assembly comprising a body portion adapted to be mounted to a door and having a longitudinal boring, a by-pass, secondary passage of restricted diameter paralleling said boring and a plurality of side passages communicating with said secondary passage and opening at spaced points into said boring, a tubular liner member slidable endwise into intimately fitted position within said boring having walls defining a plurality of apertures, each adapted to register with one of said spaced points and to extend longitudinally beyond said points a predetermined distance from the end of said body portion, a spring biased piston member reciprocable in and intimately engaging the inner periphery of said liner, and connector means linking said piston to the frame of said door for relatively moving said piston and body portion in accordance with the relative movement of said door and said frame.

2. A door closer device comprising a casing member adapted to be secured to a door, said casing member including walls defining a cylindrical bore, a secondary passage by-passing portions of said bore and a plurality of side passages communicating said secondary passage with said bore and opening into said bore at discharge points longitudinally spaced along said bore, a tubular liner member adapted to be intimately received in said bore, said liner member including spaced cutout portions, each adapted to register with one of said discharge points and to extend for an area around said points effectively to communicate said points with said bore, a piston member having a head portion intimately fitting and slidable within said liner member to divide the latter into forward and rearward chambers and having rear and forward cutoff bevel means, connector means for moving said piston head to forward and rearward limiting positions of the stroke of the piston head in said liner in accordance with the relative movement of a door and door frame, one of said cutout portions being positioned in the liner to communicate with and extend rearwardly of said rear cutoff bevel means at the forward and rearward limiting positions of said piston head and another of said cutout portions being positioned in the liner to communicate with and extend forwardly of said forward cutoff bevel means at the forward and rearward limiting positions of said piston head whereby a side passage is communicated with said bore, both forwardly and rearwardly of said piston head at all positions of the piston, adjustable flow limit means interposed in said secondary passage, and spring means interposed between said piston and said casing adapted to bias said piston toward said forward limiting position.

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