

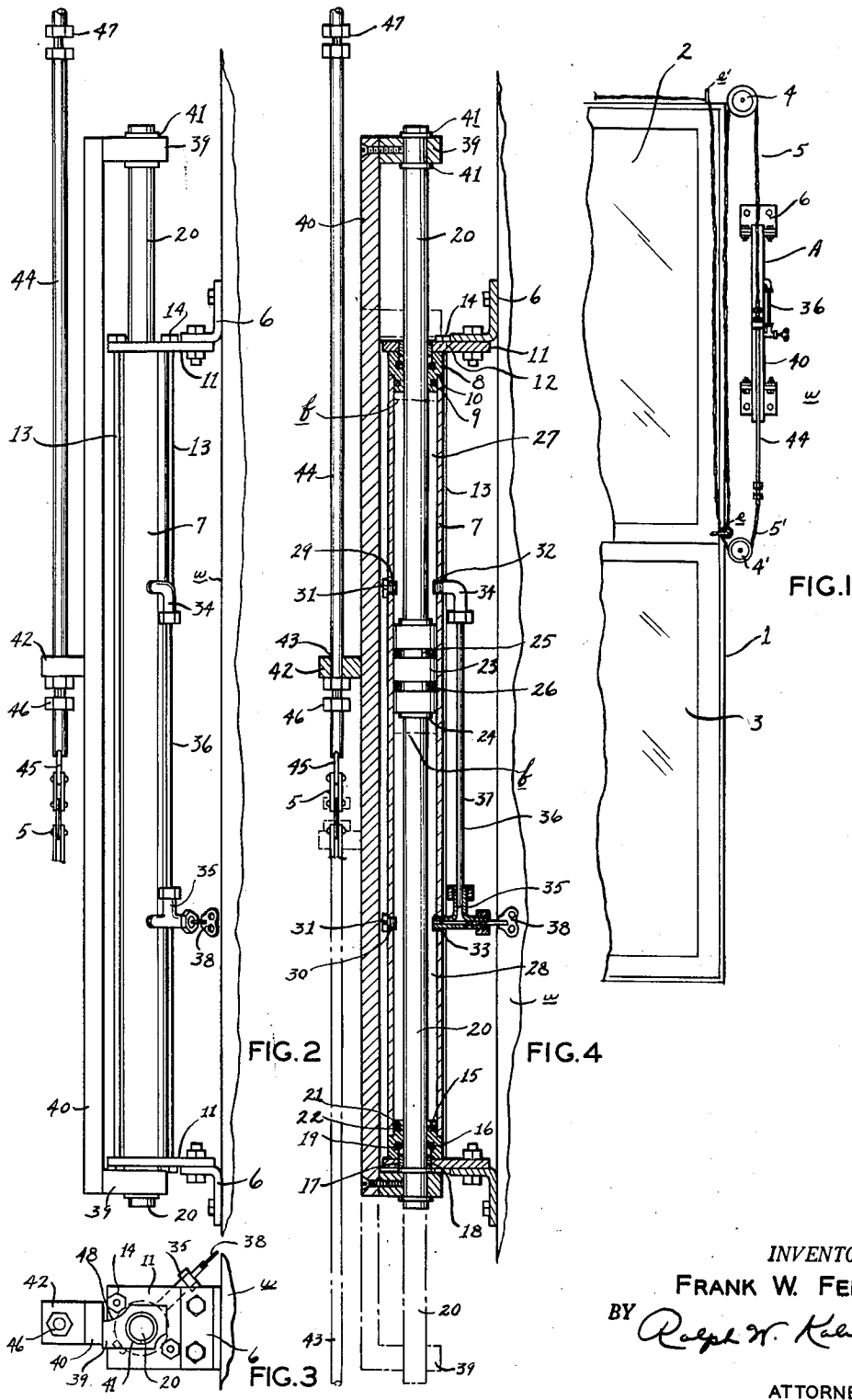
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DOOR SNUBBER

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DOOR SNUBBER

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This invention relates in general to doors and, more particularly, to a fluid-actuated snubber therefor.

With door constructions comprising companion members slidable toward and away from each other, such as may be commonly found in factories and other industrial establishments, there is the problem of damping the movement of such members during opening and closing operation to avoid damaging shock. Door members of this type are ordinarily of substantial size and weight, and, consequently, develop considerable momentum during movement so that without braking means a strong impact would occur upon the meeting of the confronting marginal portions on closing. Repetition of such impact can rapidly lead to misalignment and breakdown with the entailing of frequently performed and costly maintenance. Similarly, the opposite margins of such door members would forcibly contact the door frames and adjacent portions during opening operation with equally damaging results.

Therefore, it is a primary object of the present invention to provide a door snubber adapted to reduce the rate of travel to zero of cooperating door members as the same arrive at the limits of closed and opened position whereby damaging impact between same as well as with door frame members is effectively prevented.

It is a further object of the present invention to provide a door snubber which may be readily installed for use in existing door constructions and may be equally effectively utilized with doors having vertically slidable or horizontally slidable cooperating members.

It is an additional object of the present invention to provide a door snubber which is fluid-activated and has a simplicity of parts; is reliable and durable in operation; is economically manufactured; and does not require costly maintenance.

These and other detailed objects are obtained by the structure illustrated in the accompanying drawing in which:

Figure 1 is a fragmentary view of a door construction having an operating mechanism incorporating a snubber constructed in accordance with and embodying the present invention;

Figure 2 is an enlarged side view of the door snubber;

Figure 3 is an end view; and

Figure 4 is a longitudinal vertical sectional view of the door snubber.

Referring now to the drawing which illustrates the preferred embodiment of the present invention, 1 generally designates a door frame within which are suitably mounted upper and lower door panels 2, 3, vertically slidable toward and away from each other for closing and opening operation, respectively, and mutually counterweighting each other. Provided on a wall surface *w* adjacent door frame 1 is a pulley and chain type door operating mechanism which will be described more fully hereinafter. Fixedly positioned, as by securement to angle brackets 6 upon wall *w* is a door snubber indicated

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at A for integration with the door operating mechanism and which incorporates a cylindrical housing member 7 having at each end a cap 8 diametrically reduced on its inner portion 9 to form a shoulder 10 against which the ends of cylinder 7 snugly abut. Presented against the outer end face of each cap 8 is a rectangular retaining plate 11 for attachment of cylinder 7 to brackets 6. Plates 11 are bolted to brackets 6 and contain aligned openings 12 for transverse extension therebetween of tie rods 13 upon the extending ends of which are engaged nuts 14 whereby retaining plates 11, end caps 8, and cylinder 7 are maintained in assembled, unit-forming relationship.

Each end cap is provided with an axial bore 15 and is counter-bored to form a recess 16 in the outer face thereof for receiving a bushing 17 which extends through an aligned aperture 18 in plates 11. Seated against the base of each recess 16 is a gasket 19 of the O-ring type for sealing engagement with a piston rod 20 which extends through cylinder 7 and end caps 8 for slidable movement therein, and projects at its ends therebeyond. The inner portion of each end cap 8 is peripherally grooved as at 21 for receiving a static O-ring 22 which tightly abuts against the adjacent portion of the inner wall of cylinder 7. Substantially intermediate its length, piston rod 20 carries a head element or piston 23 maintained in position upon rod 20 by snap rings 24 and having spaced peripheral grooves 25 within which are disposed resilient members 26 for forming a fluid-tight fit with the inner wall of cylinder 7. Piston 23 divides the interior of cylinder 7 into chambers 27, 28. Tapped in the wall of cylinder 7 for respectively opening into chambers 27, 28, are apertures 29, 30, through which fluid, whose upper level in each chamber 27 and 28 is indicated at *f*, is introduced into, and withdrawn from, housing 7; said apertures 29, 30, being closable by plugs 31. Also tapped in the wall of cylinder 7 respectively diametrically opposite apertures 29, 30, are openings 32, 33, for respectively threadedly engaging an elbow fitting 34 and a T fitting 35 of a restrictor assembly 36 having a conduit 37, axially parallel to cylinder 7 connecting said fittings 34, 35. Adjustably mounted in the outwardly extending arm of T fitting 35 is a control valve or cock 38 for regulating the fluid flow through restrictor 36 which thus provides communication between chambers 27, 28.

At its opposite ends, piston rod 20 is snugly received within suitable openings formed in relatively short mounting arms 39 secured, as by screws at each end of an elongated support bar 40, said arms 39 being normal to said bar 40 whereby rod 20 is axially parallel thereto. Snap rings 41 are engaged about piston rod 20 adjacent the inner and outer face of each arm 39 to prevent unauthorized displacement of said rod 20. On the outwardly presented face of support bar 40, intermediate its ends, there is fixed, as by welding, a projecting lug 42 having an opening 43 for slidable extension therethrough of a rod 44. Said rod 44 is incorporated within a pair of cables or chains 5, 5' of the door operating mechanism for movement therewith by the connection between eyelets 45 provided at each of its ends and cables 5, 5'. Adjacent each of its ends, bar 40 mounts abutment members 46, 47, of any suitable construction, such as double lock nuts of the wedge type including a split ring element, for engagement with lug 42 for purposes described hereinafter.

Referring now to Figure 1, it will be noted that the particular door-operating assembly herein set forth for purposes of illustrating the operation of door snubber A comprise the cables 5, 5', with the former being connected to the normally upper end of snubber rod 44 and being trained about a pulley 4 mounted on the wall sur-

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face *w* adjacent the upper corner of door panel 2 when the latter is in closed position; from pulley 4 cable 5 is led downwardly for fixed engagement to an eyelet *e* secured upon door panel 2 in the lateral face thereof adjacent its bottom edge. Secured to the normally lower end of snubber rod 44 is one end of cable 5' which is led downwardly for training about a pulley 4' mounted on wall surface *w* in alignment with pulley 4 and substantially proximate the line of meeting of door panels 2, 3 when in closed position. From pulley 4' cable 5' is led upwardly through eyelet *e* and thence is continued upwardly and then directed through eyelet *e'* for direction laterally along a line parallel to the upper edge of door panel 2; said eyelet *e'* being located above door panel 2. Said cable 5' is suitably directed by guide means such as eyelets (not shown) for securement at its other end to the lower door panel 3 on its side margin opposite from the side of the door upon which eyelet *e* is secured, with the point of securement being preferably adjacent the bottom edge of door panel 3.

The operation of snubber A is as follows: Assuming that the door is closed, and its panels 2, 3 and snubber A are in the position shown in Figure 1, if it is desired to open the door, the operator will actuate the door operating mechanism whereupon as door panels 2, 3 move away from each other cable 5' will be caused to exert a downward pull upon snubber rod 44. Since rod 44 is slidable through opening 43 of lug 42, the same will move freely of snubber A until abutment member 47 engages the confronting face of lug 42; continued travel in the same direction will effect joint movement of support bar 40 and rod 44 with consequent downward sliding movement of piston rod 20 within cylinder 7. Piston 23 will then move against the pressure of fluid *f* in chamber 28 and force the fluid to flow through restrictor 36 and, hence, into chamber 27, which will be perforce enlarged with corresponding volume-reduction of chamber 28. Piston 23 will arrive at the lower limit of its stroke when the end plate 11 at the upper end of cylinder 7 abuts against the adjacent mounting arm 39. It is to be noted that the stroke of piston 23 terminates short of the openings 29, 32. To prevent untoward interference, mounting arms 39 are provided with cut away portions 48 into which tie rod nuts 14 may move.

Similarly, during door closing operation, rod 44 will slide upwardly freely through lug 42 until abutment member 46 engages said lug whereupon support bar 40 and piston 20 will move with rod 44 upwardly as a unit. The engagement of end plate 11 at the lower end of housing 7 and the confronting mounting arm 39 will determine the limit of travel in that direction, at which point door members 2, 3, will be restored to fully closed position (Figure 1).

In order that door members 2, 3, may be effectively slowed or braked to prevent violent impact, snubber A is designed to institute the retarding action when door members 2, 3, have reached a predetermined distance from the approaching limit of travel whereby over the remaining distance deceleration will be caused to result in a zero velocity of doors 2, 3, at the moment of arrival at the limit of travel. To bring this about, abutment members 46, 47, are adjustably positioned upon bar 40 so that the joint travel of rod 44, bar 40 and piston 23 will be over the predetermined distance, such as, for example, five inches, and, consequently, piston 23 will have a stroke equivalent to the preselected decelerating distance.

Valve member 38 is appropriately set to control the rate of flow of fluid *f* through restrictor 36 under the force of piston 23 so that sufficient resistance to said piston is caused to produce the requisite retarding or braking action. Thus, by means of restrictor 36, a marked range of deceleration is possible, from the extreme of substantially non-braking action wherein re-

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strictor 36 is in full open position to immediate jarring stoppage when restrictor 36 is closed. Consequently, any desired setting of snubber A for the particular door in question may be easily and reliably made.

It is apparent that snubber A may be readily utilized for doors consisting of but a single slidable panel and for doors wherein the sliding member or members are adapted to travel horizontally. In such case, snubber A may be disposed horizontally in which position it will operate with equal maximum effectiveness. Furthermore, snubber A can be incorporated in existing door structures without costly modification.

The details of construction can be varied without departing from the spirit of the invention and the exclusive use of those modifications coming within the scope of the claims contemplated.

What is claimed is:

1. In a door snubber, in combination with a shiftable member movable in opposite directions responsive to movement of a door between its closed and open limits of travel, a fluid-containing housing, a piston having a piston rod disposed in said housing for axial reciprocation, said piston rod projecting at its ends beyond the ends of said housing, and an elongated intermediate member engaging said piston rod at its projecting end portions and being operably engageable with said shiftable member when the door reaches a predetermined distance from either limit whereby consequent thereto said piston rod and shiftable member will move jointly with the piston until said intermediate member abuts the housing and thereby decelerate and limit the movement of the door toward either travel limit.

2. In a door snubber, in combination with a shiftable member movable in opposite directions responsive to travel of a door between its closed and open limits of travel, a fluid-containing housing, a piston rod extending through said housing and projecting at its ends therebeyond for axial reciprocation, a piston carried on said piston rod between the ends thereof and within said housing, and an elongated intermediate member located externally of said housing disposed in axial parallel relation to said piston rod and having axially perpendicular mounting arms at its ends for fixed engagement with said projecting ends of said piston rod whereby said piston rod and intermediate member are jointly movable, said intermediate member being operably engageable with said shiftable member when the door reaches a predetermined distance from either travel limit whereby the stroke of said piston rod is equivalent to said predetermined distance, and whereby the end of said stroke is determined by abutment of a mounting arm of said intermediate member against the adjacent end of the housing.

3. In a door snubber, in combination with a shiftable member movable in opposite directions responsive to travel of a door between its open and closed limits of travel, a fluid-containing housing, a piston rod extending through said housing with its ends projecting therebeyond for axially reciprocal movement along a path substantially parallel to that of said shiftable member, a piston carried by said piston rod between its ends and within said housing for operation on its opposite end faces against the fluid in said housing, said piston dividing the interior of the housing into a pair of chambers, a restrictor unit for controllable fluid transfer between said chambers under pressure of the piston during operation thereof, and an elongated intermediate member externally of said housing and fixed to said piston rod for movement therewith and being operably engageable with said shiftable member when the door reaches a predetermined distance from either travel limit whereby the stroke of said piston rod is equivalent to said predetermined distance and limited by abutment of said intermediate member with said housing.

4. In a door snubber, in combination with a shiftable

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member movable in opposite directions responsive to travel of a door between its open and closed limits of travel, a fluid-containing housing having end walls, a piston rod extending through said housing and projecting at its ends beyond the end walls thereof for axially reciprocal movement along a path substantially parallel to that of the shiftable member, a piston carried by said piston rod intermediate its ends and within the housing for operation on its opposite end faces against the fluid contained in said housing, a support bar located outside the housing in parallel relation to the piston rod, axially perpendicular mounting arms secured to said support bar at opposite ends thereof, said piston rod being fixedly engaged at its projecting ends to said mounting arms whereby the support bar is movable with said piston rod, and means for operably connecting said shiftable member and support bar when the door reaches a predetermined distance from either travel limit whereby consequent thereto said shiftable member, support bar, and piston rod will jointly move as a unit with the stroke of said piston rod being equivalent to said predetermined distance, the stroke of said piston being terminated by abutment of a mounting arm against the proximate end wall of the housing.

5. In a door snubber as described in claim 4 wherein the means operably connecting said shiftable member and support bar are cooperative abutment members mounted on said shiftable member and support bar.

6. In a door snubber, in combination with a shiftable member movable in opposite directions responsive to travel of a door between its open and closed limits of travel, a fluid-containing housing having end walls, a piston rod extending through said housing with its ends projecting beyond the end walls thereof for axially reciprocal movement along a path substantially parallel to that of said shiftable member, a piston carried by said piston rod

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substantially intermediate its length for operation on its opposite end faces against the fluid in said housing, an elongated support bar located outside said housing in axial parallel relation to said piston rod and being provided at its ends with axially perpendicular mounting arms which are fixedly engaged to said piston rod at the projecting ends thereof for movement therewith, a lug mounted on said support bar and having an opening, said shiftable member extending freely through said opening for relative movement with respect to said support bar, and abutment members carried on said shiftable member adjacent each of its ends for abutment with said lug when the door reaches a predetermined distance from either travel limit whereby consequent thereto said shiftable member, support bar, and piston rod will move jointly, with the stroke of said piston rod being equivalent to said predetermined distance, and the termination of the stroke being determined by abutment of a support bar mounting arm against the adjacent end wall of the housing, said piston rod being of such length that said piston will be spacedly disposed from the ends of said housing at the end of the piston stroke.

7. In a door snubber as described in claim 6 wherein the piston divides the interior of the housing into a pair of chambers, conduit means located between the ends of said housing connecting said chambers for fluid transfer therebetween responsive to the pressure exerted by said piston during movement, and control means for regulating the rate of flow through said conduit means whereby the rate of deceleration of the door may be preselected.

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