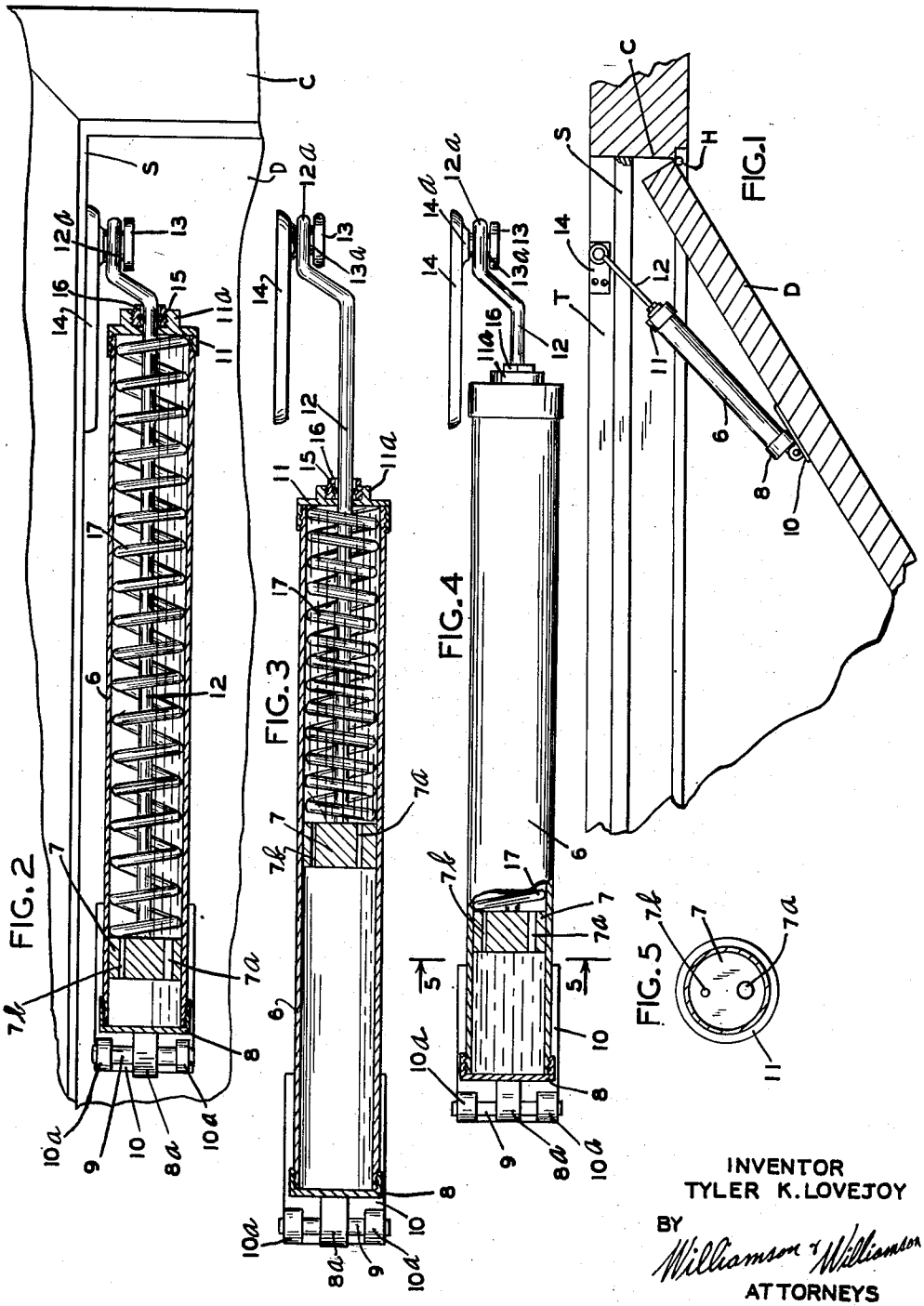
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DOOR CHECK AND CLOSER

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DOOR CHECK AND CLOSER

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This invention relates to mechanism for checking and cushioning the opening of a swinging door, as well as for returning the door to a closed and latched position.

In conventional door closing and checking mechanism whether of the hydraulic or spring cushioning type, material resistance is encountered in the initial opening movements of the door as well as in the initial return swinging of the door from open to closed position, causing undue effort to be expended in opening the door and requiring a considerable time interval for closing and latching of the door.

It is an object of my invention to provide a simple and highly efficient door check and closer which may be readily applied to conventional swinging doors and which enables the door to be initially swung through a considerable arc with a minimum of effort while effectively cushioning the last portion of the swinging movement and which materially decreases the time interval for automatically closing the swinging door.

Another object is the provision of a door checking and closing mechanism of the class described wherein through the combination of a pressure equalizing communication air passage in the upper portion of a piston with a hydraulic principle operative essentially during only certain portions of the opening and closing cycle the desirable and valuable results heretofore enumerated are accomplished.

More specifically, it is an object to provide in an efficient inexpensive mechanism of the class described an elongated cylinder constructed for disposition in horizontal position and interposed between a portion of a swinging door and the doorway and having mounted therein a piston with its piston rod extending longitudinally through the cylinder and connected at its outer end with one of the essential elements of the door and doorway and wherein the piston is actuated by an internally mounted coil spring for closing the door and is provided with a pair of communication ports, one disposed near the lower portion of the cylinder for passage of hydraulic fluid and the other disposed above the normal level of the hydraulic fluid in the cylinder and of smaller diameter for equalization of pressure and for cushioning effect during portions of the cycle of operation of the device.

These and other objects and advantages of the invention will more fully appear from the following description made in connection with the accompanying drawing, wherein like reference characters refer to the same or similar parts throughout the drawing, and in which

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Fig. 1 is a fragmentary horizontal section looking upwardly showing a conventional swinging door and doorway with an embodiment of my invention operatively applied and with the door shown in partially open postion;

Fig. 2 is a view mostly in vertical section taken axially through an embodiment of my invention applied to the top of the doorway and to a swinging door with the door shown in closed position;

Fig. 3 is a similar view with my structure, however, detached from the doorway, showing the relationship of the working parts of my device when the door has been swung to an approximately full open position;

Fig. 4 is a similar view showing the parts of my structure related as they will appear when the door is approaching closed position; and

Fig. 5 is a cross section taken on the line 5—5 of Fig. 4.

In the embodiment illustrated, my structure is applied to a conventional doorway comprising the upright column C to which the swinging door D is hinged by conventional hinges H. The doorway includes the usual door stops S and top plate T to which one end of my door checking and closing mechanism is pivotally connected as will later be more clearly described.

My improved mechanism includes an elongated rigid cylinder 6 constructed of suitable, preferably non-corrosive metal having a smooth inner bore for accommodating and having sealed relation with a piston 7. The piston 7 in my device is provided with a hydraulic fluid port 7a adjacent the bottom portion of the cylinder and with a much smaller air communication passage 7b disposed well above the normal hydraulic fluid level within the cylinder and positioned adjacent the top of the interior of the cylinder. While the relationship of the diameters of passages 7a and 7b may vary considerably in accordance with particular requirements, I prefer to utilize a hydraulic port 7a of at least four times the diameter of the air communication passage 7b.

One end of cylinder 6 as shown is closed by a suitable closure cap 8 which may have threaded and sealed connection with an externally threaded end of cylinder 6 and which as shown rigidly carries an outwardly extending hinge lug 8a vertically drilled for accommodation of a hinge pintle 9 which is carried by and accommodated as shown in a pair of vertically aligned lugs 10a carried by an attachment bracket 10 which may be secured to an appropriate portion of one face of the door removed some distance from the hinge H. The pintle 9 is constructed preferably by a pin fixed to the lug 8a on the cap 8 to cause the cylinder to

be centrally disposed between the two lugs 10*a* in operation. At the opposite end of the cylinder a closure cap 11 is provided as shown threadedly engaging the external threads provided on the right hand end of the cylinder, as shown in Fig. 2, and this closure cap is centrally apertured to receive an axial piston rod 12 and is provided with a packing gland which may utilize a conventional O-ring for making a sealed joint between the closure cap and piston rod.

The piston rod 12 is secured at its inner end to the piston 7 and extends for some distance beyond the cylinder 6 and, as shown, is offset at its outer end to provide a pivot attachment eye or loop 12*a* which is pivotally connected by a threaded pivot post 13 with a top attachment bracket 14 secured to the top plate or timber of the doorway. The bracket 14, as shown, constitutes a heavy flat plate having an internally threaded boss portion 14*a* in which is threaded the upper end of the pivoting post 13. The pivot post has an enlarged retaining knob 13*a* at its lower end which confines and retains the loop 12*a* at the outer end of the piston rod 12. It will further be noted that since the eye or loop 12*a* is confined by the pivot post 13 for swinging movement thereon on a vertical axis and since the opposite end of cylinder 6 is retained in a predetermined position against rotation on its axis, that piston 7 will at all times, when my device is installed, maintain its upstanding relation illustrated in the drawings with the small air port 7*b* disposed uppermost and with the larger hydraulic fluid passage 7*a* being disposed adjacent the bottom of the cylinder. It will, of course, be understood that any suitable means for preventing relative oscillation of the piston and cylinder may be employed.

At the outer end of the closure cap 11 for the cylinder, I provide a suitable packing gland to prevent leakage of hydraulic fluid and air outwardly of the cylinder, and in the form shown this gland comprises a removable plug member 15 having screw-threaded attachment with a boss 11*a* on the cap and carrying, as shown, in a shallow annular groove at its interior a conventional O-ring 16 which forms an efficient seal between the packing gland and outer portion of the piston rod 12.

A coil spring 17 of suitable strength to close the door is interposed within the cylinder 12 between the piston 7 and the right hand end of the cylinder, as shown in the drawing, this spring surrounding the piston rod 12.

In operation, my device is interposed or mounted between the top plate of the doorway and the inner face of the door D, as shown, the plate or bracket 14 being fixed by screws or other means to the top plate, with the pivot pin 13 depending therefrom and disposed a few inches away from the hinge pillar or column C of the doorway. The attachment bracket 10 carrying the hinge pintles for the opposite end of the cylinder is vertically attached to the inner face of the swinging door at a distance properly spaced toward the free edge of the door, the attachment being such that upon closing of the door the outer end of piston rod 12 is disposed preferably two or three inches beyond the adjacent closed end of the cylinder. My structure necessarily comprehends the partial filling of the cylinder 6 with suitable hydraulic fluid, preferably to less than the half-way point, when the piston 7 is disposed as shown in Fig. 2. Thus, in operation the hydraulic fluid passage 7*a* is always immersed in liquid in the cylinder, while through portions of the cycle of operation the air communication port 7*b* is disposed above the level of the hydraulic fluid.

Upon the initial opening of the door from the relative positioning of the parts shown in Fig. 2, pressures at both sides of the piston 7 are equalized through communication of the port 7*b* and only a relatively small exertion is required to swing the door through from one-fourth to one-half of its opening movement, sufficient exertion, of course, to overcome the resistance of coil spring 17. In the initial movement of the piston from the position shown in Fig. 2 to a position substantially half-way between initial position and the position of the piston shown in Fig. 3, the hydraulic fluid to the right of the piston is for the most part moved to the right without requiring substantial passage thereof through the liquid port 7*a*, the liquid, of course, gradually increasing in its level within the right hand portion of the cylinder until at a predetermined point in operation the liquid is dammed up to an extent where it covers the air communication port 7*b*. Thereafter, a substantial checking action is provided requiring passage of the hydraulic liquid mainly through the port 7*a*. This, of course, means that in the final swinging action of the door to open position, resistance and checking is encountered, while in the initial and substantial portion of the opening movement of the door the resistance is only slight, dependent upon compression of spring 17 and air check means through passage of air through the air port 7*b*.

When the door is released from full open position, the spring 17, of course, urges the piston 7 back to normal retracted position, and since the level of hydraulic fluid in the left hand side of the piston, as shown in Fig. 3, is then relatively low, the first portion of the door closing movement is fairly rapid and comparatively unrestricted. Thereafter, as the liquid accumulates in the left hand portion of the cylinder 6 to the point where it covers the air communication port 7*b*, checking and resistance is encountered and the last portion of the closing movement is therefore very efficiently checked through hydraulic means with positive elimination of shock and slamming of the door.

From the foregoing description it will be seen that I have provided an extremely simple but highly efficient door check and door closer embodied in an extremely simple mechanism which combines in the cycle of opening and closing a door the combination of hydraulic cushioning and checking means at the points where checking is necessary, while offering little resistance to swinging of the door in either direction through considerable portions of the cycle.

It will, of course, be understood that various changes may be made in the form, details, arrangement, and proportions of the various parts without departure from the scope of the present invention, which, generally stated, consists in the matter shown, and described, and set forth in the appended claims.

What I claim is:

1. A door check and closer comprising a cylinder adapted for application to a swinging door and a doorway in horizontal position, means connected with one end of said cylinder for attachment of said cylinder to permit swinging movement thereof on a vertical axis, a piston slidably mounted in said cylinder and having

sealed contact with the inner peripheral wall thereof, an actuating coil spring interposed between said piston and one end of said cylinder, and a piston rod connected with said piston and extending through one end of said cylinder and having at its outer end means for connection to provide for swinging of said cylinder and rod on a vertical axis and for preventing circumferential oscillation of said piston relative to said cylinder during swinging of the latter, said piston having an hydraulic port therethrough adjacent the bottom of said cylinder and having a substantially smaller, constantly open air port therethrough adjacent the top of the said cylinder.

2. A door check and closer comprising a cylinder adapted for application to a swinging door and a doorway in horizontal position, means connected with one end of said cylinder for attachment of said cylinder to permit swinging movement thereof on a vertical axis, a piston slidably mounted in said cylinder having sealed contact with the inner peripheral wall thereof and having means for preventing circumferential oscillation of said piston relative to said cylinder during swinging of the latter, means for urging said piston to door closing position, and a piston rod connected with said piston and extending longitudinally through said cylinder and having at its outer end an element for pivotal connection to provide for swinging of said rod and cylinder on a vertical axis, said cylinder containing a hydraulic fluid to an average level less than one-half of its diameter, said piston having a small port therethrough adjacent its upper peripheral edge disposed well above the average level of said fluid and having a substantially larger, constantly open hydraulic port therethrough adjacent the bottom of said cylinder and disposed below the average fluid level in said cylinder, the cooperation of said ports and level of fluid in sadi cylinder causing little resistance to be offered to initial opening of the door or to initial closing of the door from open position while offering substantially greater resistance in the later opening and closing movements through damming up of fluid behind the moving piston.

3. A door check and closer comprising a cylinder adapted for application to a swinging door and a doorway in horizontal position, means connected with one end of said cylinder for attachment of said cylinder to permit swinging movement thereof on a vertical axis, a piston slidably mounted in said cylinder having sealed contact with the inner peripheral wall thereof and mounted to prevent oscillation of said piston in its sliding movement, means for urging said piston to door closing position, and a piston rod connected with said piston and extending longitudinally through said cylinder and having at its outer end an element for pivotal connection to provide for swinging of said rod and cylinder on a vertical axis, said cylinder containing a hydraulic fluid to an average level less than one-half of its diameter, said piston having a constantly open, small port therethrough adjacent the upper edge of said piston and adjacent the top of said cylinder disposed well above the average level of said fluid and said piston having a large, constantly open hydraulic port therethrough adjacent the bottom of said cylinder and disposed below the average fluid level in said cylinder, said ports being open constantly through all operations of said piston whereby upon initial opening of the door or initial closing of the door from open position, little resistance to movement is occasioned by said hydraulic fluid and whereby in the subsequent checking action in opening and closing, fluid is dammed up behind the moving piston and substantial resistance is encountered.

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