Jan. 26, 1954 T. A. STEHLIN 2,666,944

DOOR CLOSING MECHANISM

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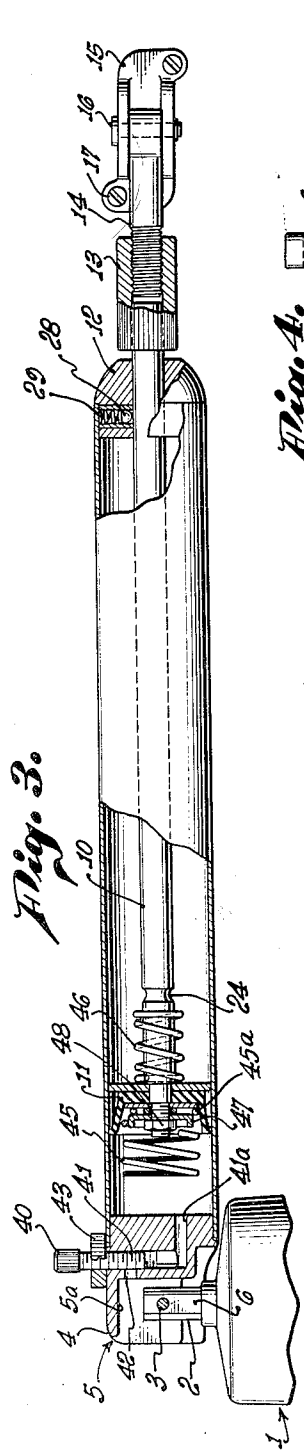


Fig. 3.

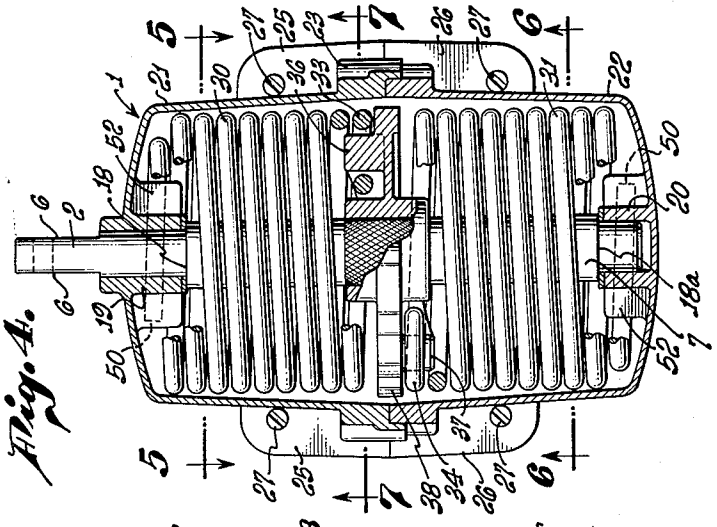


Fig. 4.

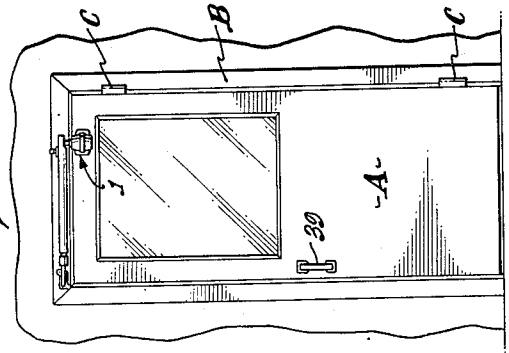


Fig. 2.

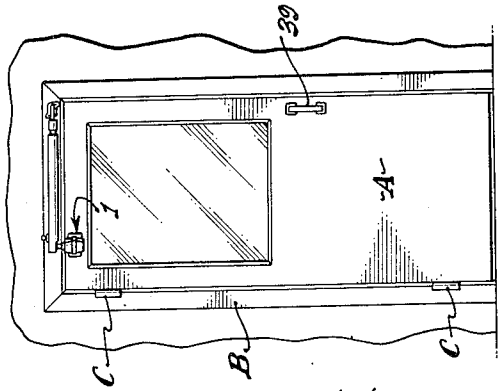


Fig. 1.

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Fig. 5.

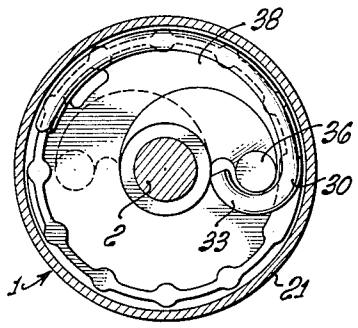


Fig. 6.

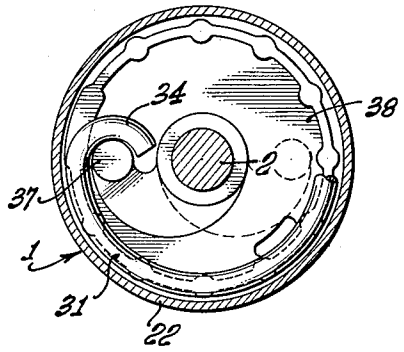


Fig. 7.

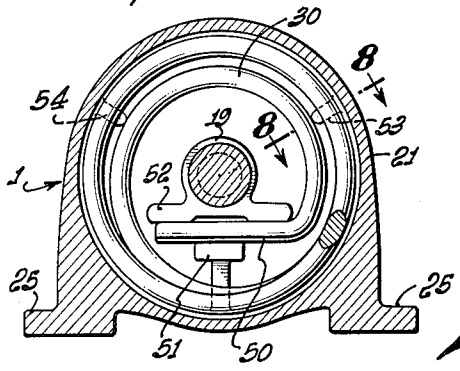


Fig. 8.

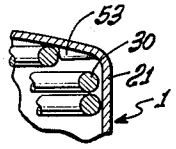


Fig. 10.

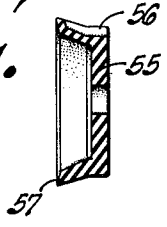


Fig. 11.

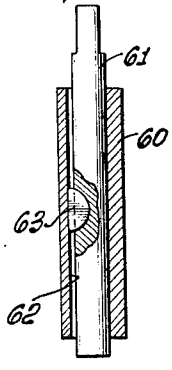
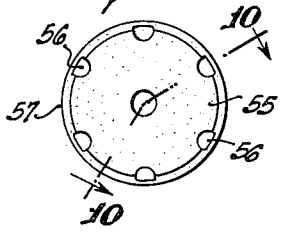


Fig. 9.



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DOOR CLOSING MECHANISM

Theodore A. Stehlin, Pasadena, Calif.

Application December 20, 1950, Serial No. 201,824

10 Claims. (Cl. 16—70)

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This invention has relation to door operating mechanism and has particular reference to devices for controlling the door closing movement of a door.

It is the general object of the invention to provide a simple, inexpensive and conveniently operable device which may be applied to doors of various sizes for controlling the opening and closing movements of such doors through an arc of any desired predetermined degree. A further object is to provide resilient means designed to induce closing movement of the door. Another object is to provide resilient door closing means which comprises a pair of door closing members, either one of which may be employed to effect the door closing movement and one of which may be substituted for the other in case the one employed for the door closing operation should, for some reason, become damaged or otherwise fail to operate properly. A still further object is to provide, in a door closing mechanism of the type referred to, means for uniformly controlling speed of closing movement of the door. Another object is to provide means for cushioning final opening and closing movement of the door. It is a still further object of the invention to provide means for yieldingly maintaining the door in open position.

These and other objects of the invention, together with the many advantageous features thereof, will hereinafter be fully described and reference is invited to the accompanying drawings in which preferred forms of the invention are illustrated.

In the drawings:

Fig. 1 shows a door conventionally hung within a framing and with the device of the invention mounted in position thereon;

Fig. 2 is a similar view showing the door hung on the opposite side of the framing and the position which the device of the invention assumes in this door combination;

Fig. 3 illustrates, on a larger scale, the position of the device which is mounted on the door framing;

Fig. 4 shows the portion of the device mounted on the door and with the casing thereof broken away in order to disclose the interior mechanism thereof;

Figs. 5 and 6 show the central coupling member of the casing, as viewed in the direction of the arrows 5, 6 of Fig. 4;

Fig. 7 is a view taken substantially on line 7—7 of Fig. 4;

Fig. 8 is a fragmentary view taken on line 8—8 of Fig. 4;

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Figs. 9 and 10 illustate an element of the invention the importance of which is hereinafter fully explained; and

Fig. 11 shows a modification of portions of the structure of Fig. 4.

Referring in the first instance to Fig. 1, it is noticed that a door A is hung within a conventional framing B on hinges C for opening movement in one direction. At the upper edge of the door and nearer the inner side edge thereof is mounted casing 1 within which the door closing devices of the invention are mounted in a manner which will be described presently, it being thought sufficient at the moment to point out that a stem 2 rises from the top of this casing and that it is secured for rotating movement within the casing. The stem is near the upper end thereof shown perforated to receive a pin 3 which extends transversely through the head 4 of a cylinder 5 operatively to connect the parts for simultaneous positive rotation. The head 4 is for this purpose recessed, substantially as indicated at 5ª, and the upper end of the stem is machined to provide parallel side surfaces 6 which fit snugly between the side walls of the recess 5. When these parts are properly proportioned, it is found that rotation of the stem will positively swing the cylinder 5 in a horizontal plane.

A rod 10 is mounted for axial sliding movement within the cylinder and a piston 11 is secured to the inner end of this rod. A plug 12 is fitted into the cylinder to close the other end thereof and this plug is perforated to form a seat for the rod 10, the projecting end of which is shown seated within a sleeve 13 which latter is rigidly secured in position on the rod in any suitable manner. The sleeve is internally threaded to receive the threaded end of a stem 14 which, in turn, is hung to swing on a bracket 15 by means of a pivot 16 vertically extending through the bracket and the end of the stem. This bracket is, as best shown in Fig. 1, by means of screws 17 rigidly mounted in position on the upper horizontal member of the door frame B.

Referring now to Fig. 4, it is noticed that the stem 2 extends axially through the casing 1 and that the enlarged central portion 7 of this stem is held against axial movement therein by shoulders 18, 18ª engaging the inner surfaces of the bearing portions 19, 20 of the casing. Upon further examination of Fig. 4, it is observed that the casing is made in two parts 21, 22, one of which is fitted with a flange 23 riding on the outer periphery of the other part to maintain both ends of the casing in axial alignment. Ears 25, 26 project laterally from the casing to provide a base

by means of which the casing is mounted in position on the door and the base is for this purpose shown perforated to receive fastening screws 27. This completes the external interconnection between the door and the door frame.

Helical springs 30, 31 are placed within the casing and the upper end of the upper spring, as well as the lower end of the lower spring, is shaped to become securely anchored between elements rising from the inner surfaces of the casing ends. Since the elements at both ends may be exactly alike, only the upper portion of the casing is illustrated in Fig. 7. The upper end of the spring 30 is in this view shown bent to form a straight lip 50 which is forced into position between projecting elements 51, 52 of the casing, whereupon the first loop of the spring is forced behind bosses 53, 54 inwardly projecting from the side wall of the casing. When the upper end of the spring 30 is so placed and the lower end of the spring 31 is similarly seated, it is found that the two springs will be securely anchored within the two casing parts. The opposite ends of the two springs are bent to form hooks 33, 34 which are shaped to ride on studs 36, 37 projecting from the end surfaces of a coupling member 38 in opposite directions. This coupling member is in any suitable manner rigidly secured in position on the stem 2 to cause the springs to function during the opening and closing movement of the door in the manner which will now be described.

Any suitable conventional handle or grip may be provided, substantially as indicated at 39 in Fig. 1, for manual opening movement of the door during which movement it is found that the stem 2 is rotated in clockwise direction to cause the piston 11 to recede within the cylinder. During this opening movement it is found that the upper spring 30 is gradually put under tension by the movement of the stud 36 of the coupling member 38 which forces the hook 33 of the spring forward in the same direction. It is important to note that the stud 37 projecting from the opposite side of the coupling member during the same movement recedes from the hook 34 of the spring 31 which, for this reason, remains undisturbed during the opening movement of the door. The moment the door is manually released, it is found that the tension of the spring 30 will instantly initiate closing movement thereof to cause the spring to return the coupling member, the stem 2 and the piston of the cylinder to their initial positions.

The size of the spring depended upon for closing the door should be sufficient to overcome any resistance the door may offer to the closing movement thereof. When of sufficient strength to insure complete closing movement at all times, it may be found that the closing movement of the door becomes too rapid and the end of the closing movement so sudden that operation of the door will become uncomfortable, if not dangerous. It is for this reason necessary to provide means for controlling the closing movement of the door and this may be accomplished in the following manner. A screw 40 engages the threads of a recess 41 which is vertically sunk into the head 4 of the cylinder and this recess communicates through an extension 41a with the space within the cylinder and through an opening 42 with the atmosphere. It is important to note that the opening 42 is placed a considerable distance above the extension 41 and that this is done in order that, when the screw is advanced into the recess beyond the opening 42, it will serve gradually more completely to cut off communication of the space within the cylinder with the atmosphere, it being understood, of course, that the threads of the screw are rather loosely fitted within the threads of the recess so as to permit some escape of air therethrough when the opening 42 is completely closed by the screw. When this screw is correctly proportioned, it is found that adjustment thereof will be effective to control the closing movement of the door as required in each case. Once the screw has been correctly adjusted, it is clamped into position by means of a lock nut 43.

In order further to soften the impact at the end of the opening and closing movements of the door, I have provided within the cylinder cushioning springs 45, 46. The spring 45 is shown seated within the piston 11 by means of a cup-shaped washer 47, which holds the inner end of the spring firmly in position within the piston. As shown in Fig. 3, a part of the spring is for the sake of clearness broken away, but it should be clear to anyone versed in the art that the spring extends behind this washer, as indicated at 45a. A nut 48 engages the threaded end of the piston rod 10 firmly to clamp the spring in position behind the washer. The spring 46, on the other hand, is shown freely seated on the rod 10 at the opposite side of the piston. The tension of these springs should, of course, be calculated effectively to check the final opening and closing movements of the door in accordance with the size of the door and the tension of the closing spring.

It was above stated that the casing 1 is placed at the upper end of the door nearer the inner edge thereof and it should be clear to anyone versed in the art that the distance from the inner side edge of the door to the axis of the stem 2 bears a definite relation to the length of travel of the piston within the cylinder. Once the casing has been mounted in proper position on the closed door, it is merely required to advance the piston rod 10 in the cylinder until the spring 45 becomes compressed, whereupon the bracket 15 may be mounted in position on the door frame. Upon subsequent opening of the door, it may be found that the tension of this spring is either too great or insufficient to insure proper cushioning. In such case, it is merely required to rotate the sleeve 13 on the screw 14 thereby to move the piston 11 forward or rearward as may be required in order to obtain the desired result.

It may at times be desired to maintain the door in fully opened position and the piston rod 10 is for this purpose shown made with a circular groove 24 which can be moved into registration with a plunger 28 of the plug 12 when the door is swung into fully opened position. A spring 29 urges the plunger into engagement with the groove yieldingly to retain the door in this position.

It was above explained that the lower spring 31 remains dormant during the opening movement of a door which is hung to swing on hinges at the left side of the door frame, as indicated in Fig. 1. But where the door is hung at the right side of the door frame, it is found that the lower spring is placed under tension during the opening movement of the door to urge closing movement thereof while the upper spring 30 remains inactive. The great advantage of this arrangement is that at no extra expense, except the small cost of one additional spring, the de-

vice of the invention, is adapted for both right and left handed operation. And not only that, but it is important to note that a spring is always kept in reserve for use in case the active spring should for some reason fail to function properly. It then merely becomes necessary to unscrew the casing and to interchange the two springs.

Even this interchange of springs may be eliminated by slightly modifying the construction of the stem 2. Illustrative of a simple manner of reconstructing this stem, I have in Fig. 11 shown the stem made in two parts, 60 and 61, of which the part 60 corresponds to the enlarged central portion 7 of the stem 2. A spline 62 is cut into the part 60 of a size to receive therein a feather 63 of the inner part 61. When the stem is so designed, it is merely required to unscrew the casing and to withdraw it from the part 61, whereupon the casing may be reversed and remounted thereon. When the casing again is fastened to the door, it is found that the lower spring 31 will take the position of the upper spring 30 and will function in the same manner.

One of the difficulties ordinarily encountered in door operating mechanisms of the type herein considered is that a cup-shaped piston such as commonly employed, does not function properly at all times. In order to overcome this difficulty I have, in Figs. 9 and 10, shown a piston 55 molded from soft, resilient material and having a series of equidistantly spaced recesses 56 in the outer periphery thereof, substantially as indicated in these views of the drawings. When such recesses are provided, it is found that the operating rim, or crown 57 of the cup becomes more pliable and sensitive to contracting and expanding self-adjustments during opening and closing movements of the door. This type of piston can be depended upon to give complete, uninterrupted service over an extended period of time.

I claim:

1. A closing device for a door mountable to swing outwardly on either jamb of the door framing from the same side of the door opening comprising, a cylinder, a piston within said cylinder, a piston rod extending from the piston through the cylinder in the direction away from the hinges of the door, means securing the outer end of the piston rod to the framing above the door for horizontal swinging movement relative to the framing, a cap on the opposite end of the cylinder, a casing on the door nearer the hinged side thereof, a stem rising through said casing and rigidly secured to said cap, means within the casing operatively connected with said stem to urge rotation of the stem in the direction required to swing the door into closed position, and resilient means within the cylinder for checking the piston movement at each end thereof.

2. A closing device for a door mountable to swing outwardly on either jamb of the door framing from the same side of the door opening comprising, a casing at the upper end of the door nearer the hinged side thereof, a stem vertically seated for rotation within said casing, a coupling member rigidly secured to the stem intermediate the ends thereof, interchangeable helical springs above and below the member, one spring having its upper end and the other spring its lower end rigidly seated in the casing, the adjacent inner ends of the springs being operatively connected with said member, means operatively connecting the stem with the door frame to effect rotation thereof in one direction during opening movement of the door when the latter is hung at one jamb of the frame and in the opposite direction when hung at the other jamb of the frame, opening movement of the door placing one of said springs under tension to urge closing movement of the door the dormant spring becoming active upon reversal of the casing.

3. A closing device for a door mountable to swing outwardly on either jamb of the door framing from the same side of the door opening comprising, a cylinder, a piston within said cylinder, a piston rod extending from the piston through the cylinder in the direction away from the hinges of the door, means securing the outer end of the piston rod to the framing above the door for horizontal swinging movement relative to the framing, a cap on the opposite end of the cylinder, a passage through said cap to the space within the cylinder, means seated in said passage and operable to control the air flow therethrough, a casing on the door nearer the hinged side thereof, a stem rising through said casing and rigidly secured to said cap, and means within the casing operatively connected with said stem to urge rotation of the stem in the direction required to swing the door into closed position.

4. A closing device for a door mountable to swing outwardly on either jamb of the door framing from the same side of the door opening comprising, a cylinder, a piston within said cylinder, a piston rod extending from the piston through the cylinder in the direction away from the hinges of the door, means securing the outer end of the piston rod to the framing above the door for horizontal swinging movement relative to the framing, to cause the piston to recede within the cylinder, means for adjusting the length of the piston rod correctly to position the piston within the cylinder, a cap on the opposite end of the cylinder, a casing on the door nearer the hinged side thereof, a stem rising through said casing and rigidly secured to said cap, and means within the casing operatively connected with said stem to urge rotation of the stem in the direction required to swing the door into closed position.

5. A closing device for a door mountable to swing outwardly on either jamb of the door framing from the same side of the door opening comprising, a cylinder, a piston within said cylinder, a piston rod extending from the piston through the cylinder in the direction away from the hinges of the door, means securing the outer end of the piston rod to the framing above the door for horizontal swinging movement relative to the framing, a cap on the opposite end of the cylinder, a threaded passage through said cap, a screw seated in said passage and adjustable therein to control air flow through the passage, a casing on the door nearer the hinged side thereof, a stem rising through said casing and rigidly secured to said cap, and means within the casing operatively connected with said stem to urge rotation of the stem in the direction required to swing the door into closed position.

6. A closing device for a door mountable to swing outwardly on either jamb of the door framing from the same side of the door opening comprising, a cylinder, a piston within said cylinder, a piston rod extending from the piston through the cylinder in the direction away from the hinges of the door, the piston rod having a peripheral groove therein, means securing the outer end of the piston rod to the framing above the door for horizontal swinging movement relative to the framing to cause the piston to recede

within the passage, an element seated in the cylinder wall, a spring urging said element into engagement with said groove as the piston rod reaches the end of its receding movement yieldingly to maintain the rod in this position, a cap on the opposite end of the cylinder, a casing on the door nearer the hinged side thereof, a stem rising through said casing and rigidly secured to said cap, and means within the casing operatively connected with said stem to urge rotation of the stem in the direction required to swing the door into closed position.

7. A closing device for a door mountable to swing outwardly on either jamb of the door framing from the same side of the door opening comprising, a cylinder, a piston within said cylinder, a piston rod extending from the piston through the cylinder in the direction away from the hinges of the door, means securing the outer end of the piston rod to the framing above the door for horizontal swinging movement relative to the framing, a cap on the opposite end of the cylinder, a reversible casing on the door nearer the hinged side thereof, a stem rising through said casing and rigidly secured to said cap, resilient means within the casing urging rotation of the stem to close the door when hung on one jamb of the framing, and resilient interchangeable means within the casing urging rotation of the stem to close the door when hung on the other jamb of the framing, one of said means remaining dormant while the other is in operation, the dormant means becoming active upon reversal of the casing.

8. A closing device for a door mountable to swing outwardly on either jamb of the door framing from the same side of the door opening comprising, a cylinder, a piston within said cylinder, a piston rod extending from the piston through the cylinder in the direction away from the hinges of the door, means securing the outer end of the piston rod to the framing above the door for horizontal swinging movement relative to the framing, a cap on the opposite end of the cylinder, a reversible casing on the door nearer the hinged side thereof, a stem vertically seated for rotation within said casing, the upper end of the stem being rigidly secured to said cap, a coupling member secured to the stem intermediate its ends, resilient means extending from said member to one end of the casing to urge rotation of the stem in one direction to effect closing movement of the door, and similar means extending from the member to the other end of the casing to urge rotation of the stem in the opposite direction, said resilient means being interchangeable, one of said means remaining inactive while the other means is in action, the dormant means becoming active upon reversal of the casing.

9. A closing device for a door mountable to swing outwardly on either jamb of the door framing from the same side of the door opening comprising, a reversible casing at the upper end of the door nearer the hinged side thereof, a stem vertically seated for rotation within said casing, two resilient members within the casing operatively connected to urge rotation of said stem, and means operatively connecting the stem with the door frame for effecting closing movement of the door during rotation of the stem, one of said members being placed under tension during the opening movement of the door when hinged on the jamb at one side of the frame, the other member being similarly placed under tension when the door is hinged on the other jamb of the frame, said resilient members being interchangeable.

10. A closing device for a door mountable to swing outwardly on either jamb of the door framing from the same side of the door opening comprising, a reversible casing at the upper end of the door nearer the hinged side thereof, a stem vertically seated for rotation within said casing, a coupling member on the stem intermediate the ends thereof, resilient means having one end thereof rigidly secured to the upper end of the casing and having its other end operatively connected with said coupling member at the top thereof, resilient means similarly extending from the lower end of the casing to the bottom surface of the member, said two resilient means being interchangeable, means operatively connecting the stem with the door frame to effect rotation of the stem in one direction during opening movement of the door when hung on one jamb of the frame and in opposite direction when hung on the other jamb of the frame, opening movement of the door being effective to place one of said means under tension to urge closing movement of the door, the dormant means becoming active upon reversal of the casing.

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