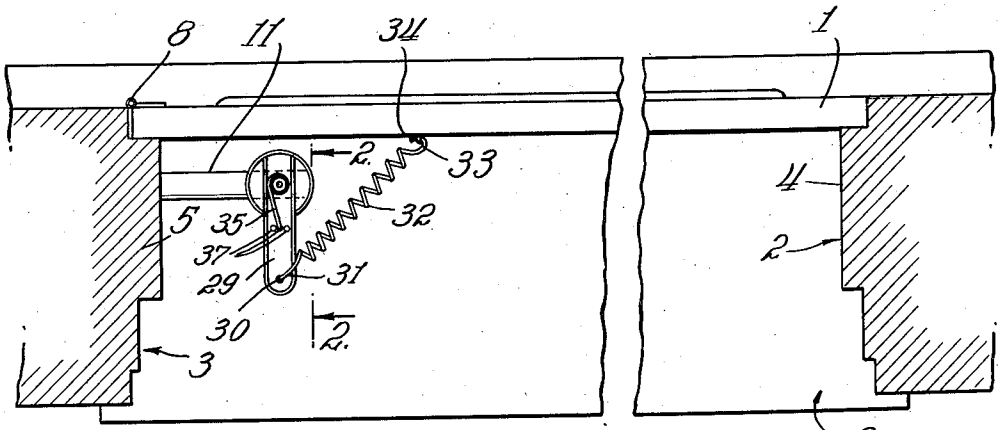
May 11, 1948. F. W. TETZMAN 2,441,455

DOOR CLOSING DEVICE

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Fig. 1.



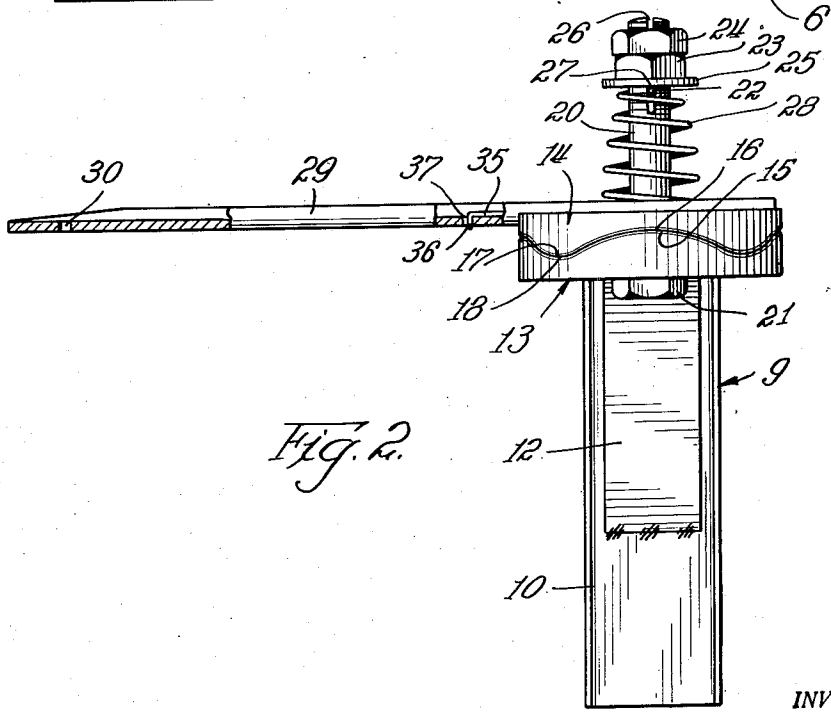




Fig. 2.

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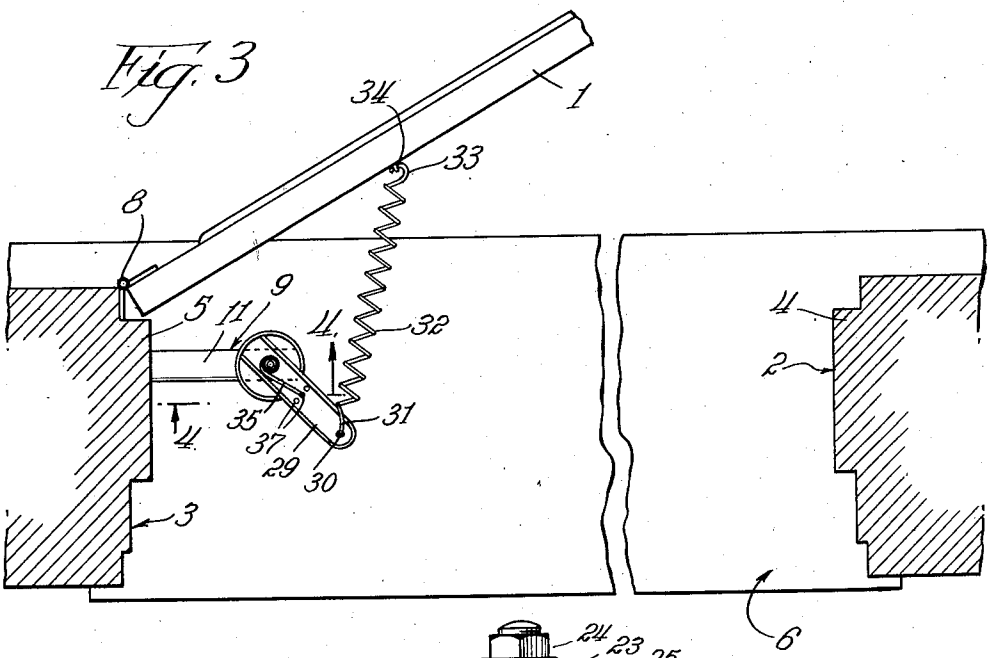
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DOOR CLOSING DEVICE

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Fig. 3



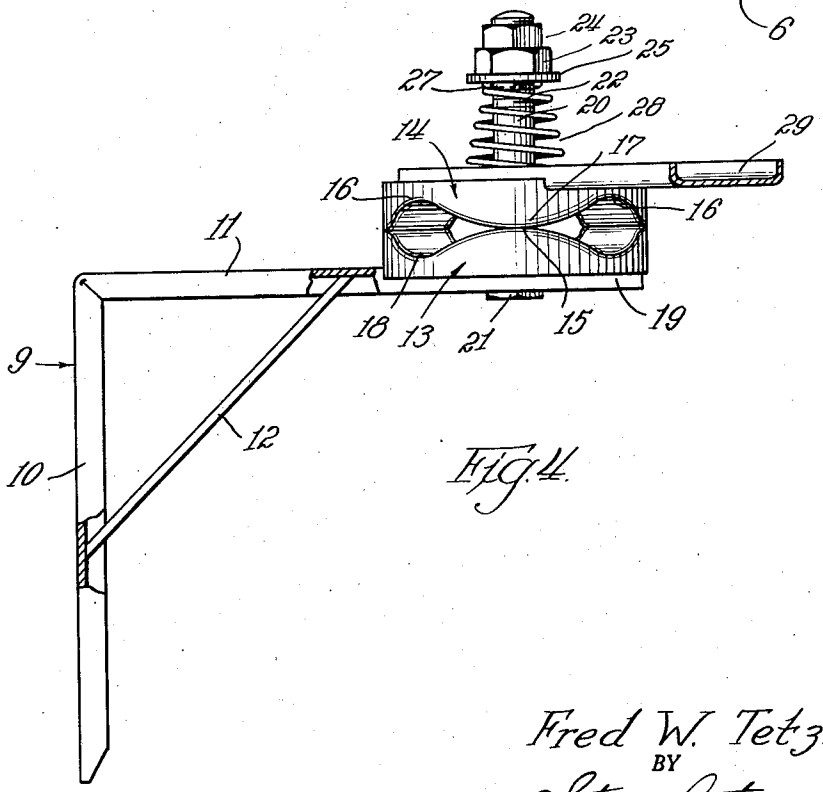




Fig. 4

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DOOR CLOSING DEVICE

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Fig. 5.

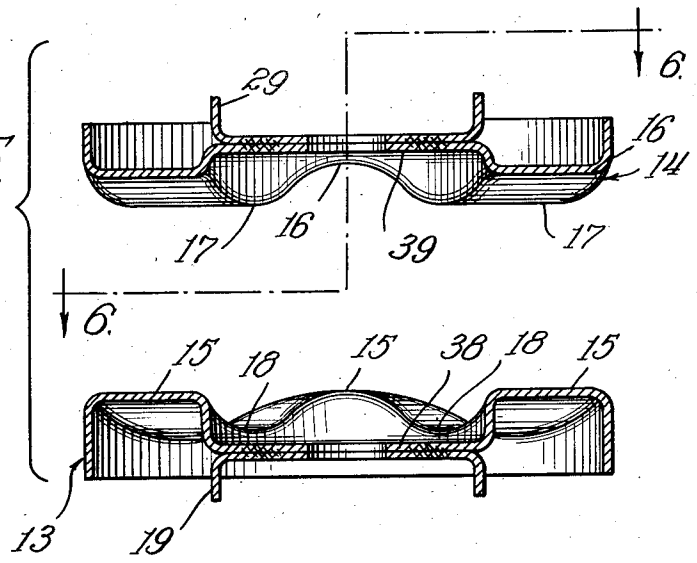
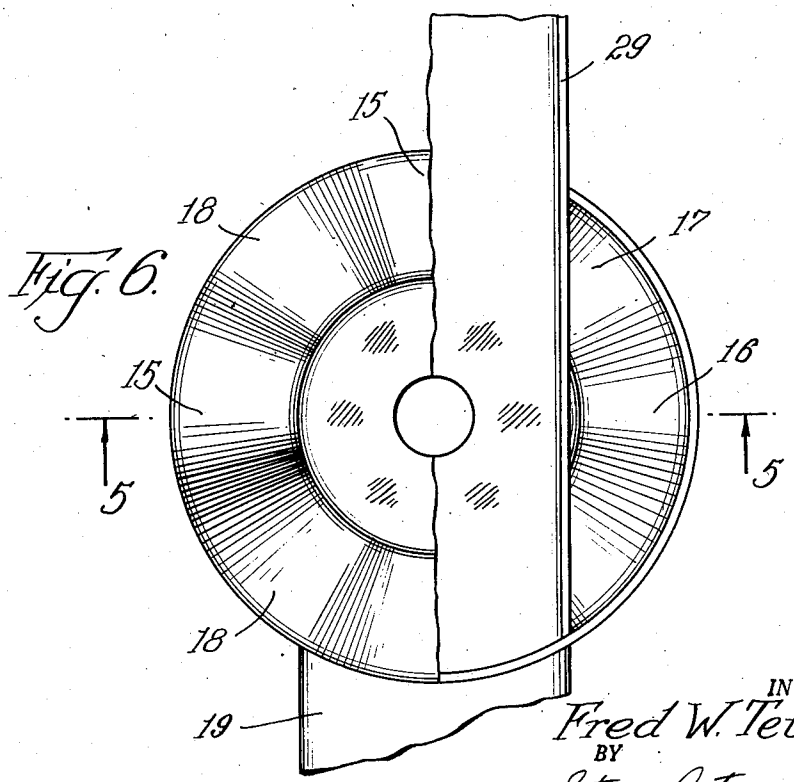



Fig. 6.




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# UNITED STATES PATENT OFFICE

2,441,455

## DOOR CLOSING DEVICE

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Application October 30, 1944, Serial No. 560,933

6 Claims. (Cl. 16—65)

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The present invention relates to a door closing device so associated to a door and door frame as to control the closing action of the door to a given and desired effect and wherein slamming or banging is eliminated.

Among the objects of the invention is to provide a novel device in which a resilient member, such as a spring, is coordinated with the reacting mechanical powers of the door and frame, and with associated cam means, the camming action of which is also stressed or counter-stressed under the stress of the aforesaid spring as to create a resultant quiet closing of the door.

The invention also may comprehend a connecting member, such as another spring, so related to the center line of the arm of the cam means as to assume a varied stress reactive between the door in its opening and closing movements and the cam spring, and to shift the applied component force or power as to nearly balance but be subservient to a small preponderance of the stress effected by the cam means and the cam spring.

Other objects, advantages, capabilities, features and the like are comprehended by the invention as will later appear, and as are inherently possessed by the invention.

Referring briefly to the drawings:

Fig. 1 is a top plan view of the invention and a horizontal sectional view of a doorway with which the invention is applicable;

Fig. 2 is a side view in elevation with a portion broken away and shown in section of the invention;

Fig. 3 is a view similar to that shown in Fig. 1 and showing the door in partly opened position;

Fig. 4 is a rear view of the invention with parts shown in a stage of operation and as taken in planes represented by line 4—4 in Fig. 3 of the drawings;

Fig. 5 is an exploded sectional view of part of the invention and as taken in a plane represented by line 5—5 in Fig. 6 of the drawings;

Fig. 6 is a stepped plan view taken in planes represented by line 6—6 in Fig. 5 of the drawings.

Referring more in detail to the drawings, the embodiment selected to illustrate the invention is shown in connection with a door 1 in a doorway having sides 2 and 3, these sides being provided with stops or jambs 4 and 5 and having a suitable threshold 6. The door is hinged to the part 5 by way of suitable hinges 8.

Attached or suitably secured to the side 3, as to the jamb 5 thereof, is a support 9 which may be in the form of a bracket and which comprises an upright leg or post 10 suitably firmly connected

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to the jamb 5, as shown in Fig. 1, and a top piece or shelf 11 suitably fixed at an end thereof to the upper end of the leg or post 10, and this top piece or shelf 11 may be braced by a suitable brace member 12 suitably secured, as by welding, at its ends to the leg 10 and the top piece 11. These parts 10, 11 and 12 may be made of metal or other suitable material which is strong and stiff, and the parts 10 and 11 may be of channel shape or form.

The invention comprehends the provision of a pair of counter-part cam members 13 and 14 of generally circular or annular form or shape and with counter-part opposed cam surfaces or races of undulated form or wave shaped so that in a normal position or relation the cam 13 will have a cam lobe or crest 15 matching or meshing with a cam dwell or trough 16 provided in or on the cam 14, and the cam 14 will have a cam lobe or crest 17 matching or meshing with a cam dwell or trough 18 provided in or on the cam 13, as shown in Fig. 2. These dwells and lobes are preferably distributed around the cams in any number desired so that normally there are diametrically opposed corresponding lobes and diametrically opposed corresponding dwells.

The lower cam member 13 is preferably secured, as by welding or otherwise to the free end portion 19 of the top piece or shelf 11 and is provided with a suitable aperture or hole, as also is the shelf portion 19, for the upward extension therethrough of a bolt or stud 20 having a head 21 in thrust engagement with the lower side of the shelf portion 19. The upper cam 14 is coaxial with the cam 13 and also has a hole or aperture for the extension therethrough of the bolt or stud 20 and to permit the rotation of the cam 14 about the axis of the bolt or stud 20.

The upper end of the stud 20 is preferably provided with threads 22 for engagement therewith of a binding nut 23 and a lock nut 24. Below the nut 23 is a suitable thrust plate or washer 25. In the upper portion of the stud 20 is provided a longitudinal slot 26 for the anchoring therein of an end portion 27 of a coil spring 28 which is interposed between the thrust plate or washer 25 and the cam 14. The washer 25 acts as an adjustable member for the spring 28, and the nut 23 acts as a regulating member for the force or stress imposed by the spring 28 on the cam 14, in accordance with the degree of adjustment of the nut 23 on the threaded portion 22 of the stud 20.

Fixed to and extending radially from the cam 14 is an arm 29 which has at or near its end an

aperture 30 in which is passed or hooked an end 31 of a coil spring 32 which has its other end 33 suitably connected to or hooked into a fastening 34, as a screw eye, hook, or the like secured to the door 1.

The spring 28 has at its lower end an extension or anchor tail part 35 which extends part-way along the arm 29 and has an end hook or the like 36 adapted to catch or extend selectively and adjustably into any one of several apertures or holes 37 arranged in the arm 29 and concentric to the axis of the stud 20 and the cam 14.

Referring to Figs. 5 and 6 it will be observed that the cams may be made of sheet metal and stamped to form troughlike central web portions 38 and 39 and perimetral annular portions having an undulated or wave form to provide for the lobes and dwells of the cams. The bracket part 19 may be secured as by welding to web 38 and the arm 29 may be secured to the web 39 also by means of welding or the like.

The spring 28 has at least a double function, one offering a torsional resistance or reaction, as the arm 29 is turned about the axis of the spring 28 and the stud 20 by way of the anchor part 35 hooked to the arm 29 and by way of the anchor part 27 extending through the slot 26 of the stud 20; and the other offering a compression resistance or reaction against the cam 14 and the urge of the lobes or crests 17 of the cam 14 to ride up the slopes of the lobes or crests 15 of the cam 13 as the arm 29 is turned about the axis of the stud 20.

In use and operation, and with the parts in the relations shown in Fig. 1, the normal stress of the spring 32 is at its minimum; the torsional reactive stress of the spring 28 also is at its minimum; and by reason of the cam lobes and dwells being in mesh or normal neutrality, the reactive resistance is nil. By reason of the center line of the spring 32 and the center line of the arm 29 being at a small angle the component force of the spring 32 upon initial opening of the door will be smallest. Hence, upon starting opening of the door 1, the spring 32 will be strained to the point when its augmented stress will start turning the arm 29 and cam 14. As this turning progresses the angle between the center lines of the spring 32 and arm 29 will widen, shifting the component force on the arm 29 progressively toward the normal or right angle relation to the center line of the arm 29 whereby there is lesser necessary applied stress by the spring 32 on the arm 29, but coordinately the torsional resistance of the spring 28 increases to contribute a counter balancing force or stress, and also the lobes or crests 17 of the cam 14 start to ride and do ride up the slopes of the lobes or crests 15 of the cam 13 against the compressible resistance or counterforce of the spring 28, so that this resistance together with the counterbalancing torsional reactive stress of the spring 28 will about equal the stress of the spring 32 in its varying angular relations with or to the center line of the arm 29. See Fig. 4 which shows the riding of the crests of the upper cam upon the crests of the lower cam. The cam profile portions formed by the lobes on the cam members 13 and 14 are so formed as to diminish the rate of relative axial movement of the cams per unit of relative rotative movement as such relative rotation occurs in one direction, namely, the direction incurred by rotation of the cam member 14 pursuant to swinging of the door from the closed position toward the wide open position. This is apparent from comparing Figs. 2 and 4,



the cam profiles offering greater resistance to relative rotation of the cam members 13 and 14 when the lobes of these members are completely meshed as shown in Fig. 2 than when the crests of the lobes approach alignment as illustrated in Fig. 4. This diminution in resistance by the cam profiles to relative rotation of the cam lobes 13 and 14 while the door is swinging to the open position counteracts the increased resistance to such relative movement by the spring 28 which is concurrently wound up as the arm 29 is swung counterclockwise, as viewed in Fig. 3, by the counterclockwise swinging door. When closing the door the same substantial balance is present so that the door will close without slamming or banging. To effect the necessary small amount of predominance of the forces or stresses for automatic returning or closing movement of the door 1, the end 35 of the spring 28 may be selectively and adjustably hooked into one of the holes 37, depending upon the mechanical ease or impedance of the hinging action of the door 1.

While I have herein described and upon the drawings shown an illustrative embodiment of the invention, it is to be understood that the invention is not limited thereto but comprehends other structures, details, arrangements of parts, features and the like, without departing from the spirit of the invention.

Having thus disclosed the invention, I claim:

1. In a door closing device having cams provided with counter-part camming surface portions and of which one of the cams is for connection with the door and the other of said cams is for connection with a door frame about said door, a spring connected to one of said cams and pressing against the other of said cams to resiliently press the camming surface portions of said cams together and to resiliently resist and yield to the relative movement of said camming surface portions, and said spring being also connected to the other of said cams to afford a torsional resilient stress to the relative movement of said cams.

2. In a device of the character disclosed and which has a door and a door frame; a door closing device having cams provided with counterpart camming surface portions and of which one of the cams is connected to the door and the other of said cams is connected to the door frame, a spring connected to one of said cams and pressing against the other of said cams to resiliently press the camming surface portions of said cams together and to resiliently resist and yield to the relative movement of said camming surface portions, and said spring being also connected to the other of said cams to afford a torsional resilient stress to the relative movement of said cams, said connection to said door frame comprising a support secured to the door frame, and said other of said cams being secured to said support, said support being in the form of a bracket having a leg secured to the door frame and having a shelf part for supporting said other of said cams.

3. In a door closing device having cams provided with counter-part camming surface portions and of which one of the cams is for connection with the door and the other of said cams is for connection with a door frame about said door, a spring connected to one of said cams and pressing against the other of said cams to resiliently press the camming surface portions of said cams together and to resiliently resist and yield to the relative movement of said cam-

ming surface portions, and said spring being also connected to the other of said cams to afford a torsional resilient stress to the relative movement of said cams, said other of said cams having a stud fixed thereto, and said one of said cams having an opening for the extension therethrough of said stud, said spring being connected at an end thereof to said stud and at the other end thereof to said one of said cams.

4. In a closing device for a door swingable to and from a closed position with respect to a portal within a door frame, relatively rotatable cams having intermeshed axially projecting profile portions cooperable to cause relative axial movement of such cams in one direction pursuant to such relative rotation in one direction, a helical spring exerting a force between said cams to urge them in the opposite axial direction and also being connected with said cams to tortionally urge relative rotation thereof in the opposite direction, and means for connecting said cams respectively with said door and door frame for causing such relative rotation of the cams in said one direction pursuant to the door being opened, and said cam profile portions being of a contour to diminish the rate of relative axial movement of the cams per unit of relative rotative movement as such relative rotation occurs in the one direction.

5. In a closing device for a door structure swingable to and from a closed position with respect to a portal within a door frame structure, relatively rotatable cams having intermeshed axially projecting profile portions cooperable to cause relative axial movement of such cams in one direction pursuant to such relative rotation in one direction, a helical spring exerting a force between said cams to urge them in the opposite axial direction and also being connected with said cams to tortionally urge relative rotation thereof in the opposite direction, means for anchoring one of said cams to one of said structures, the other of said cams having a point of attachment at which force is applicable to rotate such cam relatively to the anchored cam, a stretchable spring for distension and connection between said point of attachment and a point of attachment on the other of said structures so located that such spring is further distended and caused to exert such rotating force to said other cam member as the door structure is swung open.



6. In a closing device for a door structure movable to and from a closed position with respect to a portal within a door frame structure and normally urged into the closed position by an elongatable spring connected at a point of attachment to one of said structures; a pivotable member pivotally mounted upon the other of said structures and having an anchorage point of attachment for the other end of said spring, said pivotable member being pivoted in one direction to cause displacement of said anchorage point of attachment toward the first point of attachment, a spring urging said pivotable member to pivot in the opposite direction, and cam means cooperable with the last-named spring to resist pivotal movement of the pivotable member in said one direction and to cause the combined resistance of the spring and cam means to such rotation to increase at a decelerated rate as said member is pivoted in the one direction.

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