Oct. 23, 1945. C. F. SPONSLER 2,387,689

SHOCK ABSORBING DEVICE

Filed June 30, 1942

Fig. 4.

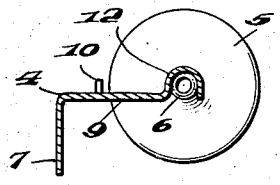


Fig. 1.

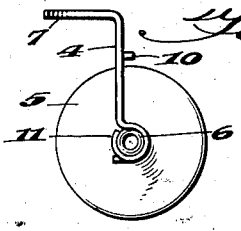


Fig. 8.

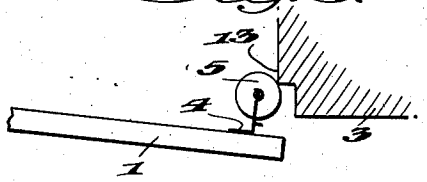


Fig. 3.

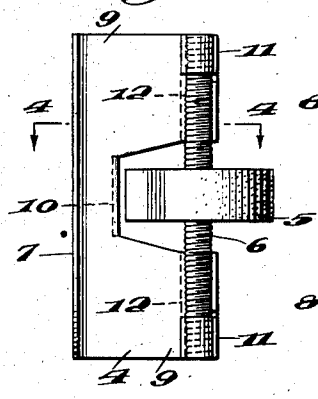


Fig. 2.

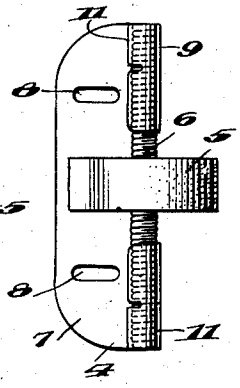


Fig. 9.

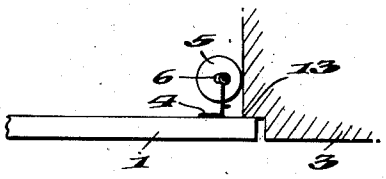


Fig. 5.

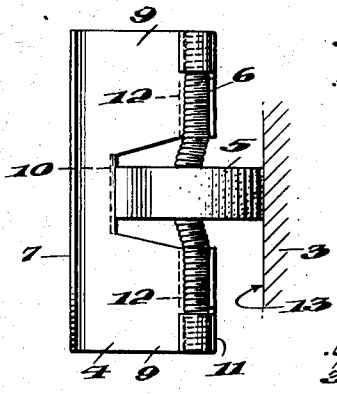


Fig. 7.

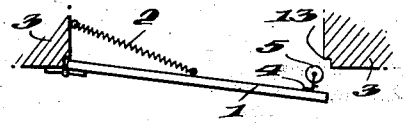


Fig. 10.

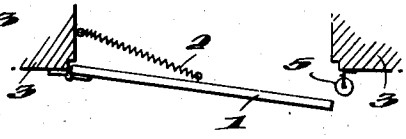
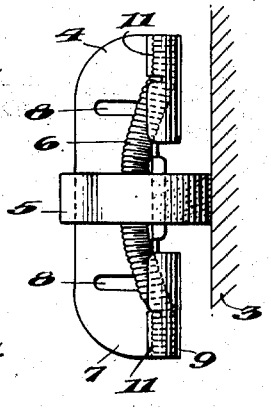


Fig. 6.



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SHOCK ABSORBING DEVICE

Charles F. Sponsler, Philadelphia, Pa.

Application June 30, 1942, Serial No. 449,135

10 Claims. (Cl. 16—86)

This invention relates to a device for absorbing the shock attendant upon the closing of doors which normally tend to assume closed position, such, for example, as screen doors that are closed by spring force.

The invention has for its object to provide a device of the character indicated which, while permitting the door to close completely, will afford reliable and positively acting means for preventing violent contact or slam of the door against its door frame and which is of simple construction, small in size and cheaply and easily manufactured.

The principal feature of the invention, generally stated, consists in yieldingly mounting upon a bracket, through the intermediacy of spring means, a resilient member which is adapted to be deformed when cushioning the impact between a closing door and its associated jamb, the spring means providing forces of different values and directions for resisting bodily displacement of said resilient member in a corresponding plurality of directions at an angle to each other, whereby when the door is opened, the deformable resilient member is caused by said spring means to assume and temporarily maintain a position in which it provides a positive obstruction to any fast closing movement of the door, but when during closing of the door the closing speed has been sufficiently reduced to permit the door to close quietly, the door is enabled to displace the deformable resilient member in a direction removing it from its position of obstruction.

A further feature of the invention consists in yieldingly supporting a deformable resilient roller upon the bracket by means of a spring which permits the roller to have bodily movement in two directions with respect to the bracket at an angle to each other and to execute a limited turning movement during the final closing movement of the door, the spring being adapted to offer greater resistance to bodily displacement of the roller in one of its said two directions of movement.

There are other features of invention, residing in particular combinations of parts and elemental features of construction, all as will hereinafter appear and be particularly pointed out in the claims.

In the drawing, illustrating the preferred embodiment of the invention, the scope whereof is pointed out in the claims.

Figure 1 is a plan view of the shock absorbing device.

Figure 2 is a front elevation of the device.

Figure 3 is a side elevation of the device, the parts being in the same positions as illustrated in Figures 1 and 2.

Figure 4 is a sectional view on line 4—4 of Figure 3.

Figure 5 is a view corresponding to Figure 3 but showing the relative positions assumed by the parts when the device is absorbing the shock incident to closing movement of the door.

Figure 6 is a view corresponding to Figure 2 but illustrating the relative positions assumed by the parts during the final closing movement of the door.

Figure 7 is a diagrammatic plan view illustrating the shock absorbing device applied to a spring actuated swinging door.

Figure 8 is a diagrammatic plan view showing the positions assumed by the parts at the instant of impingement of the shock absorbing device against the door jamb.

Figure 9 is a view corresponding to Figure 8 but illustrating the relative positions of the parts after the door has fully closed.

Figure 10 is a diagrammatic plan view showing the device applied to a door frame instead of to the door.

In the drawing, 1 indicates the ordinary swinging type door closed by the force of a spring 2. The shock absorbing device is preferably mounted upon the inside of the door so as better to protect it against molestation but, as shown in Figure 10, it may be mounted on the outside of the jamb of the door frame 3.

The device preferably consists of only three parts, a bracket 4, a deformable resilient roller 5 and spring means 6 for yieldingly supporting the roller upon the bracket.

The bracket 4 may be conveniently made of sheet metal. It is formed with a base plate 7 preferably provided with parallel slots 8 to receive screws or other means for fastening the bracket either directly to the door or to the door frame as may be desired, the direction of the slots being at right angles to the axis of the roller 5 so as to permit limited adjustment of the device to properly position the roller for effectively preventing slamming of the door. Extending at substantially right angles to the base 7, the bracket is formed with a pair of spaced arms 9 to which the spring 6 is firmly secured and between which the deformable resilient member 5 intervenes. Between the arms 9 of the bracket and spaced a short distance from the circular face of the roller 5 and at a substantially greater distance from the base plate 7 the bracket is provided with a

shelf or abutment 10 which forms an abutment for the roller when the latter is displaced in a direction substantially perpendicular to the base 7 of the bracket, as occurs during a rapid door closing movement. At that time, the energy of the fast moving door is sufficient to overcome the force exerted by the spring 6 in opposition to the body displacement of the roller towards the base of the bracket. As a simple means for firmly attaching the ends of the springs 6 to the bracket 4, the arms 9 of the bracket may be formed with short curled or cylindrical portions 11 which encircle the spring at its ends and firmly hold it in place. Between the cylindrical clamping members 11 and in spaced relation to the roller 5 are two spring abutments 12 which are in light contact with the under side of the spring 6 and are located between it and the base 7 of the bracket. If desired, these shelves or abutments 12 may be extended, as shown in Figures 1 and 4, so as to partially encircle the spring but such encirclement should not be sufficient to interfere with the free action of the spring when the displacement of the resilient roller occurs in a direction substantially parallel to the base plate 7 during the final closing movement of the door, as shown in Figure 6. The purpose of these shelves or spring abutments 12 is to provide simple means for enabling the spring 6 to offer greater resistance to displacement of the roller 5 towards the base 7 of the bracket than in the direction parallel thereto.

The spring 6, which is preferably of tightly coiled form, provides a central axis for the resilient roller 5, the latter being mounted upon the spring at the center of its length and being held in place by frictional contact. When mounting it upon the bracket, the spring 6 is preferably assembled with a slight initial tension and thus constitutes a flexible shaft mounting which always tends to keep the central axis of the roller on the straight line passing through the central axis of the cylindrical clamping lugs 11 at the ends of the bracket 4. This position of the roller 5 with respect to the bracket 4 is that which it normally assumes unless displaced therefrom by an outside force. The spring 6 is in effect a flexible beam to which, through the roller 5, outside forces are applied at the center of its length in a plane perpendicular to its axis. It will be perceived that, if the force applied by the roller to the spring is in a direction parallel to the base 7 of the bracket, it will be opposed by the force of the length of spring measured between the two cylindrical clamping lugs 11 (see Figure 6), whereas, if the force applied by the roller 5 is in a direction perpendicular to the base 7 of the bracket, displacement of the roller 5 is opposed by only that part of the length of the spring which lies between the adjacent ends of the two spring abutment shelves 12 (see Figure 5). It will, therefore, be apparent that, since the shorter length of spring will offer greater resistance to displacement from its normal straight line position than will the greater length of spring, the spring 6 offers greater resistance to displacement of the resilient roller 5 toward the base plate 7 of the bracket than when displaced in a direction substantially parallel with the base plate.

The resilient member 5 is adapted to be deformed when arresting a closing movement of the door. It is preferably made of rubber and in the form of a short cylinder. The roller is of such a size that, when it is not acted upon by any outside force, a small clearance exists between it and the flange or abutment 10 with which it comes in contact when arresting a rapid closing movement of the door.

To perform its intended function efficiently, a door check of the bumper type must stop a fast closing movement of the door at a point in the swing of the door which is sufficiently distant from the door frame to prevent slam when the door check first comes into action, for at this moment the door is warped out of a plane surface because of its momentum. By providing the bracket 4 with a shelf 10 to serve as an abutment for the resilient roller 5 a greater door opening is obtainable when impingement of the roller occurs than would be possible if a roller of the same diameter were interposed directly between the door frame and the door itself. Without this shelf or abutment 10, a larger diameter roller would be necessary to obtain a door opening of corresponding extent. The use of a larger roller involves greater side displacement thereof in order to allow the door to close fully. This necessitates a greater length of the spring 6 for equally easy flexure of the spring material and that, in turn, involves the use of a longer bracket upon which to mount the spring. The shelf or abutment 10 for cooperating with the deformable resilient member 5, therefore, reduces the necessary size of all of the parts of the device.

It has been pointed out that, depending upon the direction of displacement of the rubber roller member 5 from its normal position, the device provides spring forces of different values for resisting displacement of the roller and that the force resisting movement of the roller member in the direction of the shelf or abutment 10 is greater than that in a direction parallel to the base plate 7 of the bracket. This is the feature which enables the shock absorbing device to check the door when it closes rapidly but to avoid any material checking action when the door closes very slowly. The principle involved in this mode of action of the shock absorbing device will be understood by referring to Figures 7 and 8 of the drawng, from which it will be seen that when the door is slightly open the roller 5 projects some distance beyond the corner 13 of the door frame member against which the door abuts when it is closed, and that the roller makes contact with this corner of the door frame as the door closes. As the amount the roller 5 projects determines the point on the face of the roller which makes contact with the corner 13 of the door frame member, and as the location of that point on the roller determines the direction of the door frame reaction or force tending to displace the roller from its normal free position in relation to the bracket 4 upon which it is mounted, the greater the amount the roller projects the greater is the force tending to displace it in a direction perpendicular to the base plate 7 of the bracket and to the plane of the door. Conversely, a lesser projection of the resilient roller member 5 increases the force tending to displace the roller in a direction parallel to the base 7 of the bracket and to the plane of the door.

The operation of the shock absorbing device is as follows: Assuming that the door shown in Figure 7 is about to complete a rapid closing movement and that the device is located on the inside face of the door so that the resilient roller 5 is in proper position relative to the door frame member, further closing movement of the door causes the roller to impinge upon the door frame member at the corner 13 and forces the roller

towards the door until it comes in contact with shelf or abutment 10, the parts then assuming the relative positions illustrated in Figure 5. The roller 5 thus being in contact with the door frame at one point on its periphery and being also in contact at a distant point on its periphery with the shelf 10, therefore then constitutes an obstruction interposed between the door and door frame and prevents the door from closing. During its contact with the shelf or abutment 10 of the bracket, the resilient roller 5 is compressed and momentarily deformed from its normal circular shape. The door then rebounds outwardly until its movement is checked by the opposing action of the door closing spring 2. The door closing spring again causes the door to approach the door frame but at a less speed than that of the previous closing movement. If the closing speed of the door has not been reduced sufficiently by the first rebound to permit final closing, the door will rebound again. This action continues and as successive rebounds of the door become shorter, the force due to impingement of the roller against the corner 13 of the door frame becomes progressively smaller until this force is less than the force of the spring 6 resisting movement into contact with the shelf or abutment 10 of the bracket 4. At this time, the roller 5 remains in contact with the door frame but no longer makes contact with the shelf 10. The door is now free to close and the residual tension in the door spring 2 first displaces the roller inwardly towards the hinge side of the door and then closes the door completely. When this final closing movement takes place, the force imparted to the roller by impingement against the door frame has become very slight but is still sufficient to overcome the opposition of the spring 6 to displacement of the roller parallel to the base plate 7 and to the face of the door, as shown in Figures 6 and 9. During final closing movement of the door, the roller 5 is no longer distorted from its cylindrical shape, but rolls freely around the corner 13 of the door frame until it assumes the positon (see Figure 9) it occupies when the door has completely closed. In assuming this position when the door is fully closed, the spring 6 upon which the roller 5 is mounted is appreciably flexed transversely out of its normal straight line condition and this insures the restoration of the roller to its normal position of obstruction when the door is again opened.

While for manufacturing reasons the deformable resilient member 5 is preferably a complete circular roller presenting the same circular surface throughout its entire periphery, it will be appreciated that a roller of full cylindrical form is not necessary for satisfactory operation since only a portion of the circumference of the roller is required to have rolling contact with the door frame.

It will be apparent that, when the shock absorbing device is applied to the outside of the door frame, as shown in Figure 10, it will operate in the same manner as when used on the inside of the door. It will also be apparent that the device is suitable for use on doors of either hand and on doors in which space limitations necessitate the use of a shock absorbing device of compact form.

What I claim is:

1. A shock absorbing device for a door which normally tends to assume closed position, said device comprising a bracket, resilient means adapted to be deformed when arresting the closing movement of said door, and flexible means for movably mounting said resilient means on said bracket, said flexible means constituting a yielding beam, and said bracket being provided with means for causing said flexible means to have a plurality of different effective beam lengths respectively corresponding to different directions of bodily displacement of said resilient means.

2. A shock absorbing device for a door which normally tends to assume closed position with respect to a door frame with which it is associated, said device comprising a bracket, resilient means adapted to be deformed when arresting a closing movement of the door, and yielding means for supporting the resilient means upon the bracket, said yielding means being adapted to flex transversely in a plurality of directions at an angle to each other in response to a corresponding plurality of bodily movements of said resilient means with respect to the bracket and said bracket being provided wtih means whereby said yielding means is enabled to offer different degrees of resisitance when flexed in said different directions.

3. A shock absorbing device for a door which normally tends to assume closed position with respect to a door frame with which it is associated, said device comprising a bracket, resilient means adapted to be deformed when arresting a closing movement of the door, spring means carried by said bracket and yieldingly supporting said resilient means so as to permit the latter to rotate and be displaced bodily with respect to said bracket, said bracket being provided with a base whereby it may be mounted in operative relation to said door and door frame and being also provided wtih an abutment intervening between said base and said resilient means and adapted to be engaged by said resilient means when the latter is arresting a closing movement of the door, and said spring means projecting beyond opposite sides of said resilient means and being attached to said bracket at a plurality of spaced points.

4. A shock absorbing device for a door which normally tends to assume closed position with respect to a door frame with which it is associated, said device comprising a bracket, resilient means adapted to be deformed when arresting a closing movement of the door, and spring means for supporting said resilient means upon the bracket, said spring means being adapted to be energized in a plurality of different amounts by forces respectively acting thereon at different angles thereto, the said different amounts of said forces being respectively induced by equal bodily displacements of said resilient means with respect to said bracket in directions at an angle to each other.

5. A shock absorbing device for a door which normally tends to assume closed position with respect to a door frame with which it is associated, said device comprising a bracket provided with an abutment, resilient means adapted to be deformed by engaging said abutment when arresting a closing movement of the door, and spring means for supporting the resilient means upon the bracket, said resilient means being adapted to be displaced bodily with respect to said bracket in a plurality of directions at an angle to each other and to rotate during one of said bodily displacements to thereby permit movement of the door to final closed position, and said spring means being energized in respectively different amounts by the said bodily displacements of said resilient means.

6. A shock absorbing device for a door which normally tends to assume closed position with respect to a door frame with which it is associated, said device comprising a bracket, a resilient roller member adapted to be deformed when arresting a closing movement of the door, and a coiled spring extending through said roller member for yieldingly mounting the latter upon the bracket so as to enable it to execute a limited rolling movement and to have bodily movements in two directions with respect to said bracket and at an angle to each other, and said bracket being provided with an abutment adapted to be engaged by the roller member when the latter is arresting a closing movement of the door and being provided with means for attaching the said coiled spring thereto and being also provided with means for causing said spring to offer greater resistance to bodily displacement of the roller member in one of its said two directions of movement.

7. A shock absorbing device for a door which normally tends to assume closed position with respect to a door frame with which it is associated, said device comprising a bracket, resilient means adapted to be deformed when arresting a closing movement of the door, and spring means carried by said bracket and yieldingly supporting said resilient means so as to permit the latter to rotate and to be displaced bodily with respect to said bracket in a plurality of directions at an angle to each other, said spring means constantly acting upon said resilient means with a force tending to cause it to occupy a position enabling it to cushion the closing impact of the door, said spring means being adapted to flex with respect to said bracket in a plurality of directions at an angle to each other in response to a corresponding plurality of bodily movements of said resilient means, said bracket being provided with a base whereby it may be mounted in operative relation to said door and door frame, and said spring means projecting beyond opposite sides of said resilient means and being attached to said bracket at a plurality of spaced points on opposite sides of said resilient means.

8. A shock absorbing device for a door which normally tends to assume closed position with respect to a door frame with which it is associated, said device comprising a bracket, a resilient roller member adapted to be deformed when arresting a closing movement of the door, and a coiled spring for yieldingly mounting the roller member on the bracket so as to enable said roller to execute a rotary movement during the final closing movement of the door and to have bodily movements in a plurality of directions with respect to said bracket, the longitudinal axis of a portion of the coils of said coiled spring being substantially coincident with the axis of rotation of said roller member in all positions assumed by the latter, and the said spring constantly acting upon said resilient member with a force tending to cause it to occupy a position enabling it to cushion the closing impact of the door.

9. A shock absorbing device for a door which normally tends to assume closed position with respect to a door frame with which it is associated, said device comprising a bracket having a base whereby it may be secured in position, resilient means adapted to be deformed when arresting a closing movement of the door, and spring means for supporting the resilient means upon the bracket, said resilient means being adapted to be displaced bodily with respect to said bracket in a plurality of directions at an angle to each other, and said bracket having an abutment spaced toward said resilient means from said base and adapted to be engaged by said resilient means when the latter is arresting a closing movement of the door.

10. A shock absorbing device for a door which normally tends to assume closed position with respect to a door frame with which it is associated, said device comprising a bracket, a roller member constituting resilient means adapted to be deformed when arresting a closing movement of the door, yielding means secured to said bracket at opposite sides of said resilient means for supporting the resilient means upon the bracket, said yielding means between its ends being spaced from said bracket so as to enable it to yield in a plurality of directions at an angle to each other in response to a corresponding plurality of bodily movements of said resilient means with respect to the bracket, said yielding means constantly acting upon said resilient means with a force tending to cause it to occupy a position enabling it to cushion the closing impact of the door, and said yielding means serving to maintain said resilient means out of contact with said bracket during the final closing movement of the door to thereby permit said resilient means to execute a rolling movement as the door finally closes.

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