

PATENT SPECIFICATION

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(54) DOOR CLOSING DEVICE

(71) I, YOSHITAKA NAKANISHI a Japanese subject, of 12-9, 5-chome, Yawata, Ichikawa-shi, Chiba-ken, Japan, do hereby declare the invention, for which I pray that

5 a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a door closing device wherein a torsion spring stores energy during opening of a door and applies a biasing force to the door in a direction for closing the door and wherein mechanically frictional brake means controls the closing speed of the door to prevent too rapid closing, or slamming, of the door.

Prior door closing devices have been proposed which have a torsion spring for closing the door and a frictional brake means for preventing too rapid closing, or slamming, of the door. In practice few if any devices of that type are on the market. The reasons appear to be that such known devices do not work properly and smoothly in checking the closing speed of the door, and cannot be maintained in good condition for a long time. Also the devices are complex in structure, expensive, and are not compact.

According to the present invention there is provided a door closing device comprising a casing for connection to the door to be closed, a spindle mounted in the casing and rotatable in either direction, means connected to the spindle for connection to the frame of the door, means comprising a torsion spring circumferentially of said spindle for storing energy during opening of the door and applying a biasing force to said spindle in a direction for closing the door, a brake drum circumferentially of the spindle coaxial with the torsion spring, means connecting the brake drum to the spindle for rotation therewith, a plurality of brake shoes having arcuate braking surfaces biased into engagement with braking surfaces

biased into engagement with the brake drum peripherally thereof thereby to exert a braking force on the drum, a friction brake member coaxial with the drum, and spring means urging the drum and the friction brake member axially into frictional contact with one another, thereby to produce a further braking force coacting with the force exerted by the brake shoes to brake the rotation of the brake drum.

The brake drum, brake shoes and brake member can be made of resilient materials such as plastics or metals.

In the accompanying drawings:

Figure 1 is a perspective view of an embodiment of the door closer according to the present invention;

Figure 2 is a plan view of the door closer without an upper cover plate and an arm;

Figure 3 is a bottom view of the door closer without a lower cover plate and an arm;

Figure 4 is a vertical cross-sectional view of the door closer along the line IV-IV of Figure 2, partly cut away;

Fig. 5 is a longitudinal sectional view of the door closer along the line V-V of Fig. 4;

Fig. 6 is a vertical sectional view of the door closer along the line VI-VI of Fig. 4, partly cut away;

Fig. 7 is a perspective view of a brake drum, a brake shoe and a brake disc;

Fig. 8 is a perspective view of the brake drum viewed from the lower part thereof;

Fig. 9 is a perspective view of the brake disc viewed from the lower part thereof;

Fig. 10 is a perspective view of a rotor and a lining;

Fig. 11 is a vertical sectional view showing a modification of Fig. 4; and

Fig. 12 is a perspective view showing another embodiment of the brake drum.

In Figs. 1 to 4, a casing 1 is secured to the door (not shown) by means of brackets 2 on both sides thereof. A spindle 3 is

[Price 25p]

ture which comprises 100 parts by weight of Duracon (Trademark of Cellanese Co., U.S.A.) and from 10 to 45 parts by weight of asbestos powder. A brake drum of this
 5 mixture has high durability, high friction co-efficient and rigidity, materials, a low creep and low hygroscopicity. As the brake drum wears on its circumferential periphery, the brake drum maintains its rigidity and
 10 friction for reason that the brake drum has the asbestos powder distributed therein uniformly.

Furthermore, the asbestos powder gives thermal resistance to the brake drum which
 15 reduces thermal expansion and thermal strain caused by contact friction. Instead of Duracon, nylon can be used.

It is preferable to form the brake disc and brake shoe of the same material as the
 20 brake drum, as this improves the braking action, and the jagged portion on the periphery of the drum is better able to withstand being broken.

As the spindle 3 has its ends protruding
 25 from both the top 40 and the bottom 30 of the casing 1 either end of the spindle can be connected to the arm 5, so that the device can be used with part 40 of the casing either at the top or at the bottom 30
 30 of the casing, according to whether the door is to swing right handed or left handed. When the arm 5 is connected with the top end of the spindle and not with its bottom end, the bottom end is covered with
 35 a cap 70, made for example of synthetic resin. The cap has a projection extending rigidly and laterally from the edge of the cap and engaging with the edge of the hole 33, of the cover plate 30.

Fig. 11 shows a modification of the device in which the spring 39 is provided at the lower portion of the brake disc 19 instead of pressing the brake drum downwardly into frictional contact with the
 40 brake disc 19, and the spring 39 presses the brake disc 19 upwardly into frictional contact with the brake drum. A cylinder 65 is provided coaxially in the cylinder 16 and extends downwardly from the partition 12.
 50 The spring 39 is located in a space 67 between the cylinder 65 and the spindle 3, and is supported by a flange 66 provided at the lower end of the cylinder. The C-ring 18 is engaged with the groove 17 of the spindle and is positioned between the
 55 flange 66 and the lower end of the spring 39.

Instead of using screw 22 to fix the disc 19 to the partition 12, an axially extending
 60 pin 68 is provided rigidly on the bottom surface of the disc 19, which is received in a hole 69 of the partition 12 movably into the axial direction, so that the brake disc is not rotatable.

65 The casing 1, the partition 12 and the

cylinders 16 65 may be integrally formed by die casting but it is also possible to form each member separately and to assemble them together for example with
 70 screws.

When the door is opened, the spindle is rotated through the arms 5 and 6, and the torsion spring 24 is twisted to store energy and apply a biasing force to the spindle
 75 in a direction to close the door.

When the door is closed by the energy of the torsion spring, the brake shoes are biased into contact with the brake drum symmetrically on both its sides by the
 80 springs 47 so that the door is closed without slamming. The door can be closed smoothly and quietly by the frictional contact between the brake drum and the disc, biased axially towards each other by the
 85 spring 38 or 39 in addition to the frictional contact between the brake drum and shoes.

WHAT I CLAIM IS:—

1. A door closing device comprising a casing for connection to the door to be closed, a spindle mounted in the casing and
 90 rotatable in either direction, means connected to the spindle for connection to the frame of the door, means comprising a torsion spring circumferentially of said spindle for storing energy during opening of
 95 the door and applying a biasing force to said spindle in a direction for closing the door, a brake drum circumferentially of the spindle coaxial with the torsion spring, means connecting the brake drum to the
 100 spindle for rotation therewith, a plurality of brake shoes having arcuate braking surfaces biased into engagement with braking surfaces biased into engagement with the brake drum peripherally thereof thereby to
 105 exert a braking force on the drum, a friction, brake member coaxial with the drum, and spring means urging the drum and the friction brake member axially into frictional contact with one another, thereby to
 110 produce a further braking force coacting with the force exerted by the brake shoes to brake the rotation of the brake drum.

2. A door closing device according to claim 1, in which the brake drum has an
 115 external knurled surface.

3. A door closing device according to either preceding claim, in which the friction brake member is disposed circumferentially of the spindle, and in which the spring
 120 means is disposed internally of the brake drum.

4. A door closing device according to any preceding claim, including a rotor circumferentially of the spindle and rotatable
 125 therewith, the rotor being disposed coaxially with the torsion spring, and means on the rotor for connecting the torsion spring and rotor for variable adjustment of the torsion force developed by the said 130



ture which comprises 100 parts by weight of Duracon (Trademark of Cellanese Co., U.S.A.) and from 10 to 45 parts by weight of asbestos powder. A brake drum of this mixture has high durability, high friction co-efficient and rigidity, materials, a low creep and low hygroscopicity. As the brake drum wears on its circumferential periphery, the brake drum maintains its rigidity and friction for reason that the brake drum has the asbestos powder distributed therein uniformly.

Furthermore, the asbestos powder gives thermal resistance to the brake drum which reduces thermal expansion and thermal strain caused by contact friction. Instead of Duracon, nylon can be used.

It is preferable to form the brake disc and brake shoe of the same material as the brake drum, as this improves the braking action, and the jagged portion on the periphery of the drum is better able to withstand being broken.

As the spindle 3 has its ends protruding from both the top 40 and the bottom 30 of the casing 1 either end of the spindle can be connected to the arm 5, so that the device can be used with part 40 of the casing either at the top or at the bottom 30 of the casing, according to whether the door is to swing right handed or left handed. When the arm 5 is connected with the top end of the spindle and not with its bottom end, the bottom end is covered with a cap 70, made for example of synthetic resin. The cap has a projection extending rigidly and laterally from the edge of the cap and engaging with the edge of the hole 33, of the cover plate 30.

Fig. 11 shows a modification of the device in which the spring 39 is provided at the lower portion of the brake disc 19 instead of pressing the brake drum downwardly into frictional contact with the brake disc 19, and the spring 39 presses the brake disc 19 upwardly into frictional contact with the brake drum. A cylinder 65 is provided coaxially in the cylinder 16 and extends downwardly from the partition 12. The spring 39 is located in a space 67 between the cylinder 65 and the spindle 3, and is supported by a flange 66 provided at the lower end of the cylinder. The C-ring 18 is engaged with the groove 17 of the spindle and is positioned between the flange 66 and the lower end of the spring 39.

Instead of using screw 22 to fix the disc 19 to the partition 12, an axially extending pin 68 is provided rigidly on the bottom surface of the disc 19, which is received in a hole 69 of the partition 12 movably into the axial direction, so that the brake disc is not rotatable.

The casing 1, the partition 12 and the

cylinders 16 65 may be integrally formed by die casting but it is also possible to form each member separately and to assemble them together for example with screws.

When the door is opened, the spindle is rotated through the arms 5 and 6, and the torsion spring 24 is twisted to store energy and apply a biasing force to the spindle in a direction to close the door.

When the door is closed by the energy of the torsion spring, the brake shoes are biased into contact with the brake drum symmetrically on both its sides by the springs 47 so that the door is closed without slamming. The door can be closed smoothly and quietly by the frictional contact between the brake drum and the disc, biased axially towards each other by the spring 38 or 39 in addition to the frictional contact between the brake drum and shoes.

WHAT I CLAIM IS:—

1. A door closing device comprising a casing for connection to the door to be closed, a spindle mounted in the casing and rotatable in either direction, means connected to the spindle for connection to the frame of the door, means comprising a torsion spring circumferentially of said spindle for storing energy during opening of the door and applying a biasing force to said spindle in a direction for closing the door, a brake drum circumferentially of the spindle coaxial with the torsion spring, means connecting the brake drum to the spindle for rotation therewith, a plurality of brake shoes having arcuate braking surfaces biased into engagement with braking surfaces biased into engagement with the brake drum peripherally thereof thereby to exert a braking force on the drum, a friction, brake member coaxial with the drum, and spring means urging the drum and the friction brake member axially into frictional contact with one another, thereby to produce a further braking force coacting with the force exerted by the brake shoes to brake the rotation of the brake drum.

2. A door closing device according to claim 1, in which the brake drum has an external knurled surface.

3. A door closing device according to either preceding claim, in which the friction brake member is disposed circumferentially of the spindle, and in which the spring means is disposed internally of the brake drum.

4. A door closing device according to any preceding claim, including a rotor circumferentially of the spindle and rotatable therewith, the rotor being disposed coaxially with the torsion spring, and means on the rotor for connecting the torsion spring and rotor for variable adjustment of the torsion force developed by the said



spring when the door is opened.

- 5 5. A door closing device according to claim 4, including a casing having a first and a second compartment, the spindle extending axially through the compartments, the spring and rotor being disposed in one of the compartments and the friction brake member and brake drum being disposed in the other of the compartments.
- 10 6. A door closing device, substantially

as herein described with reference to Figures 1 to 10 or Figures 1 to 10 as modified by Figure 11 or 12 of the accompanying drawings.

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