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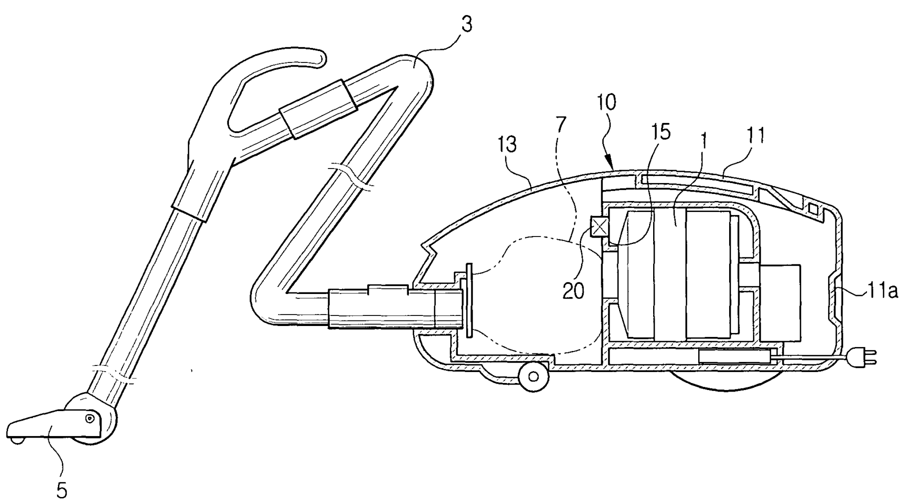
(54) Apparatus for preventing motor overload of a vacuum cleaner

(57) A motor overload preventing apparatus for a vacuum cleaner includes a damper body and an resilient member. The damper body has an opening/closing portion formed on one end, to selectively block a tapered aperture of a body frame of the vacuum cleaner, and the opening/closing portion is tapered to correspond in shape with the aperture. The resilient member resiliently biases the opening/closing portion toward a direction of closing the aperture. The damper body is movably disposed to rotate so as to selectively open and close the aperture, and to this end, it is preferred that the damper body is connected by a hinge to the body frame. Satisfactory sealing can be ensured even when there is surface contact between the opening/closing portion and the aperture without requiring additional material, such as a rubber. Additionally, the number of components can be reduced, and with the omission of flexible material, such as rubber, the manufacturing costs can be reduced.

FIG. 1



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Description

BACKGROUND OF THE INVENTION

1. Field of the invention

[0001] The present invention relates generally to a vacuum cleaner, and more particularly, to an apparatus for preventing overload of a driving motor when it generates a suction force for a vacuum cleaner.

2. Description of the Related Art

[0002] Generally, a vacuum cleaner draws in air and entrained dust by using a suction force that is generated by a driving motor. FIG. 1 schematically shows such a conventional vacuum cleaner.

[0003] Referring to FIG. 1, a conventional vacuum cleaner includes a body 10 in which a driving motor 1 is mounted, a suction pipe 3 which is in fluid communication with the body 10 at one of its ends and a suction nozzle 5 which is formed at the other end of the suction pipe 3 from the end connected to body 10. The body 10 includes a motor housing portion 11, in which the driving motor 1 is disposed, and a dust collecting housing portion 13, that includes a filtering portion 7 for filtering and collecting dust drawn in through the suction pipe 3. The motor housing portion 11 and the dust collecting housing portion 13 are divided from each other by a partition 15.

[0004] The suction pipe 3 contains and transfers the dust from the suction nozzle 5 and directs it toward the dust collecting housing portion 13. It is preferably made of a flexible material.

[0005] The vacuum cleaner constructed as above, draws in dust through the suction nozzle 5 by using the suction force that is generated by the driving motor 1. The air and entrained dust are passed through the suction pipe 3 and the dust is collected in the filtering chamber 7 inside the dust collecting housing portion 13. The air, after it is filtered at the filtering chamber 7, is discharged to the outside of the body 10 through a discharging section 11a, which is formed at a rear side of the motor housing portion 11.

[0006] However, when the filtering chamber 7 is filled with dust, or if the suction pipe 3 becomes clogged, fluid communication through the system is hampered, and therefore, the driving motor 1 suffers an overload condition as a result of lack of available air in the suction process. In order to prevent undesirable damage to the driving motor 1 due to such an overload condition, there is usually provided a motor overload preventing apparatus 20, which permits external air flow into the dust collecting housing portion 13.

[0007] FIGS. 2A and 2B illustrate in cross-sectional views one example of a conventional motor overload preventing apparatus 20. Referring now to FIGS. 2A and 2B, the conventional motor overload preventing apparatus 20 includes a casing 21, a resilient member such as spring 23, an opening/closing member 25 and a flange portion 27.

[0008] The casing 21 defines a space for receiving the spring 23 and the opening/closing member 25. One end of the casing 21 is open, while the other end is formed with a plurality of holes 21a, as shown in FIG. 2B. The casing 21 is also fixed to the partition 15 by the flange portion 27 within an opening 15a of the partition 15, which divides the motor housing portion 11 from the dust collecting housing portion 13.

[0009] The flange portion 27 is formed in an annular or ring shape with a central hole formed therein so as to hold the open end of the casing 21 securely against the partition 15.

[0010] The opening/closing member 25 is formed of a material, such as rubber, to ensure tight sealing capability within the opening 15a. The member 25 selectively opens or closes the ring-type flange portion 27 depending on the relative pressure, as will be explained below. The opening/closing member 25 has a plurality of holes 25a formed to correspond to a ring having a diameter outside of the diameter of a hole 27a at a central location formed in the flange portion 27. When the opening/closing member 25 engages the flange portion 27, it closes the hole 27a of the flange portion 27, and simultaneously the flange portion 27 selectively blocks the holes 25a of the opening/closing member 25.

[0011] The spring 23 is interposed between the other end of the casing 21 and the opening/closing member 25, and resiliently biases the opening/closing member 25 toward the direction of the flange portion 27, thereby maintaining the closed condition of the hole 27a.

[0012] According to the conventional motor overload preventing apparatus 20, constructed as above, if the filtering portion 7 becomes clogged with dust or the suction pipe 3 becomes obstructed during the operation of the vacuum cleaner, thereby causing a negative pressure to be generated inside the dust collecting housing portion 13, the opening/closing member 25 as a result of the negative pressure, overcomes the resilient recovery force of the spring 23 and is transposed toward the dust collecting housing portion 13, and thereby retracts the opening/closing member from the hole 27a.

[0013] Accordingly, the opening/closing member 25 does not block the ring-type flange portion 27, and an external air flow is introduced inside the dust collecting housing portion 13 through the hole 27a of the ring-type flange portion 27, and the holes 25a of the opening/closing member 25 and holes 21a of the casing 21, thus preventing overload conditions of the driving motor 1.

[0014] However, the motor overload preventing apparatus 20 requires an overly complex structure. Further, because the opening/closing member 25 is usually made of expensive material, such as rubber, in order to ensure sufficient sealing of the opening/closing member 25, manufacturing cost increases.

SUMMARY OF THE INVENTION

[0015] In an effort to overcome the above-mentioned problems, it is an aspect of the present invention to provide a motor overload preventing apparatus for use in a vacuum cleaner which has a simple structure and which can reduce inconvenience that results from a requirement for additional material, such as rubber, while ensuring a sealing of an opening/closing member.

[0016] In order to accomplish the above aspect and/or other features of the present invention, an apparatus for preventing motor overload conditions of a vacuum cleaner includes a damper body having an opening/closing portion formed adjacent a first end to selectively block a tapered aperture extending through a body frame of the vacuum cleaner, the opening/closing portion being tapered to correspond in shape with the tapered shape of the aperture, and a resilient member to resiliently bias the opening/closing portion toward a direction of closing the aperture.

[0017] According to one preferred embodiment of the present invention, the damper body is mounted and movably disposed to rotate so as to selectively open and close the aperture, and to this end, the damper body is preferably connected to the body frame and is transversely transposable to selectively open and close the aperture.

[0018] The resilient member preferably comprises a plate spring having two ends which engages and overlaps the damper body adjacent a first end, and the second end engages and overlaps the body frame adj acent the second end.

[0019] According to the preferred embodiment of the present invention, in order to adjust the recovery force biasing the resilient member toward the body frame, a hinge portion of the body frame on which the other end of the resilient member is mounted protrudes from the body frame and the recovery force may be made adjustable by adjusting the position of the plate spring.

[0020] The hinge portion of the body frame is adjustable in the height to which it protrudes from the surface of the body frame of the vacuum cleaner.

[0021] The apparatus for preventing motor overload constructed as above can be mounted in the partition which divides a motor housing, where a driving motor of the vacuum cleaner is disposed, from a dust collecting housing, where a dust filtering portion is placed. Alternatively, the motor overload preventing apparatus can also be mounted on the frame of the dust collecting housing.

[0022] Meanwhile, according to a second preferred embodiment of the present invention, there is provided a cap portion disposed adjacent the second end of the damper body. The resilient member preferably comprises a coil spring interposed between the opening/closing portion of the damper body and the cap portion.

[0023] The coil spring is shaped and configured having a diameter that is larger than the smallest diameter of the tapered opening/closing portion of the damper body, and is larger than the smallest diameter of the aperture.

[0024] Further, the damper body comprises a plurality of holes to permit air to flow therethrough, and the plurality of holes extend in a lengthwise direction of the damper body so as to define posts.

[0025] The above-described apparatus for preventing motor overload constructed can be mounted on the partition which divides a motor housing, where a driving motor of the vacuum cleaner is placed, from a dust collecting housing, where a dust filtering portion is placed. Alternatively, the motor overload preventing apparatus can also be mounted on the frame of the dust collecting housing.

[0026] Instead of forming the opening/closing portion with additional material, such as rubber, satisfactory sealing can be ensured by tapering the opening/closing portion and the aperture even when surface contact occurs between the opening/closing portion and the aperture. Additionally, the number of components can be reduced, and with the omission of expensive flexible material, such as rubber, the manufacturing cost can be reduced.

BRIEF DESCRIPTION OF THE DRAWING FIGURES

[0027] The above aspects and other features of the present invention will become more apparent by describing in detail preferred embodiments thereof with reference to the attached drawings, in which:

FIG. 1 is a partial cross-sectional view of a conventional vacuum cleaner;

FIGS. 2A and 2B are cross-sectional views illustrating the operation of a motor overload preventing apparatus of the conventional vacuum cleaner;

FIGS. 3A to 3C are, respectively, an exploded perspective view, a front view and a side view, illustrating a motor overload preventing apparatus according to a first preferred embodiment of the present invention;

FIGS. 4A and 4B are side views illustrating in partial cross-section the operation of the motor overload preventing apparatus as shown in FIGS. 3A to 3C;

FIGS. 5A and 5B are, respectively, an exploded perspective view and a side view, showing a motor overload preventing apparatus according to a second preferred embodiment of the present invention; and

FIGS. 6A and 6B are side views illustrating the operation of the motor overload preventing apparatus shown in FIGS. 5A and 5B.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0028] Hereinafter, the present invention will be described in detail with reference to the accompanying drawings. Throughout the description, the elements similar to, or identical with, those described in the background art as illustrated in FIGS. 1 and 2A-B will be identified by the same reference numerals and further detailed description of the structure and function thereof will rely on the description made above.

[0029] FIGS. 3A-C and 4A-B are views of a motor overload preventing apparatus for use in a vacuum cleaner according to a first preferred embodiment of the present invention.

[0030] Referring now to FIGS. 3 and 4, the first preferred embodiment of the motor overload preventing apparatus 100 includes a damper body 101 and a resilient member 107.

[0031] A tapered opening/closing portion 101a is formed in an end of the damper body 101, while the other end of the damper body 101 is connected to the partition 15 of the vacuum cleaner by a hinge, as shown. More specifically, the damper body 101 is connected to the partition 15 by the cooperation of rotary axes 101b, which laterally protrude from both sides of the other end of the damper body 101, and hinge mounts 115, each having an axis hole on which the two opposite ends of rotary axis 101b is turnably seated, are disposed on the partition 15.

[0032] The tapered opening/closing portion 101a is shaped and configured to enable it to block a corresponding tapered aperture 113 of the partition 15 that divides the motor housing 11 from the dust collecting housing 13. The tapered aperture 113 is tapered so as to correspond to the shape of the tapered opening/closing portion 101a. The opening/closing portion 101a and the aperture 113 are each tapered so as to ensure sufficient sealing capacity therebetween as a result of surface contact of the tapered surfaces. Accordingly, there is no need to provide to the opening/closing portion 101a any additional material such as rubber, and therefore, manufacturing costs can be reduced.

[0033] The resilient member 107 resiliently biases the damper body 101 toward the direction where the opening/closing portion 101a of the damper body 101 closes the aperture 113 of the partition 15. According to one preferred embodiment of the present invention, the resilient member 107 further comprises a plate spring, and more preferably comprises stainless spring steel.

[0034] In the present embodiment, in order to allow the resilient member 107 to attach to the damper body 101 more securely, one end of the resilient member 107 is overlaps the damper body 101, while the other end is overlaps with the partition 15. The partition 15, where the other end of the resilient member 107 is mounted, includes a fixing portion 111 disposed thereon which protrudes so as to cause the resilient member 107 to have a predetermined resilient recovery force biasing the spring toward the partition 15. Due to the fixing portion 111 of the partition 15, the resilient member 107 resiliently biases one end of the damper body 101 toward the aperture 113 of the partition 15.

[0035] Also, in order to facilitate the overlap of the resilient member 107, resilient member receiving portions 101c, 111a (FIG. 3A) are formed to engage each other at the other end and the fixing portion 111 of the damper body 101.

[0036] The fixing portion 111 of the partition 15 is preferably adjustable in the height to which it can protrude above the surface of partition 15. Accordingly, the resilient recovery force can be adjusted appropriately by adjusting the protruding height of the fixing portion 111 without being influenced by the elastic modulus of the resilient member 107.

[0037] The operation of the motor overload preventing apparatus 100 will be described below. When there is dust undesirably clogging the filtering portion 7 or when the suction pipe 3 is obstructed by dust or other obstruction, negative pressure is generated inside the dust collecting housing 13. Because of the negative pressure, the opening/closing portion 101a of the damper body 101 is able to overcome the resilient recovery force of the resilient member 107, and consequently it rotates about the rotary axes 101b in a counter-clockwise direction away from aperture 113 and toward the dust collecting housing 13, as shown in FIG. 4A.

[0038] As the opening/closing portion 101a is rotated, the aperture 113 of the partition 15 is opened, and therefore, flow of external air is introduced into the dust collecting housing 13. By the external air flow being introduced, overload conditions of the driving motor 1 can be prevented.

[0039] Meanwhile, as the dust of the filtering portion 7 is borne away by the air flow, or the suction pipe 3 again achieves fluid communication, the negative pressure is lessened to below a certain degree so that the damper body 101 cannot any longer overcome the resilient recovery force of the resilient member 107. Accordingly, the damper body 101 is rotated by the resilient member 107 in a clockwise direction toward the aperture 113 so as to block the aperture 113 in the partition 15, as shown in FIG. 4B.

[0040] Meanwhile, FIGS. 5A and 5B are exploded perspective and side views, respectively, of a motor overload preventing apparatus 200 for use in a vacuum cleaner according to a second preferred embodiment of the present invention. Referring to FIGS. 5A and 5B, the motor overload preventing apparatus 200 includes a damper body 201 and a resilient member 203.

[0041] A tapered opening/closing portion 201a is formed adjacent one end of the damper body 201, and a cap portion 205, which will be described below, is formed adjacent the other end of the damper body 201. The cap portion 205 may be separately made and attached to the damper body 201, as shown. Alternatively, the cap portion 205 may be integrally formed as part of the damper body 201. The tapered opening/closing portion 201a blocks the aperture 215 of the partition 15 which divides the motor housing 11 from the dust collecting housing 13, and the aperture 215 is also tapered to correspond in shape to the taper of opening/closing portion 201a.

[0042] Because of the tapered shape of the opening/closing portion 201a, sufficient sealing capacity can be ensured even when surface contact between the opening/closing portion 201a and the aperture 215 is present. Accordingly, there is no need to employ additional material, such as rubber, to ensure sealing between the aperture 215 and the opening/closing portion 201a, and thus manufacturing costs can be reduced.

[0043] Further, there is a plurality of slots 201b formed in the damper body 201 so as to permit air to pass therethrough. According to the present embodiment, the slots 201b are extended in the lengthwise direction, and the slots 201b define a plurality of posts 207, which are arranged annularly around a central longitudinal passage 209.

[0044] The cap portion 205, at the other end of the damper body 201, also has a plurality of holes 205a to permit air to flow therethrough. The cap portion 205 is biased against protrusions at the end of the posts by the resilient member 203 so as to retain it in place and inhibit it from separating from the mounting mechanism.

[0045] The resilient member 203 resiliently supports and biases the damper body 201 toward the direction where the opening/closing portion 201a of the damper body 201 closes the aperture 215 of the partition 15. In the present embodiment, the resilient member 203 is a coil spring. The coil spring 203 is interposed between the opening/closing portion 201a of the damper body 201 and the cap portion 205.

[0046] One end of the coil spring 203 engages the partition 15, while the other end engages the cap portion 205. It is preferred that the coil spring 203 has a diameter larger than the smallest diameter of the tapered opening/closing portion 201a of the damper body 201, and also larger than the smallest diameter of the tapered aperture 215 of the partition 15. By this construction, the coil spring 203 is supported by the wall of the partition 15 even when the damper body 201 moves laterally, and thus can exert a predetermined resilient recovery force to bias the cap portion 205 away from the partition 15.

[0047] The operation of the overload preventing apparatus 200 constructed in accordance with the above described embodiment will be described below in more detail.

[0048] When there is dust clogging the filtering portion 7 or when the suction pipe 3 is obstructed by an object or by collected dust, negative pressure is generated inside the dust collecting housing 13. As a result of the negative pressure, the opening/closing portion 201a of the damper body 201 overcomes the recovery force of the coil spring 203 and causes the damper body 201 to move toward the dust collecting housing 13, as shown in FIG. 6A. One end of the coil spring 203 engages the partition 15, and the other end engages the cap portion 205a. Together with the damper body 201, the cap portion 205a is also transposed toward the partition 215 by the pressure of the external atmosphere applied to the opening/closing portion 201a, and by the movement of the cap portion 205a, the coil spring 203 is compressed.

[0049] As the opening/closing portion 201a is transposed to open the aperture 215 in the partition 15, external air flow is introduced into the dust collecting housing 13, and therefore, prevents overload of the motor 1.

[0050] Meanwhile, with the dust of the filtering portion 7 being cleaned, or the obstruction in suction pipe 3 being removed so as to resume fluid communication, the negative pressure is lessened to below the threshold amount so that the damper body 101 is not impelled to overcome the resilient recovery force of the coil spring 203. Accordingly, as shown in FIG. 6B, the damper body 201 is transposed toward the motor housing 11 by the resilient recovery force of the coil spring 203, and therefore, the opening/closing portion 201a re-blocks the aperture 215 of the partition 15.

[0051] Although the preferred embodiments are described above for purposes of illustration and description, the invention is not to be considered limited by the above description, but is to be considered as including any modifications, changes and alterations and the invention is to be limited only by the following claims.

Claims

1. An apparatus for preventing motor overload during operation of a vacuum cleaner, comprising:

   a damper body having an opening/closing portion formed adjacent to a first end to selectively block a tapered aperture extending through a body frame of the vacuum cleaner, the opening/closing portion being tapered to correspond in shape with the tapered shape of the aperture; and

   a resilient member to resiliently bias the opening/closing portion toward the direction of closing the aperture.

2. The apparatus of claim 1, wherein the damper body is mounted and movably disposed to rotate so as to selectively open and close the aperture.

3. The apparatus of claim 1 or 2, wherein the damper body is connected to the body frame and is transversely transposable to selectively open and close the aperture.

4. The apparatus of claim 1, 2 or 3, wherein the damp-

er body is connected to the body frame by a mounting mechanism removed from the aperture through the cooperation of a rotary axis which is disposed adjacent a second end of the damper body, the mounting mechanism having a hinge portion which has an axis mount for receiving the rotary axis in an upright position and the mounting mechanism protrudes outwardly from the body frame.

5. The apparatus of any preceding claim, wherein the resilient member further comprises a plate spring, having two ends, which engages the damper body adjacent the first end, and engages the body frame adjacent the second end.

6. The apparatus of any preceding claim, wherein one end of the resilient member overlaps the damper body and the other end overlaps the body frame.

7. The apparatus of claim 4 or claim 5 or 6 when appendant to 4, wherein the mounting mechanism further comprises a hinge portion protruding from the body frame, and having a plate engagement section connected to the second end of the resilient member so as to enable adjustment of the recovery force provided by the resilient member by adjusting the position with respect to the body frame.

8. The apparatus of claim 7, wherein the hinge portion is adjustable in the height to which it protrudes from the surface of the body frame of the vacuum cleaner.

9. The apparatus of any preceding claim, wherein a cap portion is disposed adjacent the second end of the damper body, and the resilient member further comprises a coil spring interposed between the opening/closing portion of the damper body and the cap portion.

10. The apparatus of claim 9, wherein the coil spring is shaped and configured having a diameter that is larger than the smallest diameter of the tapered opening/closing portion of the damper body, and is larger than the smallest diameter of the aperture.

11. The apparatus of any preceding claim, wherein the damper body comprises a plurality of holes to permit air to flow therethrough.

12. The apparatus of claim 11, wherein the plurality of holes extend in a lengthwise direction of the damper body, thereby defining posts.

13. The apparatus of claim 9 or 10 or claim 11 or 12 when appendant to claim 9 or 10, wherein the cap portion comprises a plurality of holes to permit air to pass therethrough.

14. The apparatus of claim 9, 10 or 13 or claim 11 or 12 when appendant to claim 9, 10 or 13 wherein the coil spring is fixed to the body frame adjacent one end, and fixed to the cap portion adjacen the other end.

FIG. 1

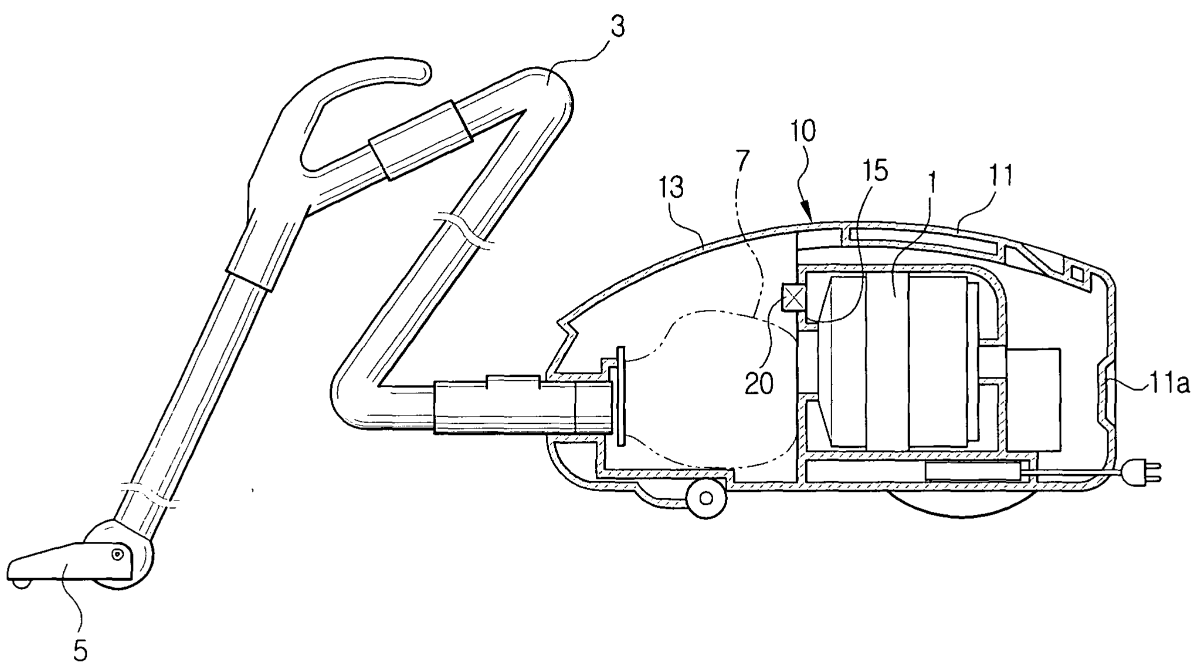

FIG. 2A

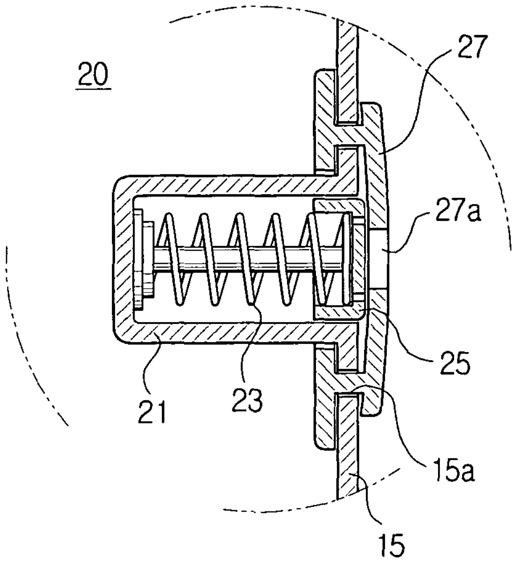

FIG. 2B

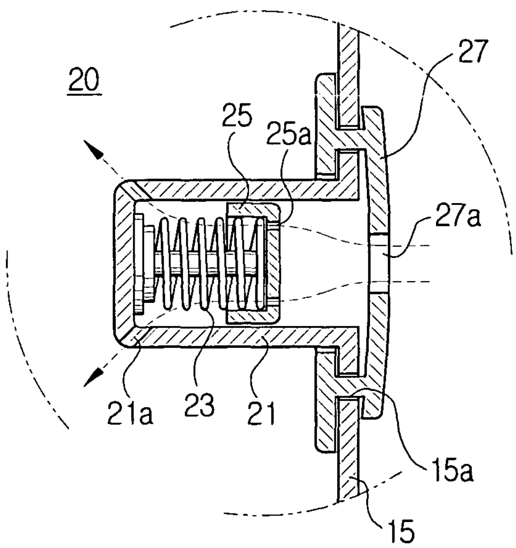

FIG. 3A

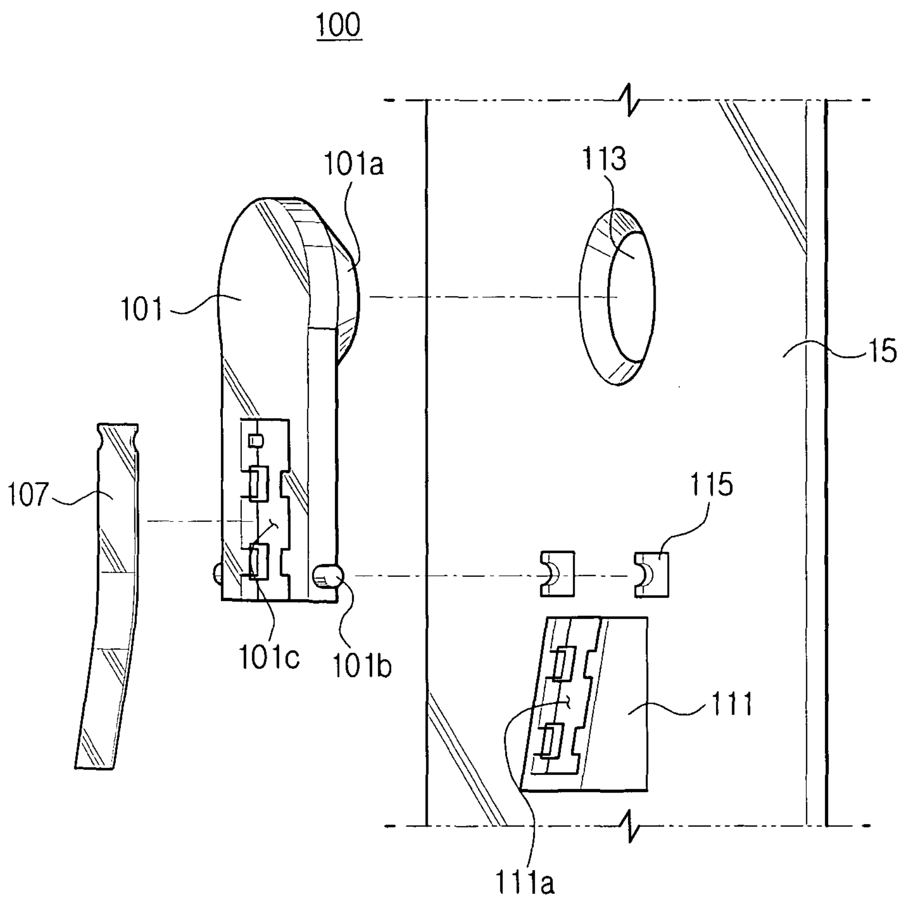

FIG. 3B

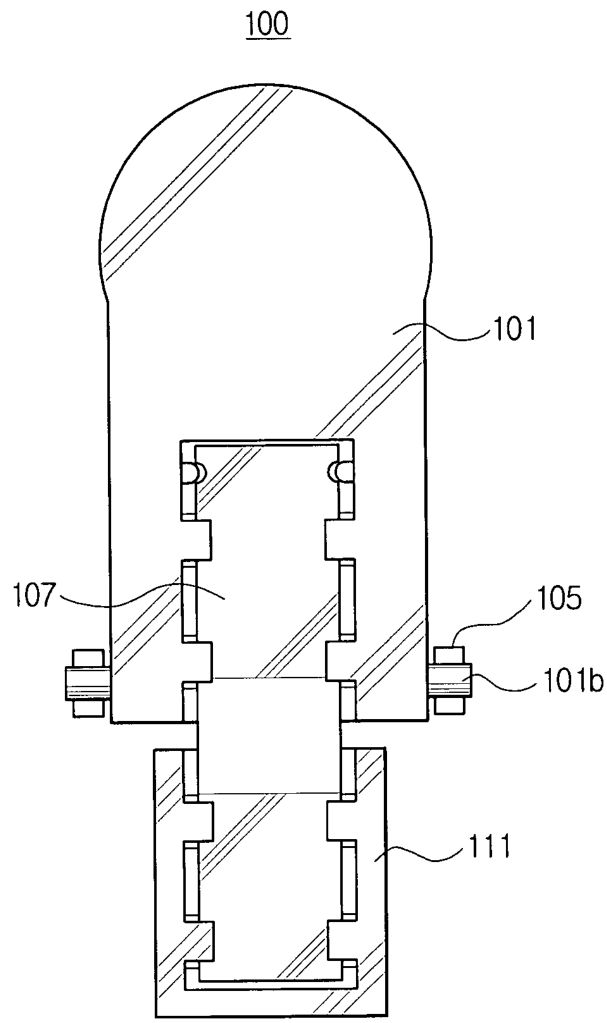

FIG. 3C

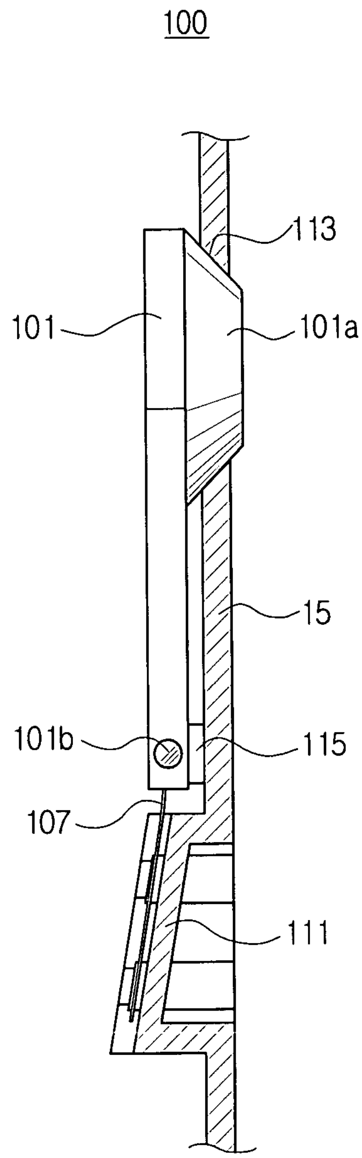

FIG. 4A

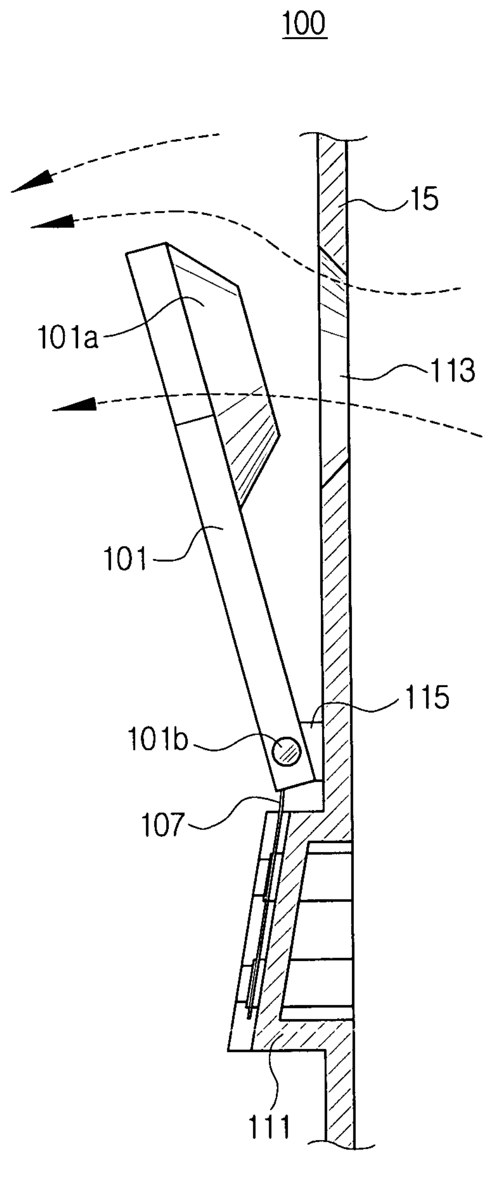

FIG. 4B

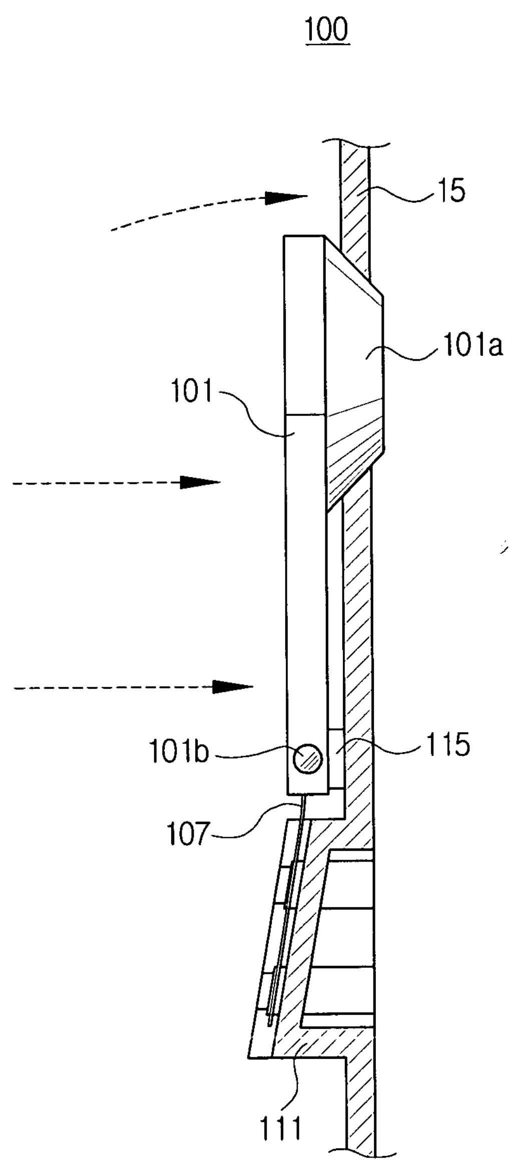

FIG. 5A

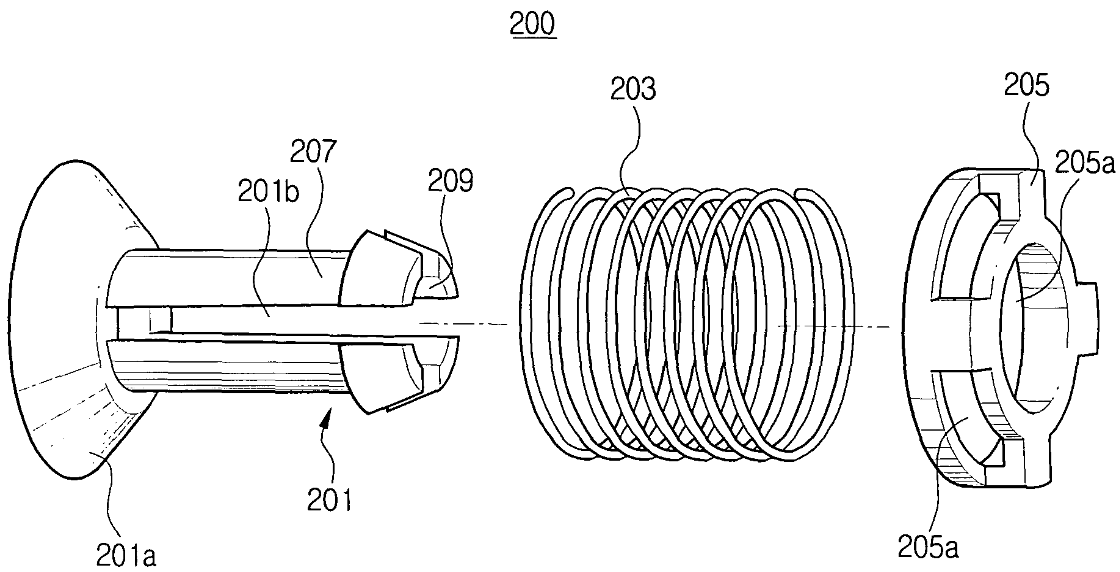
200
203
205
207
201b
209
205a
201
201a
205a

FIG. 5B

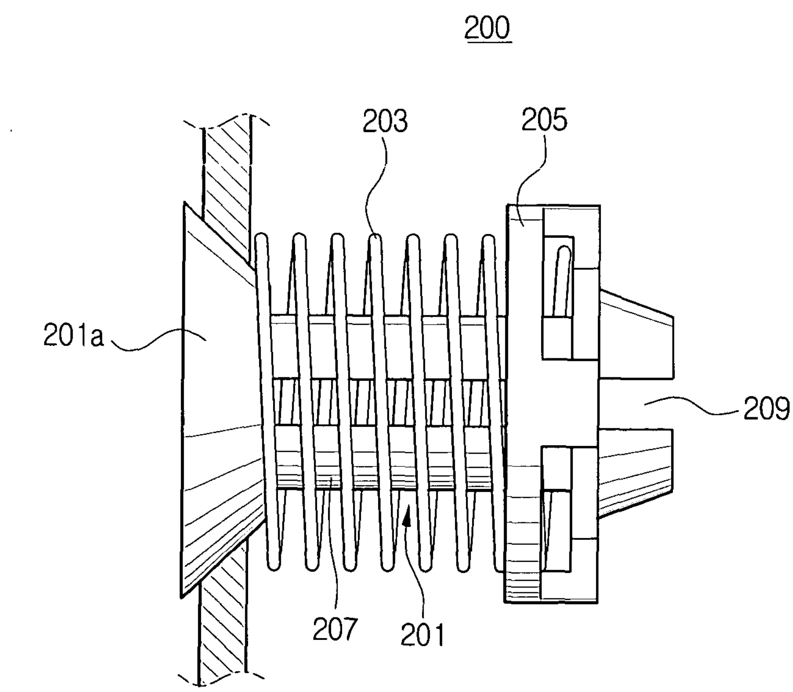
200
203
205
201a
209
207
201

FIG. 6A

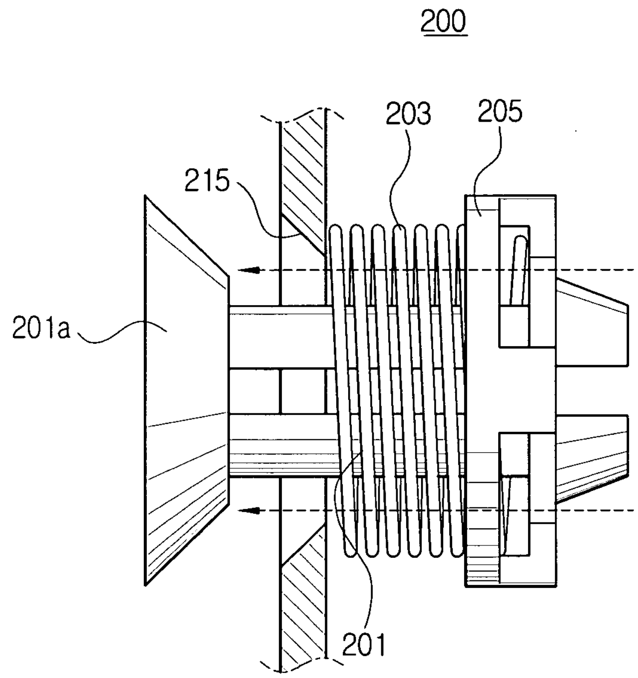

FIG. 6B