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ABSTRACT

A drum brush having a drum rotation body, a pair of bearing holders, a pair of bearings, a shaft, a pair of end-caps and pressing rings, includes bristle tufts, and the pair of bearing holders are provided to be connected to or integrally formed with both ends of the drum rotation body. A pair of bearings, each having an inner race and an outer race, are connected to each of the bearing holders. The shaft penetrates each of the inner races of the bearings and is connected to the end-cap at either end. The pressing ring is interposed between each bearing holder and each bearing to prevent rotation of the outer race. Accordingly, when the drum rotation body rotates, the bearing holder is not damaged by frictional contact with the bearing.
FIG. 2
(PRIOR ART)
FIG. 3
(PRIOR ART)
FIG. 5
DRUM-BRUSH AND A VACUUM CLEANER HAVING THE SAME

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates generally to a vacuum cleaner and more particularly relates to a drum-brush having an improved structure, and a vacuum cleaner using the same.

[0003] 2. Description of the Background Art

[0004] Conventional vacuum cleaners draw dust and foreign substances from a surface being cleaned using a high vacuum pressure generated by an internal motor. Vacuum cleaners can largely be classified into upright-type, canister-type, and stick-type vacuum cleaners, according to their structure and general appearance.

[0005] FIG. 1 shows an upright vacuum cleaner as an example of a conventional vacuum cleaner. As shown in FIG. 1, the conventional upright vacuum cleaner comprises a cleaner body 10 having a dust collection chamber 10a and a motor driving chamber (not shown), and a suction port body 20 connected to a lower part of the cleaner body 10. The dust collection chamber 10a is in fluid communication with the motor driving chamber and a suction port 20, and has therein a dust bag that filters out the dust from the air that is drawn into the suction port 20a. In the motor driving chamber, a suction motor 40 is mounted to generate a vacuum. When the suction motor 40 (shown in phantom) is driven, a vacuum is generated in the dust collection chamber 10a, and air and entrained dust are drawn into the dust bag in the dust collection chamber 10a through the suction port 20a. Then, the air flows out of the dust bag, while the dust is collected therein. The cleaned air is discharged to a discharge unit 11, after passing through the motor driving chamber.

[0006] A housing 21 of the suction port body 20 houses a drum brush 100 above the suction port 20a. The drum brush 100 agitates the surface being cleaned and loosens dirt and dust embedded in the surface being cleaned. The drum brush is normally rotated by a driving source, such as a motor or a turbine apparatus mounted in the suction port body 20.

[0007] Referring to FIG. 2, the drum brush 100 comprises a drum rotation body 110, a shaft 140 and a bearing holder 120, a bearing 130, and an end-cap 150 at each end of the drum rotation body 110. A spiral brush member 111 is attached to an outer circumference of the drum rotation body 110, and a driving belt 30 (FIG. 1) is connected adjacent one side of the outer circumference of the drum rotation body 110. A bearing holder 120 is securely inserted, one in each end of the drum rotation body 110, and a washer 160 is inserted in each bearing holder 120. Each bearing 130 comprises an outer race 131 and an inner race 132. The shaft 140 penetrates through the center of the drum rotation body 110 so that an end is inserted in the inner race 132 of the bearings 130. End-caps 150 are connected, one each to both of the ends of the drum rotation body 110. In the center of each end cap 150, a shaft-receiving hole 150a is disposed to be engaged with an opposed end of the shaft 140.

[0008] As shown in FIG. 3, the end-cap 150 is connected to the housing 21, and the shaft 140 extends through the inner race 132, and is connected to an end of the end-cap 150. As a result, the end-cap 150, the shaft 140 and the inner race 132, in combination, form a stationary assembly by being fixed relative to the housing 21, and the outer race 131, the bearing holder 120 and the drum rotation body 110, in combination, form a rotating assembly. The washer 160, which is inserted between the bearing holder 120 and axial surface of the bearing 130, secures the outer race 131 of the bearing 130 to the bearing holder 120. Therefore, when the driving belt 30 (FIG. 1) operates to rotate the drum rotation body 110, the combination of the drum rotation body 110, the bearing holder 120 and the outer race 131 all rotate with respect to the shaft 140.

[0009] However, in the conventional drum brush 100 having the above construction, the outer race 131 of the bearing 130 may rotate within its seat in an inner circumference of the bearing holder 120, or may rotate together with the bearing holder 120 within its seat, due to vibration caused by the rotation of the drum rotation body 110. Therefore, frictional heat may be generated between bearing holder 120 and the outer race 131. When used for an extended period of time, the bearing holder 120, which may be made of a plastic or other similar materials, becomes worn out and may be damaged by the heat. Furthermore, the drum rotation body 110 may vibrate due to eccentric motion when rotating. Thus, what is needed is a mechanism that will retain the stationary parts stationary relative to each other.

SUMMARY OF THE INVENTION

[0010] An aspect of the present invention is to solve at least the above problems and disadvantages and to provide at least the advantages described below. Accordingly, an aspect of the present invention is to provide a drum brush, which does not cause damage to the bearing holder, by preventing the outer race of a bearing inserted in the bearing holder from rotating, for use in a vacuum cleaner.

[0011] In order to achieve the above-described aspects of the present invention, there is provided a drum brush having a drum rotation body, a pair of bearing holders, a pair of bearings, a shaft, and a pair of end-caps and pressing rings. The drum rotation body includes a drum member, and a pair of bearing holders is provided in to be connected one to each end of the drum rotation body. The bearings each comprise an inner race and an outer race, which are connected to each of the bearing holders. The shaft penetrates each of the inner races of the bearings and is connected to the end-caps at either end. A pressing ring is interposed between each of the bearing holders and the bearings to prevent rotation of the outer races.

[0012] In the drum brush of the above construction, the pressing rings may comprise a body plate, and at least one pressing protrusion formed on the body plate.

[0013] The pressing protrusion preferably protrudes toward an inner circumference of the pressing ring.

[0014] A fixing protrusion is preferably provided on an outer circumference of the pressing ring.

[0015] The pressing ring is preferably made of stainless steel.

[0016] A fixing rib is included in each bearing holder, which tightly contacts the outer race of the associated bearing.
A locking groove is preferably formed inside the end of the drum rotation body, and a corresponding locking protrusion is formed on an outer circumference of the bearing holder for insertion into the locking groove.

In a vacuum cleaner comprising a cleaner body in which a vacuum generating device for generating a suction force, and a dust collection chamber for collecting dust are provided, a suction port body having a suction port connected to the dust collection chamber, and a drum brush rotatably mounted to the suction port body, the drum brush comprises a drum rotation body, a pair of bearing holders, a pair of bearings, a shaft, and a pair of end-caps and pressing rings. The pressing rings are interposed between each of the bearing holders and the bearings in order to prevent rotation of the outer races of the bearings.

The drum rotation body and the bearing holder may be integrated to save the number of component parts and manufacturing processes.

**BRIEF DESCRIPTION OF THE DRAWING FIGURES**

The above object and other features of the present invention will become more apparent by describing in detail exemplary embodiments thereof with reference to the attached drawing figures, wherein;

**FIG. 1** is a perspective view of a conventional upright vacuum cleaner;

**FIG. 2** is a perspective, exploded view of a conventional drum brush;

**FIG. 3** is a sectional view of the drum brush shown in **FIG. 2** in an assembled state;

**FIG. 4** is a perspective, exploded view of a drum brush according to an embodiment of the present invention;

**FIG. 5** is a perspective view of a fixing ring of the drum brush according to an embodiment of the present invention;

**FIG. 6** is a sectional view of the drum brush according to an embodiment of the present invention in an assembled state;

**FIG. 7** is an exploded perspective view schematically showing a drum brush according to another embodiment of the present invention; and

**FIG. 8** is a sectional view of a drum brush as completely assembled, according to yet another embodiment of the present invention.

In the drawing figures, it will be understood that identical reference numerals refer to identical or like elements, features and structures between the different drawing figures.

**DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS**

Hereinbelow, an embodiment of the present invention will be described in detail with reference to the accompanying drawing figures. Further, in referring to the elements having the same structure and operation as that described relating to the prior art, the elements will be identified by the same reference numerals throughout the drawing figures.

As shown in **FIG. 4**, the inventive drum brush 200 according to an embodiment of the present invention comprises a drum rotation body 210, a bearing holder 220, a bearing 230, a shaft 240, an end-cap 250 and a pressing ring 260. The bearing holder 220, the bearing 230, the shaft 240, the end-cap 250 and the pressing ring 260, respectively, are shown at one end of the drum brush 200. However, it is understood that the elements are provided in pairs for inserting at both ends of the drum rotation body 210. It will be understood that a mirror image of the connection structure illustrated and described is disposed at the other end of the drum rotation body 210. However, since the shape and function of such mirror image will be fully understood from the foregoing description, it will not be further described or illustrated.

The drum rotation body 210 comprises one or more spirally disposed rows of bristle tufts 211, which are connected along an outer circumference of the body 210 to loosen and dislodge dust on a surface being cleaned. At least one locking groove 212 is provided on the inner surface of the end of the drum rotation body 210. A plurality of locking grooves 212 can be provided, as shown in **FIG. 4**. When a plurality of the locking grooves 212 are provided, intervals between the respective locking grooves 212 are preferably uniform. An annularly shaped belt connection part 213 is formed at one side of the outer circumference of the drum rotation body 210, preferably adjacent one of the ends, as shown. The belt connection part 213 is used for engagement with the driving belt 30 (**FIG. 1**), which is connected to transmit a rotational driving force to the drum rotation body 210.

A bearing holder 220 is disposed at each end of the drum rotation body 210. The bearing holder 220 has one or more spaced locking protrusions 221 for engagement with the locking grooves 212 of the drum rotation body 210. The bearing 230 includes an outer race 231 and an inner race 232, and is mounted in the bearing holder 220, which is connected to an end of the drum rotation body 210. Inside the bearing holder 220, a fixing rib 222 (**FIG. 6**) is provided to be in tight contact with the bearing 230 so as to prevent relative axial motion between the bearing holder and the outer race 231 of the bearing 230. The fixing rib 222 tightly contacts the outer race 231 of the bearing 230, thereby reinforcing engagement between the bearing holder 220 and the outer race 231.

The shaft 240 is mounted in the drum rotation body 210 so that an end thereof protrudes beyond the end of the drum rotation body 210. A first knurled portion 241 is formed at the end of the shaft 240. The shaft 240 is forcibly inserted in the inner race 232 of the bearing 230 to form an interference fit therebetween as shown in **FIG. 6**, and the end of the shaft 240 protrudes from the inner race 232 to be connected to the end-cap 250 by engagement therewith.

The end-cap 250 covers an end of the drum rotation body 210, and supports the inner race 232 -of the bearing 230 and the shaft 240. A boss 251 (**FIG. 6**) protrudes inwardly in the center of the end-cap 250, and a connection hole 251a is formed in the boss 251, to which the end of the shaft 240 is inserted. On an inner circumference of the boss...
a second knurled portion 252 is provided, corresponding to the first knurling portion 241 for engagement therewith. When the shaft 240 is inserted in the connection hole 251a, the second knurled portion 252 tightly contacts the first knurled portion 241 in an interference fit, and the shaft 240 is fixed to the end-cap 250. The boss 251 also tightly contacts the inner race 232 of the bearing 230, and retains its relative position as a result of frictional force.

The pressing ring 260 is shown in greater detail in FIG. 5, and comprises an annular body plate 261 formed by curving an elongated metal band, and a plurality of pressing protrusions 262, protruding toward an inner circumference of the body plate 261. The pressing protrusions 262 may be formed by pressing of the body plate 261. The shape of the pressing protrusions can vary, and it is not limited to a square or frustum, as shown in FIG. 5. On an outer circumference of the body plate 261, one or more fixing protrusions 263 are formed, which also may be formed by pressing of the body plate 261. The pressing ring 260 is preferably made of a stainless steel having high strength and resistance against corrosion that may otherwise result from possible oil leaking from the bearing 230.

The pressing ring 260 is interposed between an inner annular surface of the bearing holder 220 and the outer race 231 of the bearing 230, as shown in FIG. 6, and the outer race 231 is fixed to the bearing holder 220. Since the fixing protrusions 263 (FIG. 5) of the pressing ring 260 tightly contact an inner circumference of the bearing holder 230, the pressing holder 260 cannot easily be withdrawn from the bearing holder 220.

According to another embodiment of the present invention, as shown in FIGS. 7 and 8, the bearing holder 220 may be integrally formed with the drum rotation body 210. Same drawing reference numerals are used for the same elements as in the previous embodiment of the present invention.

As shown in FIG. 7, the drum brush 300 comprises a drum rotation body 310, a bearing holder 320, the bearing 230, the shaft 240, the end-cap 250 and the pressing ring 260. The bearing holder 320 is integrally formed with both ends of the drum rotation body 310, thereby supporting the outer race 231 of the bearing 230. Inside the bearing holder 320, a fixing rib 322 (FIG. 8) is provided in tight contact with the bearing 230. The fixing rib 322 tightly contacts the outer race 231 of the bearing 230, thereby reinforcing engagement between the bearing holder 220 and the outer race 231.

After assembly, the drum brush 200 and 300 is mounted in a housing 21 of a suction port body 20 (FIG. 1), with the end-cap 250 fixed to the housing 21, with a brush member 211 protruding out of a suction port 20a (FIG. 1) extending underneath the housing 21, as shown in FIG. 6. Because the end-cap 250 is fixed so as to avoid rotation, the shaft 240 and the inner race 232 are also fixed in place. The outer race 231, the bearing holder 220 and 320 and the drum rotation body 210 and 310 altogether constitute a rotating assembly, which rotates with respect to the shaft 240.

During operation, a suction motor 40 (FIG. 1) in the cleaner body is driven, thereby generating a vacuum pressure in a dust-collection chamber. Additionally, the drum rotation body 210 and 310 (FIG. 4) is rotated by a driving force applied through a driving belt 30 (as shown in FIG. 1), extending from the motor or a turbine provided in the suction port body 20 of the vacuum cleaner. The dust lying on a surface being cleaned under the suction port 20a is loosened and dislodged by the brush member 211 of the drum rotation body 210 and 310, and is then drawn into the suction port 20a.

When the drum rotation body 210 and 310 rotates, the pressing ring 260 between the bearing holder 220 and 320 and the outer race 231 inhibits the relative rotation of the bearing holder 220 and 320 with respect to the outer race 231. Therefore, the drum rotation body 210 and 310 can rotate in a stable manner.

As can be appreciated from the above description and by the illustrated embodiments of the present invention, the pressing ring 260 is provided to prevent the bearing holder 220 and 320 and the outer race 231 from rotating relative to each other. As a result, rotation of the drum rotation body 210 and 310 does not cause abrasion or damage to the bearing holder 220 and 320.

Furthermore, according to the present invention, the drum rotation body 210 and 310 is inhibited from eccentric vibration when rotating.

According to another embodiment of the present invention, since the drum rotation body and the bearing holder are integrally formed with each other, the number of component parts and manufacturing processes can be reduced, thereby improving productivity of the drum brush.

While the invention has been shown and described with reference to specific embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention as defined by the appended claims.

What is claimed is:
1. A drum brush comprising:
   a drum rotation body comprising a plurality of bristle tufts disposed on the circumference thereof;
   a bearing holder mounted at an end of the drum rotation body;
   a bearing mounted in the bearing holder, the bearing comprising an outer race and an inner race;
   a shaft inserted in the inner race of the bearing;
   an end-cap connected to and supporting an end of the shaft; and
   a pressing ring interposed between the bearing holder and the bearing.
2. The drum brush of claim 1, wherein the bearing holder is integrally formed with the drum rotation body.
3. The drum brush of claim 1, wherein the pressing ring comprises:
   a body plate; and
   at least one pressing protrusion formed on the body plate.
4. The drum brush of claim 1, wherein the pressing ring comprises:
   a body plate; and
   at least one pressing protrusion formed on the body plate.
5. The drum brush of claim 3, wherein the pressing protrusion protrudes toward an inner circumference of the pressing ring.

6. The drum brush of claim 1 further comprising at least one fixing protrusion formed toward an outer circumference of the pressing ring.

7. The drum brush of claim 1, wherein the pressing ring is made of stainless steel.

8. The drum brush of claim 1, wherein the bearing holder comprises a fixing rib formed therein, which is in tight contact with the outer race of the bearing.

9. The drum brush of claim 1, wherein a locking groove is formed inside the end of the drum rotation body, and a corresponding locking protrusion is formed on an outer circumference of the bearing holder for insertion into the locking groove.

10. A vacuum cleaner comprising a cleaner body having a vacuum generating device for generating a suction force, and a dust collection chamber for collecting dust, a suction port body having a suction port connected to the dust collection chamber, and a drum brush rotatably mounted to the suction port body, the drum brush comprising:

   a drum rotation body having a plurality of bristle tufts disposed on the circumference thereof;

   a bearing holder mounted at an end of the drum rotation body;

   a bearing mounted in the bearing holder, the bearing having an outer race and an inner race;

   a shaft inserted in the inner race of the bearing;

   an end-cap connected to and supporting an end of the shaft, and being connected to the suction port body; and

   a pressing ring interposed between the bearing holder and the bearing.

11. The vacuum cleaner of claim 10, wherein the bearing holder is integrally formed with the drum rotation body.

12. The vacuum cleaner of claim 10, wherein the pressing ring comprises:

   a body plate; and

   at least one pressing protrusion formed on the body plate.

13. The vacuum cleaner of claim 11, wherein the pressing ring comprises:

   a body plate; and

   at least one pressing protrusion formed on the body plate.

14. The vacuum cleaner of claim 13, wherein the pressing protrusion protrudes toward an inner circumference of the pressing ring.

15. The vacuum cleaner of claim 10, further comprising at least one fixing protrusion formed toward an outer circumference of the pressing ring.

16. The vacuum cleaner of claim 10, wherein the pressing ring is made of stainless steel.

17. The vacuum cleaner of claim 10, wherein the bearing holder comprises a fixing rib formed therein, which is in tight contact with the outer race of the bearing.

18. The vacuum cleaner of claim 10, wherein a locking groove is formed inside the end of the drum rotation body, and a corresponding locking protrusion is formed on an outer circumference of the bearing holder for insertion into the locking groove.