A suction nozzle assembly usable with a vacuum cleaner includes a nozzle body configured to move along a surface to be cleaned, the nozzle body having a contaminant suction opening; and a hair collecting unit disposed at the nozzle body; wherein the hair collecting unit comprises a hair collecting member that contacts the surface to be cleaned; wherein when the nozzle body moves, the hair collecting member does not rotate; and wherein when the nozzle body moves in a first direction, the hair collecting member collects fibers from the surface to be cleaned.
FIG. 1
FIG. 29

FIG. 30

MOVING A HAIR COLLECTING DRUM IN A FIRST DIRECTION SO THAT FUR OF PETS IS SEPARATED FROM A SURFACE TO BE CLEANED:

CHANGING A MOVING DIRECTION OF THE HAIR COLLECTING DRUM FROM THE FIRST DIRECTION TO A SECOND DIRECTION SO THAT THE HAIR COLLECTING DRUM IS ROTATED BY A PREDETERMINED ANGLE:

MOVING THE HAIR COLLECTING DRUM IN THE SECOND DIRECTION SO THAT THE COLLECTED FUR OF PETS IS DRAWN
SUCTION NOZZLE ASSEMBLY USABLE WITH VACUUM CLEANER HAVING HAIR COLLECTING MEMBER, VACUUM CLEANER HAVING THE SAME, AND METHOD FOR REMOVING HAIR BY USING THE SAME

CROSS-REFERENCE TO RELATED APPLICATIONS


BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present disclosure relates to a vacuum cleaner. More particularly, the present disclosure relates to a suction nozzle assembly that can effectively remove hair from a surface to be cleaned, a vacuum cleaner having the same, and a method for removing hair by using the suction nozzle assembly.

[0004] 2. Description of the Related Art

[0005] Generally, vacuum cleaners have a suction nozzle assembly that can draw in contaminants with air from a surface to be cleaned.

[0006] The suction nozzle assembly has a contaminant suction opening that faces the surface to be cleaned and draws in contaminants from the surface to be cleaned. When a vacuum generator being disposed in a cleaner body operates to generate a suction force, contaminants are drawn into the cleaner body from the surface to be cleaned via the contaminant suction opening of the suction nozzle assembly. The term “contaminants” will be used herein to refer collectively to dust, dirt, particulates, debris, hair, fur, and other similar matter that can be entrained with the air being drawn in by the vacuum cleaner.

[0007] However, when cleaning the surface to be cleaned, which is covered with thin thread, fur, fiber, tufts, etc., such as a carpet, a rug, etc. using only the suction force, thin contaminants such as hair of human, fur of pets, thread, etc. (hereinafter referred to as fibers) cannot effectively be removed from the surface to be cleaned. To effectively remove fibers, it is preferable that the fibers be raked out from the surface to be cleaned, collected in a lump, and then guided toward the contaminant suction opening, thereby being drawn in by the suction force.

SUMMARY OF THE INVENTION

[0008] The present disclosure has been developed in order to overcome the above drawbacks and other problems associated with the conventional arrangement. An aspect of the present disclosure is to provide a suction nozzle assembly usable with a vacuum cleaner, which includes a nozzle body configured to move along a surface to be cleaned, the nozzle body having a contaminant suction opening; and a hair collecting unit disposed at the nozzle body; wherein the hair collecting unit comprises a hair collecting member that contacts the surface to be cleaned; wherein when the nozzle body moves, the hair collecting member does not rotate; and wherein when the nozzle body moves in a first direction, the hair collecting member collects fibers from the surface to be cleaned.

[0009] The hair collecting member may include a hair collecting drum substantially formed in a cylindrical shape.

[0010] When a moving direction of the nozzle body changes, the hair collecting drum may rotate by a predetermined angle.

[0011] When the moving direction of the nozzle body changes, the hair collecting drum may rotate within a range of 10 degrees to 180 degrees.

[0012] The hair collecting unit may include a drum rotation restricting member; wherein the drum rotation restricting member is configured so that while the nozzle body is moving, it does not allow the hair collecting drum to rotate; wherein the drum rotation restricting member is configured so that when a moving direction of the nozzle body changes, it allows the hair collecting drum to rotate by a predetermined angle.

[0013] The drum rotation restricting member may include a first ratchet device disposed at a first end of the hair collecting drum, the first ratchet device configured to allow the hair collecting drum to rotate in one direction; and a second ratchet device disposed at a second end of the hair collecting drum, the second ratchet device configured to prevent the hair collecting drum from rotating in the one direction in which the first ratchet device allows to rotate.

[0014] The first ratchet device may include a first ratchet wheel disposed at the first end of the hair collecting drum; and a ratchet pawl to restrict a rotating direction of the first ratchet wheel.

[0015] The second ratchet device may include a second ratchet wheel disposed at the second end of the hair collecting drum; and a lever ratchet disposed to rub against the surface to be cleaned, the lever ratchet to restrict a rotating direction of the second ratchet wheel.

[0016] Each of the first and second ratchet devices may include a rotating ratchet disposed at an end of the hair collecting drum; and a stationary ratchet configured to correspond to the rotating ratchet, the stationary ratchet to allow the rotating ratchet in only one direction.

[0017] The hair collecting member may include a plurality of protrusions.

[0018] The plurality of protrusions may be formed at an incline with respect to the surface to be cleaned.

[0019] The suction nozzle assembly may include a drum height adjusting member adjusting a height of the hair collecting drum with respect to the surface to be cleaned.

[0020] The drum height adjusting member may include first and second supporting members supporting opposite ends of the hair collecting drum, the first and second supporting members elastically supported with respect to the nozzle body; and first and second guiding portions guiding the first and second supporting members to move upward and downward with respect to the surface to be cleaned.

[0021] The hair collecting member may be disposed in at least one of front and back the contaminant suction opening in the nozzle body.
The hair collecting member may be disposed inside the contaminant suction opening.

The suction nozzle assembly may include a rotation brush rotatably disposed inside the contaminant suction opening of the nozzle body.

The above aspect and/or other feature of the present disclosure can substantially be achieved by providing a vacuum cleaner, which includes a cleaner body; and a suction nozzle assembly connected with the cleaner body to draw in contaminants from a surface to be cleaned; wherein the suction nozzle assembly comprises; a nozzle body configured to move along the surface to be cleaned, the nozzle body having a contaminant suction opening; and a hair collecting unit disposed at the nozzle body; wherein the hair collecting unit comprises a hair collecting member that contacts the surface to be cleaned; wherein when the nozzle body moves, the hair collecting member does not rotate; and wherein when the nozzle body moves in a first direction, the hair collecting member collects fibers from the surface to be cleaned.

The above aspect and/or other feature of the present disclosure can substantially be achieved by providing a method for removing hair by using a suction nozzle assembly. The method may include moving a hair collecting drum of the suction nozzle assembly in a first direction along a surface to be cleaned so that fibers are separated from the surface to be cleaned and collected; changing a moving direction of the hair collecting drum from the first direction to a second direction so that the hair collecting drum is rotated by a predetermained angle; moving the hair collecting drum in the second direction so that the collected fibers are drawn into a contaminant suction opening of the suction nozzle assembly.

The moving the hair collecting drum in the second direction may include causing the fibers caught among a plurality of protrusions of the hair collecting drum to be separated from the plurality of protrusions and remain on the surface to be cleaned before being drawn into the contaminant suction opening.

While the suction nozzle assembly is moving in the first direction or in the second direction, the hair collecting drum may not rotate.

Other objects, advantages and salient features of the disclosure will become apparent from the following detailed description, which, taken in conjunction with the annexed drawings, discloses preferred embodiments of the disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

These and/or other aspects and advantages of the disclosure will become apparent and more readily appreciated from the following description of the embodiments, taken in conjunction with the accompanying drawings of which:

FIG. 1 is a partial perspective view illustrating a upright vacuum cleaner with a suction nozzle assembly according to an exemplary embodiment of the present disclosure;

FIG. 2 is a bottom view illustrating the upright vacuum cleaner of FIG. 1;

FIG. 3 is a sectional view illustrating a brush unit of the suction nozzle assembly of FIG. 2 taken along a line III-III in FIG. 2;

FIGS. 4A and 4B are sectional views illustrating another rotation restricting member used in a rotation drum of FIG. 3; FIG. 4A illustrates the rotation drum to rotate, and FIG. 4B illustrates the rotation drum not to rotate;

FIG. 5 is a sectional view illustrating another rotation restricting member used in a rotation drum of FIG. 3;

FIGS. 6A and 6B are perspective views illustrating a drum body of a rotation drum of FIG. 3;

FIG. 7 is a perspective view illustrating a removing member of a rotation drum of FIG. 3;

FIG. 8 is an enlarged perspective view illustrating the portion of the removing member of FIG. 7 illustrated in circle X;

FIGS. 9A to 9F are partial perspective views illustrating various protrusions of a removing member of a rotation drum of FIG. 3;

FIG. 10 is a partial perspective view illustrating another removing member of a rotation drum of FIG. 3;

FIG. 11 is a bottom view illustrating a suction nozzle assembly according to another embodiment of the present disclosure;

FIG. 12 is a bottom view illustrating a suction nozzle assembly according to another embodiment of the present disclosure;

FIGS. 13A and 13B are views schematically illustrating operation of a rotation drum of FIG. 12; and

FIG. 14 is a conceptual view schematically illustrating the suction nozzle assembly of FIG. 12 having another rotation restricting member.

FIG. 15 is a perspective view illustrating an upright vacuum cleaner having a suction nozzle assembly with a hair collecting member according to an exemplary embodiment of the present disclosure;

FIG. 16 is a bottom view illustrating the suction nozzle assembly of the upright vacuum cleaner of FIG. 15;

FIG. 17 is a partial perspective view illustrating a suction nozzle assembly usable with a vacuum cleaner with a hair collecting member according to an exemplary embodiment of the present disclosure;

FIG. 18 is a sectional view illustrating a plurality of protrusions of a hair collecting drum being used in a suction nozzle assembly usable with a vacuum cleaner according to an exemplary embodiment of the present disclosure;

FIG. 19 is a partial view illustrating an unrolled surface of a hair collecting drum being used in a suction nozzle assembly usable with a vacuum cleaner according to an exemplary embodiment of the present disclosure;

FIG. 20 is a side view illustrating a hair collecting unit of the suction nozzle assembly as seen in a direction of arrow B of FIG. 17;

FIG. 21 is a side view illustrating a hair collecting unit of the suction nozzle assembly as seen in a direction of arrow C of FIG. 17;

FIG. 22 is a sectional view illustrating the hair collecting unit of FIG. 20 with no drum height adjusting member when a first ratchet device does not allow a hair collecting drum to rotate;

FIG. 23 is a sectional view illustrating the hair collecting unit of FIG. 21 with no drum height adjusting member when a second ratchet device allows a hair collecting drum to rotate;

FIG. 24 is a sectional view illustrating a state in which a lever ratchet of the second ratchet device of FIG. 23 operates;

FIG. 25 is a sectional view illustrating a state in which the first ratchet device of FIG. 22 allows the hair collecting drum to rotate;
FIG. 26 is a sectional view illustrating a state in which the lever ratchet of the second ratchet device of FIG. 24 does not allow the hair collecting drum to rotate;

FIG. 27 is a conceptual view illustrating a state in which a hair collecting member collects fibers from a carpet when a suction nozzle assembly usable with a vacuum cleaner with the hair collecting member according to an exemplary embodiment of the present disclosure moves in a first direction along the carpet;

FIG. 28 is a conceptual view illustrating a state in which fibers collected by a hair collecting member is separated from the hair collecting member when a suction nozzle assembly usable with a vacuum cleaner with the hair collecting member according to an exemplary embodiment of the present disclosure moves in a second direction along a carpet;

FIG. 29 is a sectional view illustrating another drum rotation restricting member being used in a suction nozzle assembly usable with a vacuum cleaner according to an exemplary embodiment of the present disclosure; and

FIG. 30 is a flow chart illustrating a method for removing hair using a suction nozzle assembly according to an exemplary embodiment of the present disclosure.

Throughout the drawings, like reference numerals will be understood to refer to like parts, components and structures.

DETAILED DESCRIPTION OF THE EXEMPLARY EMBODIMENTS

Hereinafter, certain exemplary embodiments of the present disclosure will be described in detail with reference to the accompanying drawings.

The matters defined in the description, such as a detailed construction and elements thereof, are provided to assist in a comprehensive understanding of the disclosure. Thus, it is apparent that the present disclosure may be carried out without those defined matters. Also, well-known functions or constructions are omitted to provide a clear and concise description of exemplary embodiments of the present disclosure.

FIG. 1 is a perspective view illustrating a suction nozzle assembly 1 according to an embodiment of the present disclosure disposed in an upright vacuum cleaner; and FIG. 2 is a bottom view of the suction nozzle assembly 1 of FIG. 1.

Referring to FIGS. 1 and 2, the suction nozzle assembly 1 for a vacuum cleaner according to the embodiment of the present disclosure includes a nozzle body 2, and a brush unit 10.

The nozzle body 2 is provided with a contaminants suction pathway (not illustrated). The brush unit 10 is disposed in a front end of the nozzle body 2. Also, the nozzle body 2 is provided with a pair of wheels 4 to allow the suction nozzle assembly 1 to move on a surface to be cleaned. The nozzle body 2 is connected with a cleaner body 5 of the vacuum cleaner.

This embodiment is referred to the suction nozzle assembly 1 used in the upright vacuum cleaner. Therefore, when a vacuum generator (not illustrated) disposed in the cleaner body 5 of the upright vacuum cleaner generates suction force, contaminants are drawn in from the surface to be cleaned via a contaminant suction opening 14 of the brush unit 10.

The brush unit 10 is disposed in the front end of the nozzle body 2. The contaminant suction opening 14 is formed on a bottom surface of the brush unit 10, and in fluid communication with the contaminant suction pathway of the nozzle body 2. At this time, the brush unit 10 may be configured to pivot with respect to the nozzle body 2 by a predetermined angle.

Referring to FIGS. 2 and 3, the brush unit 10 includes a brush 13, a rotation drum 20, and a housing 11.

The brush 13 is rotatably disposed at the contaminant suction opening 14 of the housing 11, and has a plurality of bristles that is formed on a surface of the brush 13 to contact the surface to be cleaned. Therefore, when the brush 13 rotates, contaminants can be removed from the surface to be cleaned.

The rotation drum 20 is rotatably disposed in front of the brush 13 at the housing 11 and, thus in front of the suction opening 14. The rotation drum 20 collects thin contaminants such as human hair, fur of animals, thread, etc. (or, referred to as fibers), on the surface to be cleaned in a lump, and then, guides the collected thin contaminants in a lump toward the brush 13. The rotation drum 20 includes a rotation restricting member 29, a drum body 50 (refer to FIG. 6A), and a removing member 60 (refer to FIG. 7).

The rotation restricting member 29 may be configured to allow the rotation drum 20 to rotate in a first direction but not to rotate in a reverse direction of the first direction according to a moving direction of the suction nozzle assembly 1. Alternatively, the rotation restricting member 29 may be configured to allow the rotation drum 20 to rotate in both directions within a predetermined angle. The rotation restricting member 29 may be disposed in at least one side of the drum body 50.

In FIG. 3, a ratchet part 30 is illustrated as one example of the rotation restricting member 29. In FIG. 3, the ratchet part 30 is configured to allow the rotation drum 20 to rotate only in one direction. The ratchet part 30 of FIG. 3 includes a ratchet wheel 31, which is disposed coaxially with the rotation drum 20 to rotate integrally with the rotation drum 20, and a ratchet pawl 33 that is disposed at one side of the ratchet wheel 31 at either of the housing 11 or the nozzle body 2. The ratchet pawl 33 is disposed not to rotate although the rotation drum 20 rotates.

The ratchet wheel 31 is provided with a plurality of inclined teeth 32 on an outer circumferential surface thereof. When the ratchet wheel 31 receives force in an inclined direction of each of the teeth 32, the teeth 32 of the ratchet wheel 31 are not hooked on the ratchet pawl 33 so that the ratchet wheel 31 can rotate. When the ratchet wheel 31 receives force in a reverse direction, a vertical side 32a of the teeth 32 of the ratchet wheel 31 is hooked on the ratchet pawl 33 so that the ratchet wheel 31 cannot rotate. In other words, the rotation drum 20 can rotate in a direction of an inclined surface 32b of the teeth 32 of the ratchet wheel 31, but cannot rotate in the reverse direction. Therefore, in FIG. 3, the ratchet wheel 31 is hooked on the ratchet pawl 33 in a clockwise direction (in a direction of arrow B) so that the rotation drum 20 does not rotate, but in a counterclockwise direction (in a direction opposite arrow B) the ratchet wheel 31 is not hooked on the ratchet pawl 33 so that the rotation drum 20 rotates. In other words, as illustrated in FIG. 3, when pushing the suction nozzle assembly 1 forward (in a direction of arrow A), the rotation drum 20 rotates in the counterclockwise direction as arrow B. However, when pulling the suction nozzle assembly 1 backward (in a direction opposite arrow A), the rotation drum 20 does not rotate.
Referring to FIGS. 4A and 4B, another ratchet part 40 as the rotation restricting member 29 is illustrated. In FIG. 4A, a ratchet wheel 41 of the ratchet part 40 is similar to the ratchet wheel 31 of the above-described ratchet part 30, but a ratchet pawl 43 is configured to move up and down. Therefore, when the ratchet wheel 41 receives force in the clockwise direction as arrow F illustrated in FIG. 4B, a vertical side 42a of any of teeth 42 of the ratchet wheel 41 is hooked on the ratchet pawl 43 so that the ratchet wheel 41 cannot rotate. When the ratchet wheel 41 receives force in the counterclockwise direction (in a direction of arrow D) illustrated in FIG. 4A, inclined sides 42b of the teeth 42 of the ratchet wheel 41 are not hooked on the ratchet pawl 43 so that the ratchet wheel 41 can rotate.

In the above description, the ratchet parts 30 and 40 are configured so that when the suction nozzle assembly 1 is pushed forward (refer to arrows A and C in FIGS. 3 and 4A) the rotation drum 20 rotates, and when the suction nozzle assembly 1 is pulled backward (refer to arrow E in FIG. 4B) the rotation drum 20 does not rotate. Alternatively, the ratchet parts 30 and 40 may be configured to rotate in a predetermined angle. In other words, the rotation drum 20 cannot continuously rotate or rotate by a predetermined angle in a first direction. Also, the rotation drum 20 can rotate by a similar angle in a reverse direction of the first direction. Referring to FIG. 5, an example of the rotation restricting member 29 having the above-described structure is illustrated.

Referring FIG. 5, the rotation restricting member 29 includes a rotation wheel 45 and a stopper 46. The rotation wheel 45 is formed to rotate integrally with the rotation drum 20 (refer to FIG. 2) coaxially with the rotation drum 20. A plurality of grooves 45a is formed on the outer circumferential surface of the rotation wheel 45. The stopper 46 is disposed inside any of the plurality of grooves 45a formed on the outer circumferential surface of the rotation wheel 45. The stopper 46 is fixed to the housing 11 of the suction nozzle assembly 1 so that when the rotation drum 20 rotates, the stopper 46 does not rotate. As a result, a rotation range of the rotation wheel 45 is restricted by the stopper 46 that positions inside one of the grooves 45a of the rotation wheel 45. Referring to FIG. 5, the rotation wheel 45 has five grooves 45a, and the stopper 46 positions inside any of the five grooves 45a. As a result, the rotation drum 30 disposed integrally with the rotation wheel 45 can rotate in the clockwise and counterclockwise directions (refer to arrow G in FIG. 5) with a predetermined angle determined by the groove 45a of the rotation wheel 45 and the stopper 46.

The drum body 50 and 50' may be formed in a hexagonal column shape or in a cylindrical shape as illustrated in FIGS. 6A and 6B. The drum body 50 and 50' may be formed integrally with or detachably from the ratchet wheel 31 and 41 or the rotation wheel 45 of the rotation restricting member 29. In this embodiment, the ratchet wheel 31 and 41 and the rotation wheel 45 are formed separately from the drum body 50 and 50'.

The removing member 60 collects thin contaminants (or fibers) such as human hair, fur of animals, etc. on the surface to be cleaned in a lump, and then, guides the collected thin contaminants toward the contaminant suction opening 14.

The removing member 60 is inserted in the drum body 50 and 50', and is configured of a bottom plate 61 and a plurality of protrusions 62. The bottom plate 61 is formed in a hexagonal column shape or a cylindrical shape corresponding to the shape of the drum body 50 and 50'. In FIGS. 7 and 8, the rotation restricting members 60 and 60' are formed separately from the drum body 50 and 50'. Alternatively, the removing member 60 may be formed integrally with the drum body 50.

The plurality of protrusions 62 contacts the surface to be cleaned, collects thin contaminants on the surface to be cleaned in a lump, and guides the collected thin contaminants in a lump toward the contaminant suction opening 14 (refer to FIG. 2). The plurality of protrusions 62 may be formed in various shapes as long as they are capable of performing the above-described functions.

Referring FIG. 7, the removing member 60 with the plurality of protrusions 62 having a substantially stick shape is illustrated. The plurality of protrusions 62 having the stick shape may be arranged in various patterns. In FIG. 7, the plurality of protrusions 62 is disposed in three rows on one side surface of the bottom plate 61 with the hexagonal column shape. Referring to FIG. 8, each of the protrusions 62 is formed in a mountain peak with a hill. However, this is only exemplary embodiment and is not intended to be limiting; therefore, the protrusions 62 with the substantially stick shape may be formed in various shapes.

Referring to FIGS. 9A to 9F, protrusions 63, 64, 65, 66, 67, and 68 with a substantially block shape are illustrated. Here, the term “block shape” refers to a shape of the protrusions that rise up from the bottom plate 61 in a substantially longish rectangular parallelepiped shape. The plurality of block shaped protrusions 63, 64, 65, 66, 67, and 68 may be arranged in various patterns. Referring to FIG. 9A, the plurality of blocks 63 is arranged to be parallel to a rotation axis (refer to CL in FIGS. 2 and 7) of the rotation drum 20. Referring to FIG. 9B, the plurality of blocks 64 is arranged in a substantially V shape, and referring to FIG. 9C, the plurality of blocks 65 is arranged to be inclined with respect to the rotation center CL of the rotation drum 20. Referring to FIG. 9D, the plurality of blocks 66 is arranged in one row on one side surface of the hexagonal column of the bottom plate 61. At this time, the plurality of blocks 66 is formed to be symmetrically inclined with respect to a centerline 61a of the one side surface of the hexagonal column of the bottom plate 61.

Referring to FIGS. 9E and 9F, the plurality of block shaped protrusions 63 and 64 is arranged in a similar pattern to those of FIGS. 9A and 9B, respectively, except that some protrusions 67 and 68 are formed in a split block shape. Here, the term “split block shape” refers to a block shape having split in a plurality of portions in a lengthwise direction of the block shape. In FIGS. 9E and 9F, each of the split blocks 67 and 68 is split of three portions; however, this is only an exemplary embodiment and not intended to be limiting.

Additionally, the plurality of protrusions 69 may be substantially formed in a loop shape as illustrated in FIG. 10. Referring to FIG. 10, the plurality of loop shaped protrusions 69 are arranged in two rows on each of side surfaces of the bottom plate 61 of the hexagonal column.

In above-description, the removing member 60 is formed separately from the drum body 50. Alternatively, the removing member 60 may be formed integrally with the drum body 50.
Furthermore, the removing member 60 may be formed of elastic material such as rubber, urethane, etc. Especially, the plurality of protrusions 62, 63, 64, 65, 66, 67, and 68 of the removing member may be formed of felt.

Referring to FIGS. 2 and 3, the housing 11 supports the brush 13 and the rotation drum 20 to rotate, and is provided with the contaminants suction opening 14 in fluid communication with the contaminants suction pathway of the nozzle body 2.

Hereinafter, operation of the suction nozzle assembly 1 according to an embodiment of the present disclosure will be explained with reference to FIGS. 2 and 3.

When a user turns on the vacuum cleaner and pushes the suction nozzle assembly 1 forward, that is, pushes the brush unit 10 in the direction of arrow A in FIG. 3, the brush 13 rotates and contaminants are drawn into the suction nozzle assembly 1 from the surface to be cleaned via the contaminants suction opening 14 by suction force.

When the suction nozzle assembly 1 moves forward, the rotation drum 20 disposed in front of the brush 13 rotates in the counterclockwise direction (refer to arrow B) due to friction against the surface to be cleaned. At this time, the ratchet wheel 31 of the ratchet part 30 of the rotation drum 20 is not hooked on the ratchet pawl 33 so that the rotation drum 20 can rotate in the counterclockwise direction. When the rotation drum 20 rotates in the counterclockwise direction, thin contaminants on the surface to be cleaned are moved toward the brush 13.

However, when the user pulls the suction nozzle assembly 1 backward, that is, pulls the brush unit 10 in the reverse direction of arrow A in FIG. 3, the rotation drum 20 does not rotate. In other words, when the suction nozzle assembly 1 moves in the reverse direction of arrow A, the rotation drum 20 receives force to cause the rotation drum 20 to rotate in the clockwise direction due to friction against the surface to be cleaned. However, the ratchet wheel 31 of the ratchet part 30 of the rotation drum 20 is hooked on the ratchet pawl 33 so that the rotation drum 20 cannot rotate in the clockwise direction and maintains in a stationary state. When pulling the suction nozzle assembly 1 with the stopped rotation drum 20, the plurality of protrusions 63 of the rotation drum 20 rubs against the surface to be cleaned to collect thin contaminants such as human hair, fur of animals, etc. When the thin contaminants are collected in a lump by the plurality of protrusions 63, the collected thin contaminants are easily drawn into the contaminant suction opening 14 by the suction force.

In the above description, the suction nozzle assembly 1 has the brush 13; however, this is only exemplary and not intended to be limiting. Alternatively, the suction nozzle assembly 1 according to an embodiment of the present disclosure may have no brush.

FIG. 11 is a bottom view illustrating a suction nozzle assembly 100 for the vacuum cleaner with no brush.

Referring to FIG. 11, the suction nozzle assembly 100 includes a nozzle body 101, and a rotation drum 120. The nozzle body 101 is provided with a contaminant suction opening 102, and supports the rotation drum 120 to rotate.

Contaminants are drawn into the contaminant suction opening 102 by the suction force generated in the vacuum generator (not illustrated). The contaminant suction opening 102 may be formed so that contaminants can be drawn in front of and behind the rotation drum 120 as illustrated in FIG. 11. In other words, the rotation drum 120 may be disposed in the middle of the contaminant suction opening 102.

Also, although not illustrated, the contaminant suction opening 102 may be formed only in front of the rotation drum 120. Alternatively, the contaminant suction opening 102 may be formed only behind the rotation drum 120.

Structure and operation of the rotation drum 120 are the same as those of the rotation drum 20 of the suction nozzle assembly 1 according to above-described embodiment. Therefore, detail descriptions thereof are omitted.

FIG. 12 is a bottom view illustrating a suction nozzle assembly 200 for the vacuum cleaner according to another embodiment of the present disclosure. Referring to FIG. 12, the suction nozzle assembly 200 for the vacuum cleaner according to the embodiment of the present disclosure includes a nozzle body 201, and a pair of rotation drums 221 and 222.

The nozzle body 201 is provided with a contaminant suction pathway (not illustrated) in fluid communication with a cleaner body (not illustrated) of the vacuum cleaner. A contaminant suction opening 202 through which contaminants are drawn in is formed on a bottom surface of the nozzle body 201.

The pair of rotation drums 221 and 222 is rotatably disposed in the contaminant suction opening 202 of the nozzle body 201. The pair of the rotation drums 221 and 222 rubs against the surface to be cleaned, and causes thin contaminants such as human hair or fur of animals on the surface to be cleaned to be collected in a lump and drawn into the contaminant suction opening 202. Therefore, the pair of rotation drums 221 and 222 may be disposed in the middle of the contaminant suction opening 202 so that maximum suction force can be applied to between the pair of the rotation drums 221 and 222.

Each of the pair of rotation drums 221 and 222 includes a rotation restricting member 231 and 232, a drum body, and a removing member. The rotation restricting members 231 and 232, drum body, and removing member are similar to the rotation restricting member 29, drum body 50, and removing member 60 of the rotation drum 20 according to the above-described embodiment; therefore, detail descriptions thereof are omitted.

However, the rotation restricting members 231 and 232 of the suction nozzle assembly 200 according to this embodiment are configured so that when one 221 and 222 of the pair of rotation drums 221 and 222 rotates, the other rotation drum 222 and 221 is stopped. Structure of the rotation restricting members 231 and 232 is illustrated in FIGS. 13A and 13B.

Referring to FIGS. 12, 13A, and 13B, the first rotation restricting member 231 is disposed coaxially with the first rotation drum 221, that is, the front one 221 of the pair of rotation drums 221 and 222, and allows the first rotation drum 221 to rotate in the counterclockwise direction (refer to arrow K in FIG. 13B) but not to rotate in the clockwise direction. Also, the second rotation restricting member 232 is disposed coaxially with the second rotation drum 222, that is, the rear one 222 of the pair of rotation drums 221 and 222, and allows the second rotation drum 222 to rotate in the clockwise direction (refer to arrow L in FIG. 13A) but not to rotate in the counterclockwise direction.

Therefore, if the first and second rotation restricting members 231 and 232 are configured of ratchet parts as illustrated in FIGS. 13A and 13B, a first ratchet wheel 233 of the
first rotation drum 221 is disposed to rotate in the counterclockwise direction but not to rotate in the clockwise direction. Also, a second ratchet wheel 237 fixed coaxially with the second rotation drum 222 is disposed to rotate in the clockwise direction but not to rotate in the counterclockwise direction.

[0107] Hereinafter, operation of the suction nozzle assembly 200 for the vacuum cleaner having the above-described structure will be explained with reference to FIGS. 12, 13A, and 13B.

[0108] FIG. 13B illustrates operation of the first and second rotation restricting members 231 and 232 disposed on each of the pair of rotation drums 221 and 222 when pushing the suction nozzle assembly 200 for the vacuum cleaner forward.

[0109] When a user pushes the suction nozzle assembly 200 forward as arrow J illustrated in FIG. 13B, the first and second rotation drums 221 and 222 tend to rotate in the counterclockwise direction due to friction force against the surface to be cleaned. The first rotation restricting member 231 allows the first rotation drum 221 to rotate in the counterclockwise direction (refer to arrow K) so that when the suction nozzle assembly 200 moves forward, the first rotation drum 221 rotates in the counterclockwise direction. However, the second rotation restricting member 232 prevents the second rotation drum 222 from rotating in the clockwise direction so that when the suction nozzle assembly 200 moves forward, the second rotation drum 222 maintains in a stationary state.

[0110] Since when the user moves the suction nozzle assembly 200 forward as arrow J, the second rotation drum 222 maintains in a stationary state, the plurality of protrusions 242 formed on the outer circumference of the second rotation drum 222 rub against the surface to be cleaned to collect thin contaminants in a lump. At this time, the first rotation drum 221 rotates in the counterclockwise direction as arrow K, thereby pushing up the contaminants to be collected in a lump by the first rotation drum 221 inside the contaminant suction opening 202.

[0114] If the suction nozzle assembly 200 is provided with the pair of rotation drums 221 and 222 as this embodiment, one rotation drum 221 and 222 collects contaminants and the other rotation drum 222 and 221 pushes up the collected contaminants into the contaminant suction opening 202. Therefore, the suction nozzle assembly 200 with the pair of rotation drums 221 and 222 can more effectively draw in thin contaminants from the surface to be cleaned than the suction nozzle assembly 1 with one rotation drum 20 as described above.

[0115] FIG. 14 is a conceptual view schematically illustrating a suction nozzle assembly 200 having a rotation restricting member different from that of the suction nozzle assembly 200 of FIG. 12 with the pair of rotation drums 221 and 222.

[0116] Referring to FIG. 14, the rotation restricting member according to this embodiment includes first and second rotation preventing parts 251 and 252 that are disposed at the nozzle body 201 (refer to FIG. 12) to prevent first and second rotation drums 261 and 262 from rotating. Each of the first and second rotation drums 261 and 262 includes a plurality of protrusions 261a and 262a that is disposed to be inclined in a rotation direction of the rotation drum 261 and 262 and made of felt. In other words, the plurality of protrusions 261a on the first rotation drum 261 is disposed to be inclined so that when the first rotation drum 261 rotates in the counterclockwise direction, the plurality of protrusions 261a is not caught by the first rotation preventing part 251. Also, the plurality of protrusions 262a on the second rotation drum 262 is disposed to be inclined so that when the second rotation drum 262 rotates in the clockwise direction, the plurality of protrusions 262a is not caught by the second rotation preventing part 252.

[0117] Therefore, as illustrated in FIG. 14, when a user pushes the suction nozzle assembly 200 (refer to FIG. 12) forward as arrow L so that the first and second rotation drums 261 and 262 receive force to cause the first and second rotation drums 261 and 262 to rotate in the counterclockwise direction (refer to arrow M), the plurality of protrusions 261a of the first rotation drum 261 is not caught by the first rotation preventing part 251, so the first rotation drum 261 rotates in the counterclockwise direction. However, the plurality of protrusions 262a of the second rotation drum 262 is caught by the second rotation preventing part 252, so the second rotation drum 262 does not rotate in the counterclockwise direction and maintains in a stationary state.

[0118] On the other hands, when the user pulls the suction nozzle assembly 200 backward so that the first and second rotation drums 261 and 262 receive force to cause the first and second rotation drums 261 and 262 to rotate in the clockwise direction, the plurality of protrusions 261a of the first rotation drum 261 is caught by the first rotation preventing part 251, so the first rotation drum 261 does not rotate in the clockwise direction and maintains in a stationary state. However, the plurality of protrusions 262a of the second rotation drum 262 is not caught by the second rotation preventing part 252, so the second rotation drum 262 rotates in the clockwise direction.

[0119] When the first and second rotation drums 261 and 262 rotate in the inclined direction of the plurality of protrusions 261a and 262a, the felt protrusions 261a and 262a on the outer circumferential surface of each of the first and second rotation drums 261 and 262 wash out contaminants from the surface to be cleaned.
second rotation drums 261 and 262 are elastically deformed by the first and second rotation preventing parts 251 and 252, and then restored in an original state. However, when the first and second rotation drums 261 and 262 rotate in a reverse direction of the inclination of the plurality of protrusions 261a and 262a, the first and second rotation preventing parts 251 and 252 are caught in lower portions of the plurality of protrusions 261a and 262a of the first and second rotation drums 261 and 262 so that the first and second rotation drums 261 and 262 cannot rotate.

[0120] FIG. 15 is a perspective view illustrating an upright vacuum cleaner 300 having a suction nozzle assembly 310 with a hair collecting member according to an exemplary embodiment of the present disclosure, and FIG. 16 is a bottom view illustrating the suction nozzle assembly 310 of the upright vacuum cleaner 300 of FIG. 15. In the below description, the suction nozzle assembly 310 consists of the vacuum cleaner according to an exemplary embodiment of the present disclosure that is disposed in the upright vacuum cleaner 300 is only explained. However, the suction nozzle assembly 310 according to an exemplary embodiment of the present disclosure can be used in a canister vacuum cleaner or a stick type vacuum cleaner.

[0121] Referring to FIG. 15, the upright vacuum cleaner 300 includes a cleaner body 301 and the suction nozzle assembly 310.

[0122] The cleaner body 301 includes a vacuum generator (not illustrated) generating a suction force and a contaminant collecting apparatus (not illustrated) that collects contaminants being drawn-in via the suction nozzle assembly 310. The vacuum generator and the contaminant collecting apparatus are disposed inside the cleaner body 301. The suction nozzle assembly 310 is connected to a bottom end of the cleaner body 301.

[0123] Referring to FIGS. 15 and 16, the suction nozzle assembly 310 usable with the vacuum cleaner according to an exemplary embodiment of the present disclosure includes a nozzle body 311 and a hair collecting unit 320.

[0124] A contaminant suction pathway (not illustrated) is formed inside the nozzle body 311, and a contaminant suction opening 312 is formed at a bottom surface of the nozzle body 311 to fluidly communicate with the contaminant suction pathway. The contaminant suction pathway is fluidly communicated with the vacuum generator being disposed in the cleaner body 301. A rotating brush 313 may be rotatably disposed in the contaminant suction opening 312.

[0125] Also, the nozzle body 311 is provided with a pair of wheels 315 that allows the suction nozzle assembly 310 to move along the surface to be cleaned. The nozzle body 311 is connected with the bottom end of the cleaner body 301. When the vacuum generator (not illustrated) disposed in the cleaner body 301 generates the suction force, contaminants are drawn-in from the surface to be cleaned through the contaminant suction opening 312 of the nozzle body 311.

[0126] Referring to FIG. 17, the hair collecting unit 320 includes a hair collecting member 330, a drum rotation restricting member 340, and a drum height adjusting member 370.

[0127] The hair collecting unit 320 rakes out thin long contaminants such as human hair, fur of pets (or animals), thread, etc. (hereinafter, referred to as fibers), which are in tufts of a surface to be cleaned being covered with tufts such as a rug, a carpet, etc. (hereinafter, refer to a carpet), thereby separating the fibers from the carpet. The hair collecting unit 320 may be disposed in at least one of in front of and behind the contaminant suction opening 312 in the suction nozzle assembly 310. The suction nozzle assembly 310 as illustrated in FIGS. 15 and 16 has the hair collecting unit 320 that is disposed in front of the contaminant suction opening 312. Also, the hair collecting unit 320 may be disposed inside or outside the contaminant suction opening 312. FIGS. 15 and 16 illustrate the hair collecting unit 320 being disposed inside the contaminant suction opening 312 of the suction nozzle assembly 310.

[0128] The hair collecting member 330 may be formed in various shapes having a plurality of protrusions 331 thereon. In the below explanation, a hair collecting drum being formed in a substantially cylindrical shape is used as the hair collecting member 330. However, this does not limit the shape of the hair collecting member 330.

[0129] The hair collecting drum 330 is formed substantially in a cylindrical shape. As illustrated in FIG. 18, the plurality of protrusions 331 is formed on a surface of the hair collecting drum 330. The plurality of protrusions 331 rakes out fibers from the surface to be cleaned, that is, tufts of the carpet 303. As long as they are capable of performing the above-described function, the plurality of protrusions 331 can be formed in various shapes and materials. As the plurality of protrusions 331, lint or felt may be attached on the surface of the hair collecting drum 330. Here, the lint or the felt means that a plurality of fibers made of a plastic material such as nylon, etc. is formed to project from a base member such as thin cloth.

[0130] The plurality of protrusions 331 may be formed to be inclined with respect to the surface to be cleaned 303. That is, when an end of each of the plurality of protrusions 331 reaches or approaches nearly to the surface to be cleaned 303, the protrusion 331 may form an acute angle with respect to the surface to be cleaned 303. At this time, each of the plurality of protrusions 331 forms an acute angle \( \alpha \) with respect to the surface of the hair collecting drum 330.

[0131] FIG. 18 illustrates the plurality of protrusions 331 being disposed to form an acute angle \( \alpha \) with respect to the surface of the hair collecting drum 330. In the case that the plurality of protrusions 331 forms an acute angle with respect to the surface of the hair collecting drum 330, when the hair collecting drum 330 moves in a direction which the plurality of protrusions 331 forms the acute angle (in a direction opposite to arrow S), fibers are easily separated from tufts of the carpet 303 by the plurality of protrusions 331. Also, when the hair collecting drum 330 moves in the reverse direction (in a direction of arrow S), the plurality of protrusions 331 may slightly move with respect to the surface to be cleaned 303. On the other hand, when the end 331a of each of the plurality of protrusions 331 is formed to branch in the direction opposite to arrow S as illustrated in FIG. 19, fibers can be more easily separated from the carpet 303. FIG. 19 is a view illustrating a portion of the unrolled surface of the hair collecting drum 330 when the surface of the hair collecting drum 330 is unrolled on a plane.

[0132] The drum rotation restricting member 340 prevents the hair collecting drum 330 from rotating when the suction nozzle assembly 310 moves. However, the drum rotation restricting member 340 is configured to allow the hair collecting drum 330 to rotate by a predetermined angle the moment a moving direction of the suction nozzle assembly 310 changes. When the moving direction of the suction nozzle assembly 310 changes, the hair collecting drum 330
may be configured to rotate within a range of 10 degrees to 180 degrees. So lifespan of the hair collecting drum 330 may be lengthened.

In this exemplary embodiment, when the suction nozzle assembly 310 moves in a first direction, for example, in a direction which the suction nozzle assembly 310 moves backward (in a direction opposite to arrow S in FIG. 15), the drum rotation restricting member 340 prevents the hair collecting drum 330 from rotating. When the suction nozzle assembly 310 moves in the first direction, the plurality of protrusions 331 of the hair collecting drum 330 gets into the tufts of the carpet 303, thereby separating fibers from the tufts of the carpet 303. The separated fibers are caught among the plurality of protrusions 331 of the hair collecting drum 330.

Also, even when the suction nozzle assembly 310 moves in a second direction, for example, in a direction in which the suction nozzle assembly 310 moves forward (in a direction of arrow S in FIG. 15), the drum rotation restricting member 340 prevents the hair collecting drum 330 from rotating. When the suction nozzle assembly 310 moves in the second direction, the plurality of protrusions 331 of the hair collecting drum 330 slidingly moves along the carpet 303. At this time, the fibers caught among the plurality of protrusions 331 of the hair collecting drum 330 is taken out from the plurality of protrusion 331 by a friction force against the carpet 303, thereby remaining on the carpet 303.

Referring to FIG. 17, the drum rotation restricting member 340 includes a first ratchet device 350 that is disposed at a first end 332 of the hair collecting drum 330 and allows the hair collecting drum 330 to rotate in only one direction, and a second ratchet device 360 that is disposed at a second end 333 of the hair collecting drum 330, and prevents the hair collecting drum 330 from rotating in the direction which the first ratchet device 350 allows to rotate. For example, the first ratchet device 350 may be configured to allow the hair collecting drum 330 to rotate in a clockwise direction, and prevent it from rotating in a counterclockwise direction. At this time, the second ratchet device 360 is configured to allow the hair collecting drum 330 to rotate in the counterclockwise direction, and prevent it from rotating in the clockwise direction.

Referring to FIGS. 20 and 22, the first ratchet device 350 includes a first ratchet wheel 351 that is disposed at the first end 332 of the hair collecting drum 330 and a first ratchet pawl 355 that restricts a rotating direction of the first ratchet wheel 351.

The first ratchet wheel 351 is disposed coaxially with the hair collecting drum 330 and rotates integrally with the hair collecting drum 330. The ratchet pawl 355 is disposed at a first supporting member 381 of the drum height adjusting member 370 at a side of the first ratchet wheel 351. The ratchet pawl 355 is not disposed to rotate even when the hair collecting drum 330 rotates.

A plurality of inclined teeth 352 is formed radially on an outer circumferential surface of the first ratchet wheel 351. When the first ratchet wheel 351 receives a force in an inclined direction of the inclined teeth 352, the inclined teeth 352 of the first ratchet wheel 351 are not caught on the ratchet pawl 355 so that the first ratchet wheel 351 can rotate. When the first ratchet wheel 351 receives a force in the direction opposite to the inclined direction, a side 352a of one of the inclined teeth 352 of the first ratchet wheel 351 is caught on an end portion 356 of the ratchet pawl 355 so that the first ratchet wheel 351 cannot rotate. Therefore, the hair collecting drum 330 can rotate in a direction of an inclined surface 352b of the inclined teeth 352 but cannot rotate in a reverse direction thereof.

In FIG. 22, in the counterclockwise direction the first ratchet wheel 351 is caught on the ratchet pawl 355 so that the hair collecting drum 330 does not rotate, and in the clockwise direction the first ratchet wheel 351 is not caught on the ratchet pawl 355 so that the hair collecting drum 330 can rotate. That is, as illustrated in FIG. 17, when pushing the suction nozzle assembly 310 forward in a direction of arrow S, the hair collecting drum 330 does not rotate due to the first ratchet device 350. When pulling the suction nozzle assembly 310 backward in a reverse direction of arrow S, the first ratchet device 350 allows the hair collecting drum 330 to rotate in the clockwise direction.

Referring to FIGS. 21 and 23, the second ratchet device 360 includes a second ratchet wheel 361 that is disposed at the second end 333 of the hair collecting drum 330 and a lever ratchet 365 that restricts a rotating direction of the second ratchet wheel 361.

The second ratchet wheel 361 is disposed coaxially with the hair collecting drum 330 and rotates integrally with the hair collecting drum 330. A plurality of inclined teeth 362 is formed radially on an outer circumferential surface of the second ratchet wheel 361. When one of the inclined teeth 362 of the second ratchet wheel 361 is caught on a top end 366 of the lever ratchet 365, the second ratchet wheel 361 cannot rotate. A number of the inclined teeth 362 of the second ratchet wheel 361 may be smaller than that of the inclined teeth 352 of the first ratchet wheel 351. The first ratchet wheel 351 may be configured such that the number of the inclined teeth 352 of the first ratchet wheel 351 is a multiple of the number of the inclined teeth 362 of the second ratchet wheel 361. For example, if the second ratchet wheel 361 has four inclined teeth 362, the first ratchet wheel 351 may be configured to have eight or twelve inclined teeth 362. In this exemplary embodiment, the second ratchet wheel 361 has four inclined teeth 362, and the first ratchet wheel 351 has twelve inclined teeth 352.

Furthermore, an angle by which the hair collecting drum 330 rotates when the moving direction of the suction nozzle assembly 310 changes is determined according to the number of inclined teeth 362 of the second ratchet wheel 361. In the case that the second ratchet wheel 361 has four inclined teeth 362 as this exemplary embodiment, when the moving direction of the suction nozzle assembly 310 changes, the hair collecting drum 330 rotates approximately 90 degrees. The angle by which the hair collecting drum 330 rotates when the moving direction of the suction nozzle assembly 310 changes may be determined so that when the hair collecting drum 330 rotates, a portion of the hair collecting drum 330 that contacted the surface to be cleaned 303 is separated from the surface to be cleaned 303, and a new portion of the hair collecting drum 330 contacts the surface to be cleaned 303. Therefore, the rotating angle of the hair collecting drum 330 may be determined according to a contacting area between the hair collecting drum 330 and the surface to be cleaned 303. For example, if a center angle (θ, FIG. 18) of the hair collecting drum 330 corresponding to a portion of the hair collecting drum 330 that contacts the surface to be cleaned 303 is approximately 50 degrees, the rotating angle of the hair collecting drum 330 may be set over 60 degrees more than 50 degrees.

As illustrated in FIGS. 21 and 23, the lever ratchet 365 is disposed at a second supporting member 391 at a side of the second ratchet wheel 361 to rotate on a pivot shaft 369. However, the lever ratchet 365 is not configured to rotate even when the hair collecting drum 330 rotates. A bottom surface 367 of the lever ratchet 365 is formed substantially in a circular arc so that the lever ratchet 365 rotates on the pivot shaft 369.
shaft 369 by the friction against the surface to be cleaned 303. Therefore, when the hair collecting drum 330 contacts the surface to be cleaned 303, the bottom surface 367 of the lever ratchet 365 also contacts the surface to be cleaned 303. For increasing the friction against the surface to be cleaned 303 such as the carpet, etc., as illustrated in FIG. 23, a plurality of grooves 368 may be formed on the bottom surface 367 of the lever ratchet 365.

[0144] The top end 366 of the lever ratchet 365 is formed selectively to engage with one of the inclined teeth 362 of the second ratchet wheel 361. Therefore, when the suction nozzle assembly 310 having the hair collecting drum 330 moves in the second direction, that is, in the direction of arrow A in a state that the top end 366 of the lever ratchet 365 is separated from the second ratchet wheel 361 as illustrated in FIG. 23, the lever ratchet 365 remains to be separated from the second ratchet wheel 361 and moves slidingly along the surface to be cleaned 303. At this time, the hair collecting drum 330 can rotates in the counterclockwise direction. When the suction nozzle assembly 310 changes the moving direction thereof from this state and moves in the first direction, that is, in the reverse direction of arrow S, the lever ratchet 365 is rotated on the pivot shaft 369 by the friction between the bottom surface 367 of the lever ratchet 365 and the surface to be cleaned 303 so that the top end 366 of the lever ratchet 365 is engaged with one of the inclined teeth 362 of the second ratchet wheel 361. When the top end 366 of the lever ratchet 365 is engaged with the second ratchet wheel 361, the hair collecting drum 330 does not rotate.

[0145] The drum height adjusting member 370 automatically adjusts a height of the hair collecting drum 330 corresponding to the height of tufts of the carpet 303. Referring to FIGS. 17, 20, and 21, the drum height adjusting member 370 includes first and second supporting members 381 and 391, first and second guiding portions 386 and 396, and elastic members 385 and 395.

[0146] The first and second supporting members 381 and 391 support opposite ends of the hair collecting drum 330 so that the hair collecting drum 330 can rotate. The first and second supporting members 381 and 391 are elastically supported with respect to the nozzle body 311. A supporting shaft 382 and 392 is formed at a top end of each of the first and second supporting members 381 and 391. The supporting shaft 382 and 392 is inserted in a supporting hole 383 and 393 formed at the nozzle body 311. The elastic member 385 and 395 is disposed between the supporting shaft 382 and 392 and the supporting hole 383 and 393 and elastically supports each of the first and second supporting members 381 and 391. A compression spring can be used as the elastic member 385 and 395. The ratchet pawl 355, as illustrated in FIG. 20, is rotatably disposed at an inner surface of the first supporting member 381. The lever ratchet 365, as illustrated in FIG. 21, is disposed at an inner surface of the second supporting member 391 to rotate on the pivot shaft 369. A guiding projection 384 and 394 is formed at an outer surface of each of the first and second supporting members 381 and 391.

[0147] The first and second guiding portions 386 and 396 guide the first and second supporting members 381 and 391 to move upward and downward with reference to the support to be cleaned 303. The first and second guiding portions 386 and 396 are formed at the nozzle body 311 to guide the guiding projection 384 and 394 formed at the outer surface of each of the first and second supporting members 381 and 391. Referring to FIGS. 20 and 21, each of the first and second guiding portions 386 and 396 is formed as a long groove capable of receiving the guiding projection 384 and 394 of each of the first and second supporting members 381 and 391.

[0148] Hereinafter, operation of the suction nozzle assembly 310 usable with the vacuum cleaner according to an exemplary embodiment of the present disclosure having the structure as described above will be explained in detail with reference to FIGS. 22 to 26.

[0149] As illustrated in FIG. 17, when moving the suction nozzle assembly 310 in the second direction (in the direction of arrow S), the hair collecting drum 330 does not rotate due to the first and second ratchet devices 350 and 360 of the drum rotation restricting member 340 and slidingly moves along the surface to be cleaned 303. Hereinafter, operation of the first and second ratchet devices 350 and 360 of the drum rotation restricting member 340 that prevent the hair collecting drum 330 from rotating will be explained.

[0150] When the suction nozzle assembly 310 moves in the second direction, the hair collecting drum 330 rubs against the surface to be cleaned 303 and receives a force that causes the hair collecting drum 330 to rotate in the counterclockwise direction. At this time, the bottom surface 367 of the lever ratchet 365 of the second ratchet device 360 is rotated in a direction of arrow P as illustrated in FIG. 23 by a friction force against the surface to be cleaned 303, so the top end 366 of the lever ratchet 365 is separated from the second ratchet wheel 361 so that the hair collecting drum 330 can rotate. However, as illustrated in FIG. 22, the ratchet pawl 355 of the first ratchet device 350 prevents the first ratchet wheel 351 from rotating in the counterclockwise direction so that the hair collecting drum 330 cannot rotate. Therefore, when the suction nozzle assembly 310 moves in the second direction, the hair collecting drum 330 does not rotate.

[0151] On the other hands, because the plurality of protrusions 331 as illustrated in FIG. 18, is disposed on the surface of the hair collecting drum 330 at an incline in the second direction (arrow S) with respect to the surface to be cleaned 303, when the suction nozzle assembly 310 moves in the second direction, the hair collecting drum 330 slidingly moves along the surface to be cleaned 303.

[0152] When a user moves the suction nozzle assembly 310 from the second direction to the first direction opposite to the second direction (the reverse direction of arrow S), the hair collecting drum 330 rotates by a predetermined angle. That is, the moment the moving direction of the suction nozzle assembly 310 changes, the hair collecting drum 330 rotates by the predetermined angle.

[0153] When the suction nozzle assembly 310 moves from the second direction to the first direction, the hair collecting drum 330 receives a force that causes the hair collecting drum 330 to rotate in the clockwise direction due to the friction against the surface to be cleaned 303. At this time, the first ratchet wheel 351 of the first ratchet device 350 is not caught on the ratchet pawl 355 so that the hair collecting drum 330 can rotate in the clockwise direction. Also, the bottom surface 367 of the lever ratchet 365 of the second ratchet device 360 is rotated in a direction of arrow Q by the friction against the surface to be cleaned 303 so that the top end 366 of the lever ratchet 365 moves to the second ratchet wheel 361. At this time, the top end 366 of the lever ratchet 365 locates behind a first inclined tooth 362-1 of the second ratchet wheel 361 so that the hair collecting drum 330 rotates until a second inclined tooth 362-2 of the second ratchet wheel 361 is caught on the top end 366 of the lever ratchet 365. In this exemplary embodiment, the second ratchet wheel 361 has four inclined teeth 362 so that the hair collecting drum 330 can rotate approximately 90 degrees.

[0154] When the suction nozzle assembly 310 moves in the first direction (arrow S), the first ratchet device 350 allows the hair collecting drum 330 to rotate but the second inclined...
tooth 362-2 of the second ratchet wheel 362 of the second ratchet device 360 is caught on the top end 366 of the lever ratchet 365 so that the hair collecting drum 330 does not rotate and moves in a stationary state.

[0155] At this time, as illustrated in FIG. 18, the hair collecting drum 330 is provided with the plurality of protrusions 331 disposed on the surface thereof at an incline in the second direction so that when the suction nozzle assembly 310 moves in the first direction, the plurality of protrusions 331 of the hair collecting drum 330 moves along and rubs against the surface to be cleaned 303, that is, the carpet. Therefore, fibers H among tufts of the carpet 303, as illustrated in FIG. 27, is separated from the carpet 303 and caught among the plurality of protrusions 331 of the hair collecting drum 330.

[0156] After that, when the suction nozzle assembly 310 again moves in the second direction, the lever ratchet 365 of the second ratchet device 360 moves to allow the hair collecting drum 330 to rotate, but the first ratchet device 350 prevents the first ratchet wheel 361 from rotating so that the hair collecting drum 330 does not rotate. Therefore, the hair collecting drum 330 slidingsly moves along the carpet 303. At this time, the fibers H caught among the plurality of protrusions 331 of the hair collecting drum 330, as illustrated in FIG. 28, is separated from the plurality of protrusions 331 of the hair collecting drum 330 by the friction against the carpet 303 and remains on the carpet 303. Then, the fibers R being collected on the carpet 303 is drawn-in the contaminant suction opening 312 of the suction nozzle assembly 310 by the suction force.

[0157] FIG. 29 is a sectional view schematically illustrating another drum rotation restricting member 400 being used in the suction nozzle assembly 310 usable with a vacuum cleaner according to an exemplary embodiment of the present disclosure.

[0158] Referring to FIG. 29, the drum rotation restricting member 400 according to another exemplary embodiment includes a first ratchet device 410 and a second ratchet device 420.

[0159] The first ratchet device 410 includes a first rotating ratchet 411 disposed at a first end of the hair collecting drum 330 and a first stationary ratchet 418 that is formed to correspond to the first rotating ratchet 411 and to cause the first rotating ratchet 411 to rotate only in one direction. The first stationary ratchet 418 is disposed at the first supporting member 381 of the drum height adjusting member 370.

[0160] The first rotating ratchet 411 is disposed to slidingsly move in an axial direction thereof within a groove 412 formed at the first end of the hair collecting drum 330. The first rotating ratchet 411 is elastically supported by a compression spring 414 disposed inside the groove 412 of the hair collecting drum 330. A plurality of guiding grooves 413 is formed at an outer circumferential surface of the first rotating ratchet 411, and a plurality of guiding rails 415 that is inserted in the plurality of guiding grooves 413 of the first rotating ratchet 411 is disposed at an inner circumferential surface of the groove 412 of the hair collecting drum 330. Therefore, the first rotating ratchet 411 can slidingsly move in the axial direction of the hair collecting drum 330, and when the first rotating ratchet 411 rotates, the hair collecting drum 330 rotates integrally with the first rotating ratchet 411.

[0161] The rotating ratchet 411 includes a rotating teeth surface on which a plurality of ratchet teeth 416 is formed in a circle that faces the first stationary ratchet 418. Each of the ratchet teeth 416 of the rotating teeth surface includes an inclined side that is inclined in a direction and a perpendicular side. The first stationary ratchet 418 includes a plurality of stationary ratchet teeth 419 corresponding to the plurality of ratchet teeth 416 of the first rotating ratchet 411. Therefore, the first rotating ratchet 411 can rotate in a direction of the inclined side of the plurality of ratchet teeth 416, but cannot rotate in a reverse direction thereof. That is, when the first rotating ratchet 411 receives a force in the direction of the inclined side of the ratchet teeth 416, the first rotating ratchet 411 is pushed toward the inside of the groove 412 of the hair collecting drum 330 by the stationary ratchet teeth 419 of the first stationary ratchet 418 so that the first rotating ratchet 411 can rotate. However, when the first rotating ratchet 411 receives a force in a reverse direction of the inclined side of the ratchet teeth 416, the ratchet teeth 416 of the first rotating ratchet 411 and the stationary ratchet teeth 419 of the first stationary ratchet 418 are engaged with each other so that the first rotating ratchet 411 cannot rotate. In this exemplary embodiment, the first ratchet device 410 is configured so that when the suction nozzle assembly 310 (see FIG. 17) moves in the second direction, the first rotating ratchet 411 does not rotate, and when moving in the first direction, the first rotating ratchet 411 rotates.

[0162] The second ratchet device 420 includes a second rotating ratchet 421 disposed at the second end of the hair collecting drum 330 and a second stationary ratchet 428 that is formed to correspond to the second rotating ratchet 421 and to cause the second rotating ratchet 421 to rotate only in one direction. The second stationary ratchet 428 is disposed at the second supporting member 391 of the drum height adjusting member 370.

[0163] The second rotating ratchet 421 is formed in the same structure as that of the first rotating ratchet 411 except that the number of the plurality of ratchet teeth 426 formed on the rotating teeth surface is less than that of the ratchet teeth 416 of the first rotating ratchet 411, and the inclined side of the ratchet teeth 426 is formed in a reverse direction of the inclined side of the ratchet teeth 416 of the first rotating ratchet 411. Accordingly, in this exemplary embodiment, the second ratchet device 420 is formed so that when the suction nozzle assembly 310 moves in the first direction the second rotating ratchet 421 does not rotate, and when the suction nozzle assembly 310 moves in the second direction the second rotating ratchet 421 rotates.

[0164] Also, because the number of the ratchet teeth 416 of the first rotating ratchet 411 is different from the number of the ratchet teeth 426 of the second rotating ratchet 421, when the moving direction of the suction nozzle assembly 310 changes, the hair collecting drum 330 rotates by a predetermined angle.

[0165] The first and second supporting members 381 and 391 of the drum height adjusting member 370 are guided by the first and second guiding portions 386 and 396 disposed at the nozzle body 311 of the suction nozzle assembly 310. The structures of the first and second supporting members 381 and 391 are described above; therefore, explanations thereof are omitted.

[0166] Hereinafter, operation of the drum rotation restricting member 400, as illustrated in FIG. 29, that is used in the suction nozzle assembly 310 according to an exemplary embodiment of the present disclosure and controls the rotation of the hair collecting drum 330 will be explained.

[0167] When the suction nozzle assembly 310 moves in the second direction, the hair collecting drum 330 receives a force that causes the hair collecting drum 330 to rotate in the counterclockwise direction. At this time, since the second rotating ratchet 421 of the second ratchet device 420 receives a force causing the second rotating ratchet 421 to rotate in the direction of the inclined side thereof, it is not caught on the stationary teeth 429 of the second stationary ratchet 428 but
rotates. However, the ratchet teeth 416 of the first rotating ratchet 411 of the first ratchet device 410 are caught on the stationary teeth 419 of the first stationary ratchet 418 so that the hair collecting drum 330 does not rotate.

[0168] The moment the suction nozzle assembly 310 changes the moving direction thereof, that is, the moment the suction nozzle assembly 310 moves from the second direction to the first direction, the hair collecting drum 330 receives a force that causes the hair collecting drum 330 to rotate in the clockwise direction. At this time, since the first rotating ratchet 411 of the first ratchet device 410 receives a force in the direction of the inclined side thereof, it is not caught on the stationary ratchet teeth 419 of the first stationary ratchet 418. Therefore, the first rotating ratchet 411 can rotate. Also, vertical sides of the ratchet teeth 426 of the second rotating ratchet 421 of the second ratchet device 420 are not caught on vertical sides of the stationary ratchet teeth 429 of the second stationary ratchet 428 so far. Therefore, the second rotating ratchet 421 can rotate until the vertical sides of the ratchet teeth 426 of the second rotating ratchet 421 are caught on the vertical sides of the stationary ratchet teeth 429 of the second stationary ratchet 428. Therefore, the hair collecting drum 330 can rotate by a predetermined angle. In the case that the second rotating ratchet 421 has four ratchet teeth 426, when changing the moving direction, the hair collecting drum 330 can rotate by approximately 90 degrees.

[0169] When the vertical side of each of the ratchet teeth 426 of the second rotating ratchet 421 of the second ratchet device 420 is caught on each of the stationary ratchet teeth 429 of the second stationary ratchet 428, the second rotating ratchet 421 stops rotating. Therefore, the hair collecting drum 330 also stops rotating. In this status, even when the suction nozzle assembly 310 continues to move in the first direction, the hair collecting drum 330 does not rotate.

[0170] Hereinafter, a method for removing hair by using the suction nozzle assembly 310 according to an exemplary embodiment of the present disclosure will be explained with reference to FIG. 30.

[0171] When moving the suction nozzle assembly 310 along the surface to be cleaned 303 such as the carpet in the first direction, the hair collecting drum 330 of the suction nozzle assembly 310 moves along the surface to be cleaned 303 in the first direction and separates fibers from the carpet 303 of the surface to be cleaned (S10). The separated fibers are caught among the plurality of protrusions 331 of the hair collecting drum 330.

[0172] When the user makes the suction nozzle assembly 310 to move in the reverse direction, the moving direction of the hair collecting drum 330 of the suction nozzle assembly 310 changes from the first direction to the second direction so that the hair collecting drum 330 can rotate by a predetermined angle by the first and second ratchet devices 350 and 360 of the drum rotation restricting member 340 (S20).

[0173] When the suction nozzle assembly 310 continues to move in the second direction, the hair collecting drum 330 of the suction nozzle assembly 310 also continues to move in the second direction so that the fibers being caught among the plurality of protrusions 331 of the hair collecting drum 330 is separated, and then, drawn into the contaminant suction opening 312 of the suction nozzle assembly 310. At this time, the fur of pet being caught among the plurality of protrusions 331 of the hair collecting drum 330 is separated from the plurality of protrusions 331 by the friction against the surface to be cleaned 303, thereby remaining on the surface to be cleaned 303. The fibers remaining on the surface to be cleaned 303 is drawn into the contaminant suction opening 312 of the suction nozzle assembly 310 by the suction force.

[0174] While the suction nozzle assembly 310 is moving in the first direction or in the second direction, the hair collecting drum 330 does not rotate but remains in the stationary state.

[0175] With the suction nozzle assembly usable with a vacuum cleaner having the hair collecting member according to an exemplary embodiment of the present disclosure having the structure as described above, the vacuum cleaner having the same, and the method for removing hair by using the same, the hair collecting member separates fibers from the surface to be cleaned such as a carpet so that the separated fibers can be easily drawn in by the suction force.

[0176] Also, the suction nozzle assembly usable with a vacuum cleaner having the hair collecting member according to an exemplary embodiment of the present disclosure uses a cylindrical hair collecting drum to separate fibers from the carpet. Therefore, if the hair collecting drum is disposed in a front portion of the suction nozzle assembly, a distance between a front end of the suction nozzle assembly and the contaminant suction opening may be smaller than that of the suction nozzle assembly having a flat hair collecting member. As a result, a size of a dead space in which the suction force of the vacuum cleaner does not operate may be decreased.

[0177] Furthermore, with the suction nozzle assembly usable with a vacuum cleaner having the hair collecting member according to an exemplary embodiment of the present disclosure, the vacuum cleaner having the same, and the method for removing hair by using the same, each time the moving direction of the suction nozzle assembly changes, a portion of the hair collecting drum rubbing against the surface to be cleaned changes. Therefore, a life span of the hair collecting drum may be lengthened.

[0178] While the exemplary embodiments of the present disclosure have been described, additional variations and modifications of the exemplary embodiments may occur to those skilled in the art once they learn of the basic inventive concepts. Therefore, it is intended that the appended claims shall be construed to include both the above exemplary embodiments and all such variations and modifications that fall within the spirit and scope of the disclosure.

What is claimed is:

1. A suction nozzle assembly usable with a vacuum cleaner, comprising:
   a nozzle body configured to move along a surface to be cleaned, the nozzle body having a contaminant suction opening; and
   a hair collecting unit disposed at the nozzle body; wherein the hair collecting unit comprises a hair collecting member that contacts the surface to be cleaned;
   wherein, when the nozzle body moves, the hair collecting member does not rotate; and
   wherein, when the nozzle body moves in a first direction, the hair collecting member collects fibers from the surface to be cleaned.

2. The suction nozzle assembly of claim 1, wherein the hair collecting member comprises a hair collecting drum substantially formed in a cylindrical shape.

3. The suction nozzle assembly of claim 2, wherein, when a moving direction of the nozzle body changes, the hair collecting drum rotates by a predetermined angle.

4. The suction nozzle assembly of claim 3, wherein, when the moving direction of the nozzle body changes, the hair collecting drum rotates within a range of 10 degrees to 180 degrees.

5. The suction nozzle assembly of claim 2, wherein the hair collecting unit further comprises a drum rotation restricting member;
wherein the drum rotation restricting member is configured so that while the nozzle body is moving, the drum rotation restricting member does not allow the hair collecting drum to rotate, and wherein the drum rotation restricting member is configured so that when a moving direction of the nozzle body changes, the drum rotation restricting member allows the hair collecting drum to rotate by a predetermined angle.

6. The suction nozzle assembly of claim 5, wherein the drum rotation restricting member comprises:
   a first ratchet device disposed at a first end of the hair collecting drum, the first ratchet device configured to allow the hair collecting drum to rotate in one direction, and a second ratchet device disposed at a second end of the hair collecting drum, the second ratchet device configured to prevent the hair collecting drum from rotating in the one direction in which the first ratchet device allows the hair collecting drum to rotate.

7. The suction nozzle assembly of claim 6, wherein the first ratchet device comprises:
   a first ratchet wheel disposed at the first end of the hair collecting drum, and a ratchet pawl to restrict a rotating direction of the first ratchet wheel.

8. The suction nozzle assembly of claim 6, wherein the second ratchet device comprises:
   a second ratchet wheel disposed at the second end of the hair collecting drum, and a lever ratchet disposed to rub against the surface to be cleaned, the lever ratchet being configured to restrict a rotating direction of the second ratchet wheel.

9. The suction nozzle assembly of claim 6, wherein each of the first and second ratchet devices comprises:
   a rotating ratchet disposed at an end of the hair collecting drum, and a stationary ratchet configured to correspond to the rotating ratchet, the stationary ratchet being configured to allow the rotating ratchet to rotate in only one direction.

10. The suction nozzle assembly of claim 1, wherein the hair collecting member comprises a plurality of protrusions.

11. The suction nozzle assembly of claim 10, wherein the plurality of protrusions is formed at an incline with respect to the surface to be cleaned.

12. The suction nozzle assembly of claim 2, further comprising:
   a drum height adjusting member being configured to adjust a height of the hair collecting drum with respect to the surface to be cleaned.

13. The suction nozzle assembly of claim 12, wherein the drum height adjusting member comprises:
   first and second supporting members supporting opposite ends of the hair collecting drum, the first and second supporting members being elastically supported with respect to the nozzle body, and first and second guiding portions guiding the first and second supporting members to move upward and downward with respect to the surface to be cleaned.

14. The suction nozzle assembly of claim 1, wherein the hair collecting member is disposed in the nozzle body in at least one of in front of and behind the contaminant suction opening.

15. The suction nozzle assembly of claim 1, wherein the hair collecting member is disposed inside the contaminant suction opening.

16. The suction nozzle assembly of claim 1, further comprising:
   a rotation brush rotatably disposed inside the contaminant suction opening of the nozzle body.

17. A vacuum cleaner comprising:
   a cleaner body; and a suction nozzle assembly connected with the cleaner body to draw in contaminants from a surface to be cleaned, wherein the suction nozzle assembly comprises:
   a nozzle body configured to move along the surface to be cleaned, the nozzle body having a contaminant suction opening, and a hair collecting unit disposed at the nozzle body, wherein the hair collecting unit comprises a hair collecting member that contacts the surface to be cleaned, wherein when the nozzle body moves, the hair collecting member does not rotate, and wherein when the nozzle body moves in a first direction, the hair collecting member collects fibers from the surface to be cleaned.

18. A method for removing hair by using a suction nozzle assembly, comprising:
   moving a hair collecting drum of the suction nozzle assembly in a first direction along a surface to be cleaned so that fibers are separated from the surface to be cleaned and collected;
   changing a moving direction of the hair collecting drum from the first direction to a second direction so that the hair collecting drum is rotated by a predetermined angle; and
   moving the hair collecting drum in the second direction so that the collected fibers are drawn into a contaminant suction opening of the suction nozzle assembly.

19. The method of claim 18, wherein the moving the hair collecting drum in the second direction further comprises:
   causing the fibers caught among a plurality of protrusions of the hair collecting drum to be separated from the plurality of protrusions and remain on the surface to be cleaned before being drawn into the contaminant suction opening.

20. The method of claim 18, wherein, while the suction nozzle assembly is moving in the first direction or in the second direction, the hair collecting drum does not rotate.

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