Summary of Invention

[0006] An object of the present invention is to provide a suction tool configured to allow easy removal of long dust winding around a rotary cleaning body.

[0007] A suction tool according to one aspect of the present invention is configured to be attached to a suction-type cleaning device. The suction tool includes: a case configured to define an internal space between a pair of side walls disposed respectively at positions spaced away from each other in a left-to-right direction and a channel for air flowing from the internal space into the cleaning device on a rear wall, the internal space being configured to extend upward from a suction opening which is opened downward and allows dust to be sucked from the suction opening; ~~and~~ a rotary cleaning body configured to extend laterally in the internal space and come in contact with a floor surface through the suction opening, the rotary cleaning body being configured to taper toward a distal end of the rotary cleaning body, and another rotary cleaning body including a proximal end connected to the other of the pair of side walls and being configured to extend laterally in the internal space and come in contact with the floor surface through the suction opening, the other rotary cleaning body being configured to taper toward a distal end of the other rotary cleaning body. The rotary cleaning body and the other rotary cleaning body are supported in a cantilever style by the case so that a~~.~~ ~~A~~ space is formed ~~or can be formed adjacent to~~ between the distal ends of the rotary cleaning body ~~in an extension direction of~~ and the other rotary cleaning body, the space being configured to allow dust winding around the rotary cleaning body and the other rotary cleaning body to be removed through the space.

[0008] The aforementioned suction tool allows easy removal of long dust winding around the rotary cleaning body.

[0009] The object, features, and advantages of the present invention will be made clear through the following detailed description and the accompanying drawings.

Brief Description of Drawings

[0010] FIG. 1 is a schematic side view of a cleaning device to which a suction tool according to the first embodiment is attached.

FIG. 2 is a schematic perspective view of the suction tool.

FIG. 3 is a schematic perspective view of the suction tool.

FIG. 4 is a schematic front view of the suction tool.

FIG. 5 is a schematic front view of a rotary cleaning body of the suction tool.

FIG. 6 is a schematic diagram of a scraping portion of the suction tool.

FIG. 7 is a schematic diagram of the rotary cleaning body.

FIG. 8 is a schematic front view of the rotary cleaning body.

FIG. 9 is a graph showing a relationship between a diameter of a core rod and a projection amount of the scraping portion.

FIG. 10 is a schematic perspective view of a suction tool of the second embodiment.

FIG. 11 is a schematic perspective view of the suction tool.

However, the suction tool 100 may be incorporated in a robot vacuum cleaner configured to move autonomously.

[0068] The aforementioned embodiments mainly include the following configurations.

[0069] A suction tool according to one aspect of the aforementioned embodiments is configured to be attached to a suction-type cleaning device. The suction tool includes: a case configured to define an internal space between a pair of side walls disposed respectively at positions spaced away from each other in a left-to-right direction and a channel for air flowing from the internal space into the cleaning device on a rear wall, the internal space being configured to extend upward from a suction opening which is opened downward and allows dust to be sucked from the suction opening; ~~and~~ a rotary cleaning body including a proximal end connected to one of the pair of side walls and being configured to extend laterally in the internal space and come in contact with a floor surface through the suction opening, the rotary cleaning body being configured to taper toward a distal end of the rotary cleaning body, and another rotary cleaning body including a proximal end connected to the other of the pair of side walls and being configured to extend laterally in the internal space and come in contact with the floor surface through the suction opening, the other rotary cleaning body being configured to taper toward a distal end of the other rotary cleaning body. The rotary cleaning body and the other rotary cleaning body are supported in a cantilever style by the case so that a~~. A~~ space is formed ~~or can be formed adjacent to~~ between the distal ends of the rotary cleaning body ~~in an extension direction of~~ and the other rotary cleaning body, the space being configured to allow dust winding around the rotary cleaning body and the other rotary cleaning body to be removed through the space.

[0070] According to the aforementioned configuration, the pair of rotary cleaning ~~body rotates~~ bodies extends laterally so as to rotate under a condition in contact with the floor surface~~. Since the rotary cleaning body extends laterally~~, so that dust on the floor surface is scraped off by the pair of rotary cleaning ~~body~~ bodies over an extension range of the rotary cleaning body along with movement of the suction tool. At this time, long dust on the floor surface may wind around these rotary cleaning ~~body~~ bodies. Since these rotary cleaning ~~body~~ bodies tapers toward the distal end, the dust winding around these rotary cleaning ~~body~~ bodies moves toward the distal ends of the rotary cleaning ~~body~~ bodies. Since the space is formed ~~or can be formed adjacent to~~ between the distal ends of the rotary cleaning ~~body in the extension direction of the rotary cleaning body~~ bodies, the dust reaching the distal ends of the rotary cleaning ~~body~~ bodies may be removed through the space.

[0071] In the aforementioned configuration, the space may be formed near an opening end of the channel which is opened toward the internal space.

[0072] According to the aforementioned configuration, since the space for removing the dust is formed near the opening end of the channel, a suction force from the cleaning device relatively acts strongly on the space for removing the dust and on the distal end of the rotary cleaning body. As a result, the dust having reached the space for removing the dust and the distal end of the rotary

cleaning body is easily sucked into the cleaning device.

[0073] In the aforementioned configuration, the space may be aligned with the opening end in the opening direction of the opening end.

[0074] According to the aforementioned configuration, since the space for removing the dust is aligned with the opening end of the channel in the opening direction of the opening end, the dust having reached the space for removing the dust and the distal end of the rotary cleaning body is easily sucked into the cleaning device

~~[0075] In the aforementioned configuration, the suction tool may further include another rotary cleaning body configured to extend laterally from a distal end facing the distal end of the rotary cleaning body via the space. The other rotary cleaning body may be in contact with the floor~~

~~surface through the suction opening and taper toward the distal end of the other rotary cleaning body.~~

~~[0076] According to the aforementioned configuration, a pair of the rotary cleaning bodies both extend laterally, and are in contact with the floor surface through the suction opening. The rotary cleaning bodies, therefore, may scrape off dust on the floor surface over a wide range as the suction tool moves. Dust having wound around these rotary cleaning bodies at this moment moves toward the distal ends of the rotary cleaning bodies since both of the rotary cleaning bodies taper toward their distal ends. Since the space is formed between the distal ends of these rotary cleaning bodies, the dust having reached the distal ends of the rotary cleaning bodies may be removed through the space.~~

~~[0077]~~ [0075] In the aforementioned configuration, the pair of rotary cleaning bodies may be symmetrical in shape with each other with respect to the space.

~~[0078]~~ [0076] According to the aforementioned configuration, since the pair of rotary cleaning bodies are symmetrical in shape with each other with respect to the space, the rotary cleaning bodies show cleaning abilities substantially equal to each other.

~~[0079] In the aforementioned configuration, the suction tool may further include a coupling member configured to couple the distal ends of the pair of rotary cleaning bodies to each other. The case may include a pair of side portions configured to support proximal ends of the pair of rotary cleaning bodies, respectively. The coupling member may be detachable from the distal ends of the pair of rotary cleaning bodies.~~

~~[0080] According to the aforementioned configuration, since the coupling member is attached to the distal ends of the pair of rotary cleaning bodies, the rotary cleaning bodies as a whole are supported on their both ends by the pair of side portions of the case. The suction tool, therefore, may have a structure more robust than a structure in which each of the rotary cleaning bodies is separately supported in the cantilever style. When the coupling member is removed from the distal ends of the pair of rotary cleaning bodies, a space is created to allow removal of dust winding around the rotary cleaning bodies through the space.~~

~~[0081] In the aforementioned configuration, the case may include a side portion that faces the distal end of the rotary cleaning body via the space.~~

~~[0082] According to the aforementioned configuration, dust winding around the rotary cleaning body moves to the distal end of the rotary cleaning body and is removed through the space between the distal end of the rotary cleaning body and the side portion of the case.~~

~~[0083] In the aforementioned configuration, the suction tool may further include a coupling member configured to couple the distal end of the rotary cleaning body to the side portion. The case may include another side portion on a side opposite to the side portion, the other side portion being configured to support a proximal end of the rotary cleaning body. The coupling member may be detachable from the distal end of the rotary cleaning body and the side portion.~~

~~[0084] According to the aforementioned configuration, since the coupling member couples the~~

~~distal end of the rotary cleaning body to the side portion, the rotary cleaning body is supported on its both ends by a pair of the side portions of the case. The suction tool, therefore, has a structure more robust than a structure in which the rotary cleaning body is supported in the cantilever style. When the coupling member is removed from the distal end of the rotary cleaning body and the side portion, a space is created to allow removal of dust winding around the rotary cleaning body through the space.~~

~~[0085]~~ [0077] In the aforementioned configuration, an axis of the rotary cleaning body may be inclined downward from ~~the side portion configured to support~~ the proximal end of the rotary cleaning body.

~~[0086]~~ [0078] According to the aforementioned configuration, since the axis of the rotary cleaning body is inclined downward from ~~the side portion supporting~~ the proximal end of the rotary cleaning body, the distal end of the rotary cleaning body may project downward out of the suction opening. Therefore, although the rotary cleaning body tapers toward its distal end, the distal end portion of the rotary cleaning body may be brought into contact with the floor surface.

~~[0087]~~ [0079] In the aforementioned configuration, the case may include a front wall situated in front of the internal space. The axis of the rotary cleaning body may be inclined frontward from ~~the side portion configured to support~~ the proximal end of the rotary cleaning body. The space is situated in front of the opening end of the channel which is opened toward the internal space.

~~[0088]~~ [0080] According to the aforementioned configuration, since the case has the front wall situated in front of the internal space, a suction force of the cleaning device hardly acts on a space in front of the case but concentrates in the suction opening. Since the axis of the rotary cleaning body is inclined forward ~~from the side portion~~, the distal end portion of the rotary cleaning body can be brought closer to the front wall although the rotary cleaning body tapers toward its distal end. As a result, a gap between the distal end portion of the rotary cleaning body and the front wall does not become excessively large, which suppresses a drop in the suction force around the distal end portion of the rotary cleaning body.

~~[0089]~~ [0081] In the aforementioned configuration, the rotary cleaning body may include a core rod extending laterally, and a scraping portion provided on an outer peripheral surface of the core rod and configured to scrape off dust on the floor surface. The scraping portion may extend spirally on the outer peripheral surface of the core rod or extends diagonally to three-dimensionally intersect an axis of the core rod.

~~[0090]~~ [0082] According to the aforementioned configuration, since the scraping portion extends spirally on the outer peripheral surface of the core rod or extends diagonally to three-dimensionally intersect the axis of the core rod, the scraping portion applies a force to dust on the floor surface in the extension direction of the core rod. When long dust comes in contact with the scraping portion, the contact position of the dust in contact with the scraping portion tends to move in the extension direction of the core rod. As a result, the long dust tends to wind around the core rod such that a part of the long dust does not overlap other parts of the long dust.

~~[0091]~~ [0083] In the aforementioned configuration, the projection amount of the scraping portion may be uniform.

~~[0092]~~ [0084] According to the aforementioned configuration, since the projection amount of the scraping portion is uniform, deformability of the scraping portion in the projection direction may be substantially constant. In this case, a force acting between the scraping portion and the floor surface (i.e., a force for scraping off dust on the floor surface) may also become substantially constant.

~~[0093]~~ [0085] In the aforementioned configuration, the projection amount of the scraping portion from the outer peripheral surface of the core rod may be reduced toward the distal end of the rotary cleaning body.

~~[0094]~~ [0086] According to the aforementioned configuration, since the distal end of the rotary cleaning body is distant from the side portion of the case, the distal end of the rotary cleaning body is more likely to displace than the proximal end of the rotary cleaning body. In this case, a force acting on the floor surface near the distal end of the rotary cleaning body (i.e., the force for scraping off dust on the floor surface) tends to weaken. However, since the projection amount of the scraping portion from the outer peripheral surface of the core rod is reduced toward the distal end of the rotary cleaning body, a part of scraping portion that is closer to the distal end of the rotary cleaning body is less deformable in the projection direction of the scraping portion. This allows the scraping portion closer to the distal end of the rotary cleaning body to apply a strong force (scraping force) to dust on the floor surface. Since the proximal end of the rotary cleaning body is relatively less likely to displace, the scraping portion near the proximal end of the rotary cleaning body may also apply a strong force (scraping force) to dust on the floor surface.

~~[0095]~~ [0087] In the aforementioned configuration, the scraping portion may be made of an elastically deformable material.

~~[0096]~~ [0088] According to the aforementioned configuration, the scraping portion deforms elastically and flexibly when hitting the floor surface, and returns to its original form when leaving the floor surface. This action scrapes dust off the floor surface effectively.

Industrial Applicability

~~[0097]~~ [0089] Principles disclosed in the present embodiments are applied preferably to devices used for cleaning work.

Claims

1. A suction tool attached to a suction-type cleaning device, the suction tool comprising:

a case configured to define an internal space between a pair of side walls disposed respectively at positions spaced away from each other in a left-to-right direction and a channel for air flowing from the internal space into the cleaning device on a rear wall, the internal space being configured to extend upward from a suction opening which is opened downward and allows dust to be sucked from the suction opening; ~~and~~

a rotary cleaning body including a proximal end connected to one of the pair of side walls and being configured to extend laterally in the internal space and come in contact with a floor surface through the suction opening, the rotary cleaning body being configured to taper toward a distal end of the rotary cleaning body, and

another rotary cleaning body including a proximal end connected to the other of the pair of side walls and being configured to extend laterally in the internal space and come in contact with the floor surface through the suction opening, the other rotary cleaning body being configured to taper toward a distal end of the other rotary cleaning body,

wherein the rotary cleaning body and the other rotary cleaning body are supported in a cantilever style by the case so that a space is formed ~~or can be formed adjacent to~~ between the distal ends of the rotary cleaning body ~~in an extension direction of~~ and the other rotary cleaning body, the space being configured to allow dust winding around the rotary cleaning body and the other rotary cleaning body to be removed through the space.

2. The suction tool according to claim 1,

wherein the space is formed near an opening end of the channel which is opened toward the internal space.

3. The suction tool according to claim 2,

wherein the space is aligned with the opening end in an opening direction of the opening end.

~~4. The suction tool according to any one of claims 1 to 3, further comprising another rotary cleaning body configured to extend laterally from a distal end facing the distal end of the rotary cleaning body via the space,~~

~~wherein the other rotary cleaning body is in contact with the floor surface through the suction opening and tapers toward the distal end of the other rotary cleaning body.~~

~~5~~5. The suction tool according to any one of claims ~~4~~ 1 to 3,

wherein a pair of the rotary cleaning bodies are symmetrical in shape with each other with respect to the space.

~~6. The suction tool according to claim 4 or 5, further comprising a coupling member configured to couple the distal ends of the pair of rotary cleaning bodies to each other,~~

~~wherein the case includes a pair of side portions configured to support proximal ends of the pair of rotary cleaning bodies, respectively, and~~

~~wherein the coupling member is detachable from the distal ends of the pair of rotary cleaning bodies.~~

~~7. The suction tool according to claim 1,~~

~~wherein the case includes a side portion that faces the distal end of the rotary cleaning body via the space.~~

~~8. The suction tool according to claim 7, further comprising a coupling member configured to couple the distal end of the rotary cleaning body to the side portion,~~
~~wherein the case includes another side portion on a side opposite to the side portion, the other side portion being configured to support a proximal end of the rotary cleaning body, and~~
~~wherein the coupling member is detachable from the distal end of the rotary cleaning body and the side portion.~~

~~9~~5. The suction tool according to any one of claims ~~6 or 8~~ 1 to 4,
wherein an axis of the rotary cleaning body is inclined downward from the side portion configured to support the proximal end of the rotary cleaning body.

~~10~~6. The suction tool according to any one of claims ~~9~~ 1 to 4,
wherein the case includes a front wall situated in front of the internal space, and
wherein the axis of the rotary cleaning body is inclined frontward from the side portion configured to support the proximal end of the rotary cleaning body, and
wherein the space is situated in front of the opening end of the channel which is opened toward the internal space.

~~11~~7. The suction tool according to any one of claims 1 to ~~10~~ 6,
wherein the rotary cleaning body includes a core rod extending laterally, and a scraping portion provided on an outer peripheral surface of the core rod and configured to scrape off dust on the floor surface, and
wherein the scraping portion extends spirally on the outer peripheral surface of the core rod or extends diagonally to three-dimensionally intersect an axis of the core rod.

~~12~~8. The suction tool according to claim ~~11~~ 7,
wherein a projection amount of the scraping portion is uniform.

~~13~~9. The suction tool according to claim ~~11~~ 7,
wherein a projection amount of the scraping portion from the outer peripheral surface of the core rod is reduced toward the distal end of the rotary cleaning body.

~~14~~10. The suction tool according to any one of claims ~~11 to 13~~ 7 to 9,
wherein the scraping portion is made of an elastically deformable material.