(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 548 826 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
07.05.2025 Bulletin 2025/19

(21) Application number: **23891919.5**

(22) Date of filing: **09.11.2023**

(51) International Patent Classification (IPC):
A47L 9/04 *(2006.01)* ***A47L 9/28*** *(2006.01)*
A47L 7/02 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
A47L 7/02; A47L 9/04; A47L 9/28

(86) International application number:
PCT/KR2023/017999

(87) International publication number:
WO 2024/106852 (23.05.2024 Gazette 2024/21)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
KH MA MD TN

(30) Priority: **14.11.2022 KR 20220151985**

(71) Applicant: **Samsung Electronics Co., Ltd.**
Suwon-si, Gyeonggi-do 16677 (KR)

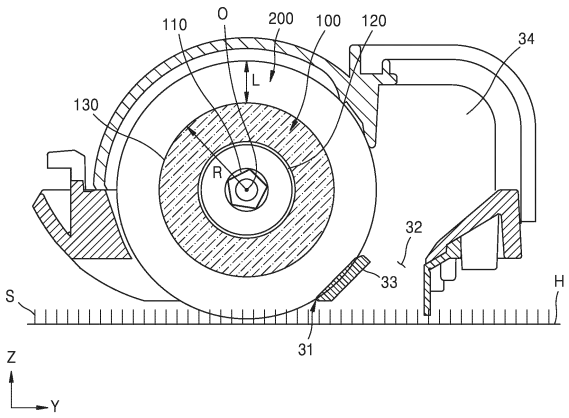
(72) Inventors:
- **NA, Woojin**
  Suwon-si, Gyeonggi-do 16677 (KR)
- **KIM, Hyeoncheol**
  Suwon-si, Gyeonggi-do 16677 (KR)
- **KWON, Kihwan**
  Suwon-si, Gyeonggi-do 16677 (KR)
- **KIM, Kyoungwoung**
  Suwon-si, Gyeonggi-do 16677 (KR)
- **KIM, Hyounsoo**
  Suwon-si, Gyeonggi-do 16677 (KR)
- **YUN, Minro**
  Suwon-si, Gyeonggi-do 16677 (KR)

(74) Representative: **Walaski, Jan Filip et al**
Venner Shipley LLP
200 Aldersgate
London EC1A 4HD (GB)

(54) CLEANING APPARATUS

(57) A cleaning device may include a body unit movable along one plane, a first suction unit extending in a first direction and arranged under the body unit, and through which waste is suctionable, a second suction unit extending in the first direction and arranged under the body unit, and through which waste is suctionable, a partition unit extending in the first direction and arranged between the first suction unit and the second suction unit, a roller unit arranged in the first suction unit, extending in the first direction, and arranged to be rotatable around one axis extending in the first direction, a brush extending by a first length from an outer circumferential surface of the roller unit, and a driving unit generating power such that the roller unit rotates around the one axis.

FIG. 7A



EP 4 548 826 A1

Description

Technical Field

[0001] The disclosure relates to a cleaning device automatically performing a cleaning operation, and more particularly, to a cleaning device including a brush rotatable around one axis.

Background Art

[0002] Recent cleaning devices may provide various conveniences, such as the fact that users do not need to personally perform cleaning and the fact that the users may optionally set an operation mode, an operation time, and the like. Accordingly, demand for automatic cleaning devices has recently increased. An automatic cleaning device operates indoors according to a preset method and sucks up dust or small waste from the floor. For this purpose, the automatic cleaning device includes a motor for generating a suction force, a dust bin for storing sucked-up dust or small waste, and a filter for purifying and discharging air sucked into the dust bin.

[0003] Waste collected by the automatic cleaning device may have various forms. For example, the waste may include not only contaminants of various sizes but also hairs removed from human bodies and textile strands separated from clothes or the like. A suction port and a suction pressure may vary depending on the type of waste collected by the automatic cleaning device.

[0004] Waste such as hairs, textile strands, or pet hairs has the property of easily adhering to an object with a rough surface due to electrostatic attraction. Simultaneously, the waste has the property of not being easily separated from the surface of an object to which it has adhered. On the other hand, in the case of contaminants of various sizes, because the contaminants do not adhere to a cleaning target surface on which the contaminants are placed, a relatively low suction pressure may be required but the suction area of the suction port corresponding to the size of the contaminants should be secured.

Disclosure

Technical Solution

[0005] A cleaning device according to an example may include a body unit movable along one plane, a first suction unit extending in a first direction and arranged under the body unit, and through which waste is suctionable, a second suction unit extending in the first direction and arranged under the body unit, and through which waste is suctionable, and a partition unit extending in the first direction and arranged between the first suction unit and the second suction unit.

[0006] Also, the cleaning device according to an example may include a roller unit arranged in the first suction unit, extending in the first direction, and arranged to be rotatable around one axis extending in the first direction, a brush extending by a first length from an outer circumferential surface of the roller unit, and a driving unit configured to generate power such that the roller unit rotates around the one axis.

[0007] Also, in the cleaning device according to an example, the outer circumferential surface of the roller unit and the partition unit may be arranged to be spaced apart from each other by a first distance, and the first length of the brush extends from the outer circumferential surface of the roller unit is greater than the first distance.

Description of Drawings

[0008]

FIG. 1 is a side view of a cleaning device according to an example.
FIG. 2 is a bottom view of a cleaning device according to an example.
FIG. 3 is an exploded perspective view of a cleaning device according to an example.
FIG. 4 is a block diagram of a cleaning device according to an example.
FIG. 5 is an exploded perspective view of a suction unit according to an example.
FIG. 6 is a perspective view of a roller unit, a brush, and a partition unit according to an example.
FIG. 7A is a cross-sectional view of a suction unit according to an example.
FIG. 7B is an enlarged cross-sectional view of a portion of a suction unit according to an example.
FIG. 8A is a perspective view of a support frame module detachable from a body unit according to an example.
FIG. 8B is an exploded perspective view of a support frame module according to an example.
FIG. 9 is a cross-sectional view of a suction unit through which contaminants are sucked up, according to an example.
FIG. 10 is a cross-sectional view of a suction unit through which contaminants are sucked up, according to an example.

Mode for Invention

[0009] Hereinafter, the configuration and operation of the disclosure will be described in detail with reference to embodiments of the accompanying drawings.

[0010] Terms used herein will be briefly described and then the disclosure will be described in detail.

[0011] The terms used herein are those general terms currently widely used in the art in consideration of functions in the disclosure, but the terms may vary according to the intentions of those of ordinary skill in the art, precedents, or new technology in the art. Also, in some cases, there may be terms that are optionally selected by

the applicant, and the meanings thereof will be described in detail in the corresponding portions of the disclosure. Thus, the terms used herein should be understood not as simple names but based on the meanings of the terms and the overall description of the disclosure.

[0012] Throughout the disclosure, when something is referred to as "including" an element, one or more other elements may be further included unless otherwise specified.

[0013] It will be understood that although terms such as "first" and "second" may be used herein to describe various elements, these elements should not be limited by these terms and these terms are only used to distinguish one element from another element.

[0014] Hereinafter, embodiments of the disclosure will be described in detail with reference to the accompanying drawings so that those of ordinary skill in the art may easily implement the disclosure. However, the disclosure may be embodied in many different forms and should not be construed as being limited to the embodiments set forth herein. Also, portions irrelevant to the description of the disclosure will be omitted in the drawings for a clear description of the disclosure, and like reference numerals will denote like elements throughout the specification.

[0015] Moreover, terms such as "upper side", "lower side", and "front-back direction" used in the following description are defined based on the drawings, and the shapes and positions of elements are not limited by these terms.

[0016] Hereinafter, embodiments of the disclosure will be described in detail with reference to the accompanying drawings.

[0017] FIG. 1 is a side view of a cleaning device according to an example. FIG. 2 is a bottom view of a cleaning device according to an example.

[0018] A cleaning device 1 according to the present embodiment of the disclosure will be described focusing on a robot cleaning device that may independently perform a cleaning operation according to a preset method without relying on the manual operation of the user. However, the disclosure is not limited thereto, and the cleaning device 1 according to the disclosure may be applied to any cleaning device that depends on the manual operation of the user.

[0019] Referring to FIGS. 1 and 2, the cleaning device 1 according to an example may include a body unit 10, a running unit 20 capable of moving the body unit 10 along one plane, a suction unit 30 for sucking up foreign substances placed on a cleaning target surface H (see FIG. 9), and a dust collection container (not illustrated) for accommodating the foreign substances sucked up from the cleaning target surface H.

[0020] The body unit 10 according to an example may form the external shape of the cleaning device 1. As an example, the body unit 10 may be provided in the shape of a housing including an accommodation space therein. In this case, the body unit 10 may accommodate components for the cleaning device 1 to perform a cleaning operation, in a space accommodated therein. For example, a dust collection container (not illustrated) described below may be detachably accommodated inside the body unit 10. In this case, the internal space of the body unit 10 may communicate with the outside. Accordingly, as the cleaning device 1 runs, the air or small waste collected through the suction unit 30 may be collected into the detachably-coupled dust collection container (not illustrated) through the internal space of the body unit 10.

[0021] As an example, the body unit 10 may collide with various obstacles located in an area where the cleaning device 1 runs, for example, an indoor area. Thus, the body unit 10 may include a high-rigidity material to prevent damage caused by collision. Also, the body unit 10 may include a lightweight material. Accordingly, the power required to run the cleaning device 1 may be reduced. For example, the body unit 10 may include synthetic resin such as reinforced plastic.

[0022] A user interface may be provided on an external surface of the body unit 10. The user may control an operation of the cleaning device 1 by operating the user interface. Also, the user interface may display information about the state of the cleaning device 1 and the area where the cleaning device 1 runs.

[0023] In the illustrated embodiment of the disclosure, the body unit 10 may have a disk shape having a circular cross-section and a certain height in the vertical direction. Accordingly, when the cleaning device 1 collides with various obstacles while running, the body unit 10 may rotate and run in various directions.

[0024] The running unit 20 may move the body unit 10 along one plane, for example, the XY plane. The running unit 20 according to an example may include one or more driving wheels and a running motor for generating power transmitted to the driving wheels. As an example, the running unit 20 may be rotatably coupled to the lower side of the body unit 10. For example, the running unit 20 may be provided as a plurality of running units. In this case, the rotation speed and rotation direction of each of the running units 20 may be controlled independently of each other. Accordingly, the body unit 10 may move forward, move backward, turn left, or turn right on one plane (XY plane).

[0025] According to an example, a running sensor unit 25 may be arranged to sense information about the path along which the cleaning device 1 runs. As an example, the running sensor unit 25 may be located in a direction in which the cleaning device 1 is expected to run. For example, the running sensor unit 25 may be arranged above the body unit 10 to sense information about the environment on the front side of the cleaning device 1. The running sensor unit 25 according to an example may be provided in any form capable of sensing information about the environment of the path along which the cleaning device 1 runs. For example, the driving sensor unit 25 may include a LIDAR sensor for sensing the distance to an obstacle, or a camera capable of sensing image

information.

[0026] The dust collection container (not illustrated) may store the waste collected while the cleaning device 1 runs. For example, the dust collection container (not illustrated) may accommodate the contaminants placed on the cleaning target surface H. The dust collection container (not illustrated) according to an example may be detachably coupled to the body unit 10. The user may remove the dust collection container (not illustrated) from the body unit 10 to easily remove the contaminants accommodated in the dust collection container (not illustrated).

[0027] The dust collection container (not illustrated) according to an example may include an accommodation space therein. The accommodation space may communicate with a space formed inside the body unit 10, for example, a movement path. The contaminants collected through the suction unit 30 may enter the dust collection container (not illustrated) through the movement path formed inside the body unit 10.

[0028] The suction unit 30 may suck up contaminants by using a suction motor (not illustrated) for generating a suction force necessary to suck up foreign substances on the cleaning target surface H. Contaminants sucked up through the suction unit 30 may have different sizes, shapes, and materials. As an example, a first contaminant T_1 (see FIG. 9) sucked up through the suction unit 30 may not be easily separated from the cleaning target surface H after adhering thereto but may have a smaller size than a second contaminant T_2 (see FIG. 10) described below. For example, the first contaminant T_1 may include hairs removed from human bodies and textile strands separated from clothes or the like. Among the contaminants collected through the suction unit 30, a contaminant such as hairs, textile strands, or pet hairs may have the property of easily adhering to an object with a rough surface due to electrostatic attraction. Simultaneously, the contaminant may have the property of not being easily separated from the surface of an object to which it has adhered. Thus, in daily life, when the contaminant adheres to the surface of an object of a textile material such as a carpet or a rug, it may not be easily separated therefrom.

[0029] Also, the second contaminant T_2 (see FIG. 10) sucked up through the suction unit 30 may be easily separated from the cleaning target surface H but may have a larger shape than the first contaminant T_1. For example, the second contaminant T_2 may be a small toy or food that does not adhere to the cleaning target surface H.

[0030] According to an example, the size and suction pressure of the suction unit 30 may vary depending on the type of a contaminant sucked up through the suction unit 30. For example, the suction area of the suction unit 30 may be increased to change the size of the suction unit 30. Also, the power of the suction motor (not illustrated) may be increased to increase the suction pressure of the suction unit 30. However, in the case of the same power of the suction motor (not illustrated), the suction pressure of the suction unit 30 may be increased by reducing the suction area of the suction unit 30, or the suction pressure of the suction unit 30 may be reduced by increasing the suction area of the suction unit 30. Hereinafter, technical features for dividing, in the case of the same power of the suction motor (not illustrated), the suction unit 30 into a first suction unit 31 through which the first contaminant T_1 passes and a second suction unit through which the second contaminant T_2 passes and differently adjusting the suction areas and suction pressures of the first suction unit 31 and the second suction unit 32 will be described in more detail.

[0031] FIG. 3 is an exploded perspective view of a cleaning device according to an example. FIG. 4 is a block diagram of a cleaning device according to an example. FIG. 5 is an exploded perspective view of a suction unit according to an example. FIG. 6 is a perspective view of a roller unit, a brush, and a partition unit according to an example. FIG. 7A is a cross-sectional view of a suction unit according to an example. FIG. 7B is an enlarged cross-sectional view of a portion of a suction unit according to an example.

[0032] Referring to FIGS. 3 to 7B, the suction unit 30 according to an example may include the first suction unit 31, the second suction unit 32, and a partition unit 33 arranged therebetween the first suction unit 31 and the second suction unit 32. As an example, the first suction unit 31 where a roller unit 100 described below is arranged may have a suction area less than the suction area of the second suction unit 32 but may have a suction pressure greater than the suction pressure of the second suction unit 32. Accordingly, the first contaminant T_1 (see FIG. 9), which is not easily separated from the cleaning target surface H after adhering thereto but has a smaller size than the second contaminant T_2, may pass through the first suction unit 31. Also, the second suction unit 32 may have a suction area greater than the suction area of the first suction unit 31 but may have a suction pressure less than the suction pressure of the first suction unit 31. Accordingly, the second contaminant T_2 (see FIG. 10), which is easily separated from the cleaning target surface H but has a larger shape than the first contaminant T_1, may pass through the second suction unit 32.

[0033] The first suction unit 31 according to an example may be a suction port extending in a first direction (X direction) and may be arranged under the body unit 10. The first suction unit 31 may fluidly communicate with a dust collection unit (not illustrated) by using a movement path 34 connected to the dust collection unit (not illustrated). Accordingly, the first contaminant T_1 sucked up through the first suction unit 31 may be accommodated into the dust collection unit (not illustrated) through the movement path 34.

[0034] As an example, the first suction unit 31 may include a rectangular opening shape extending in the first direction (X direction). However, the disclosure is not limited thereto, and the first suction unit 31 may include

any opening shape through which the first contaminant T_1 may pass.

[0035] According to an example, because the first contaminant T_1, which is not easily separated from the cleaning target surface H after adhering thereto, should pass through the first suction unit 31, the first suction unit 31 may have a relatively high suction pressure. When the same suction motor (not illustrated) is used in the first suction unit 31 and the second suction unit 32, the suction pressure of the first suction unit 31 may increase as the suction area of the first suction unit 31 becomes further smaller than the suction area of the second suction unit 32. According to an example, as the roller unit 100 where a brush 200 is arranged is arranged in the first suction unit 31, the suction area of the first suction unit 31 may decrease and the suction pressure thereof may increase.

[0036] The roller unit 100 according to an example may be connected to the body unit 10 to be rotatable around one axis 110 extending in the first direction (X direction). Both end portions of the roller unit 100 according to an example may be rotatably supported by a side frame 11 provided in the body unit 10, to be rotatable in any one of the clockwise direction or the counterclockwise direction around the one axis 110. As an example, the roller unit 100 may rotate around the one axis 110 at a speed of about 500 revolutions per minute (rpm) to about 1,500 rpm.

[0037] A driving unit 300 according to an example may generate power and transmit the same to the roller unit 100 such that the roller unit 100 may rotate around the one axis 110. In this case, a controller 700 may control the rotation speed and rotation direction of the roller unit 100 by controlling the driving unit 300. As an example, a sensor unit 500 may be arranged at one or more of each end portion in the direction in which the roller unit 100 extends. The sensor unit 500 may sense rotation-related information such as the rotation direction and rotation angle of the roller unit 100.

[0038] Also, the roller unit 100 according to an example may be formed to extend in one direction, for example, in the first direction (X direction). As an example, the first direction (X direction) may be perpendicular to a direction in which the cleaning device 1 moves forward, for example, a second direction (Y direction). Thus, when the cleaning device 1 moves forward, the area swept by the brush 200 arranged on the outer circumferential surface of the roller unit 100 to be described below may increase. Accordingly, the cleaning efficiency of the cleaning device 1 may be improved.

[0039] Also, the roller unit 100 according to an example may have any shape that may rotate around one axis between the side frames 11. For example, the cross-section of the roller unit 100 taken in the second direction (Y direction) perpendicular to the first direction (X direction) may have a circular shape 120. In this case, a radius R of the circular shape 120 measured from a center O of the roller unit 100 may be about 6 mm to about 18 mm. In the above embodiment of the disclosure, the cross-sectional shape of the roller unit 100 is described as a circular shape; however, the disclosure is not limited thereto. According to another example, the cross-sectional shape of the roller unit 100 may have a polygonal shape.

[0040] According to an example, the roller unit 100 may include a high-rigidity material capable of supporting the brush 200 described below. For example, the roller unit 100 may include synthetic resin such as reinforced plastic. As an example, an outer circumferential surface 130 of the roller unit may be a support member by which one end portion of the brush 200 may be supported. Also, the outer circumferential surface 130 of the roller unit 100 may set a boundary range through which a contaminant with a certain size may pass.

[0041] The brush 200 may be arranged on the outer circumferential surface 130 of the roller unit 100. According to an example, the brush 200 may include a plurality of brush structures extending in the radial direction of the roller unit 100. As an example, a length L of the brush 200 extending in the radial direction of the roller unit 100 from the outer circumferential surface 130 of the roller unit 100 may be about 2.9 mm to about 8.7 mm; however, the disclosure is not limited thereto.

[0042] One end portion of the brush 200 according to an example may be arranged to be fixed to the outer circumferential surface 130 of the roller unit 100. Also, the other end portion of the brush 200 may be arranged to face the cleaning target surface H. As an example, the brush 200 may include an elastic material having a certain elastic force. In this case, the length L of the brush 200 may be determined such that the other end portion of the brush 200 may be partially exposed to the outside of a lower frame 13 of the body unit 10. Accordingly, the other end portion of the brush 200 may be arranged to contact the cleaning target surface H. When the other end portion of the brush 200 contacts the cleaning target surface H, the brush 200 may be modified to correspond to the shape of the cleaning target surface H. In this case, a contaminant such as hair located on the cleaning target surface H may adhere to the modified brush 200 and move to the first suction unit 31.

[0043] As described above, a suction pressure may be generated through the suction motor (not illustrated) to suck up the contaminant moved to the first suction unit 31 into the movement path 34 provided inside the body unit 10. In this case, when the suction area of the first suction unit 31 decreases, the suction pressure of the first suction unit 31 may increase. According to an example, the partition unit 33 and the brush 200 may be arranged to overlap each other, thereby reducing the suction area of the first suction unit 31.

[0044] The partition unit 33 according to an example may extend in the first direction (X direction) and may be arranged between the first suction unit 31 and the second suction unit 32 to define a boundary area between the first suction unit 31 and the second suction unit 32. As an example, the partition unit 33 may be provided in the shape of a flat plate extending in the first direction (X

direction). In this case, the partition unit 33 may be arranged to be inclined to have a certain angle, for example, a first angle α, with respect to one plane (XY plane) along which the cleaning device 1 moves, for example, the cleaning target surface H. As an example, the first angle α may be about 15 degrees to about 75 degrees; however, the disclosure is not limited thereto.

[0045] As an example, as the partition unit 33 is arranged to be inclined to have a first angle α with respect to one plane (XY plane) along which the cleaning device 1 moves, for example, the cleaning target surface H, the path of a first suction flow path W_1 and a second suction flow path W_2 may be guided to the first suction unit 31 and the second suction unit 32. For example, the first suction flow path W_1 may move toward the first suction unit 31 along one surface 331 of the partition unit 33 having a first angle α with respect to the cleaning target surface H. Also, the second suction flow path W_2 may move toward the second suction unit 32 along another surface 332 of the partition unit 33 having a first angle α with respect to the cleaning target surface H.

[0046] Also, the partition unit 33 according to an example may be arranged to be spaced apart from the cleaning target surface H with a certain height therebetween. As an example, the partition unit 33 may be arranged to overlap a portion of a textile material S arranged on the upper surface of the cleaning target surface H, while maintaining a certain distance from the cleaning target surface H. For example, one end portion 335 of the partition unit 33 arranged to face the cleaning target surface H may be arranged at a height C of about 0.5 mm to about 3 mm in the thickness direction (Z direction) of the cleaning device 1 above the other end portion of the brush 200 located at the lowest end portion in the thickness direction (Z direction) of the cleaning device 1 perpendicular to the first direction (X direction).

[0047] According to an example, one end portion 335 of the partition unit 33 arranged to face the cleaning target surface H may be arranged to overlap a portion of the textile material S, while maintaining a certain distance from the cleaning target surface H. Accordingly, one end portion 335 of the partition unit 33 may move while contacting a portion of the textile material S, thereby additionally separating the first contaminant T_1 (see FIG. 9) from the textile material S. However, the disclosure is not limited to this, and one end portion 335 of the partition unit 33 may be arranged to be spaced apart from the textile material S in the thickness direction (Z direction) of the cleaning device 1.

[0048] The partition unit 33 according to an example may be arranged to be spaced apart from the roller unit 100 by a first distance D. For example, the first distance D may be about 1 mm to about 5.2 mm; however, the disclosure is not limited thereto. As the partition unit 33 and the roller unit 100 are arranged to be spaced apart from each other by the first distance D, the boundary area of the first suction unit 31 through which the first contaminant T_1 may pass may be set. As an example, the outer circumferential surface 130 of the roller unit 100 and one surface 331 of the partition unit 33 arranged to face the outer circumferential surface 130 of the roller unit 100 may set a boundary range through which the first contaminant T_1 with a certain size may pass. In this case, the first distance D between the roller unit 100 and the partition unit 33 may be set to the distance obtained by subtracting the radius R of the shape 120 from the distance between the center O of the roller unit 100 and one surface 331 of the partition unit 33. That is, the first distance D between the roller unit 100 and the partition unit 33 may be the distance between the outer circumferential surface 130 of the roller unit 100 and one surface 331 of the partition unit 33. Thus, as illustrated in FIG. 9, the first contaminant T_1 having a length less than the first distance D between the roller unit 100 and the partition unit 33 may be transferred through the first suction unit 31 to the inside of the body unit 10.

[0049] According to an example, the length L of the brush 200 extending in the radial direction of the roller unit 100 from the outer circumferential surface 130 of the roller unit 100 may be greater than the first distance D between the roller unit 100 and the partition unit 33. Accordingly, a portion of the brush 200 and the partition unit 33 may be arranged to overlap each other. As a portion of the brush 200 and the partition unit 33 are arranged to overlap each other, the suction area of the first suction unit 31 may be reduced. According to an example, the brush 200 and the partition unit 33 may be arranged to overlap each other within a first range K. For example, the first range K within which the brush 200 and the partition unit 33 overlap each other may be about 0.3 mm to about 2.5 mm. Because the brush 200 and the partition unit 33 are arranged to overlap each other, as the suction area of the first suction unit 31 decreases, the suction pressure of the first suction unit 31 may increase. Also, in this case, because the first contaminant T_1 passing through the reduced first suction unit 31 may pass through the first suction unit 31 while modifying the brush 200 having an elastic force, the area of the first suction unit 31 may be maintained within the range of the first distance D between the roller unit 100 and the partition unit 33. Thus, as illustrated in FIG. 9, the first contaminant T_1 such as animal hair with high adhesion may be sucked into the first suction unit 31.

[0050] The second suction unit 32 according to an example may be a suction port extending in the first direction (X direction) and may be arranged under the body unit 10. The second suction unit 32 may fluidly communicate with the dust collection unit (not illustrated) by using the movement path 34 connected to the dust collection unit (not illustrated). Accordingly, the second contaminant T_2 sucked up through the second suction unit 32 may be accommodated into the dust collection unit (not illustrated) through the movement path 34.

[0051] As an example, the second suction unit 32 may include a rectangular opening shape extending in the first direction (X direction). However, the disclosure is not

limited thereto, and the second suction unit 32 may include any opening shape through which the second contaminant T_2 may pass.

[0052] According to an example, because the second contaminant T_2, which is easily separated from the cleaning target surface H but has a larger shape than the first contaminant T_1, should pass through the second suction unit 32, the second suction unit 32 may have a relatively large suction area and a relatively low suction pressure compared to the first suction unit 31. As an example, the second suction unit 32 has a certain width P, for example, a width P of about 4 mm to about 20 mm, in the second direction (Y direction) perpendicular to the first direction (X direction).

[0053] According to an example, the boundary range through which the second contaminant T_2 may pass in the second suction unit 32 may be the width P of the second suction unit 32. As described above, the boundary range through which the first contaminant T_1 may pass in the first suction unit 31 may be defined by the first distance D between the outer circumferential surface 130 of the roller unit 100 and one surface 331 of the partition unit 33 arranged to face the outer circumferential surface 130 of the roller unit 100. In this case, the width P of the second suction unit 32 may be greater than the first distance D between the roller unit 100 and the partition unit 33. Accordingly, the second suction unit 32 may have a relatively large suction area compared to the first suction unit 31. On the other hand, because a suction pressure may be formed in the first suction unit 31 and the second suction unit 32 by the same suction motor (not illustrated), the second suction unit 32 having a relatively large suction area may have a relatively low suction pressure. Thus, the second contaminant T_2 (see FIG. 10), which is easily separated from the cleaning target surface H but has a larger shape than the first contaminant T_1, may be sucked up through the second suction unit 32.

[0054] FIG. 8A is a perspective view of a support frame module detachable from a body unit according to an example. FIG. 8B is an exploded perspective view of a support frame module according to an example.

[0055] Referring to FIGS. 3, 5, 8A, and 8B, a support frame module 800 according to an example may be arranged to be detachable from the body unit 10. As an example, the support frame module 800 may include a support frame 810, a bearing unit 820, and a fastening unit (not illustrated) in addition to the first suction unit 31, the second suction unit 32, the partition unit 33, the roller unit 100, and the brush 200.

[0056] The support frame 810 may be arranged to be detachable from the lower front side of the body unit 10. According to an example, when the body unit 10 is moved by the running unit 20, the lower side of the support frame 810 may move together with the body unit 10 while contacting the cleaning target surface or being apart therefrom by a certain distance.

[0057] The support frame 810 according to an example may be provided in the shape of a frame including an accommodation space therein. As an example, the support frame 810 may move together by being coupled with the body unit 10 and may have any shape capable of accommodating the roller unit 100 therein. For example, the support frame 810 may include a hollow polygonal pillar shape extending long in the horizontal direction.

[0058] The first suction unit 31, the second suction unit 32, and the partition unit 33 may be arranged in the accommodation space of the support frame 810 according to an example. As an example, the partition unit 33 may extend in one direction to divide the accommodation space of the support frame 810. For example, both end portions of the partition unit 33 may be supported to be fixed to both side portions of the support frame 810 respectively. Accordingly, each of the first suction unit 31 and the second suction unit 32 may be arranged in the space between the partition unit 33 and the support frame 810. According to an example, the support frame 810 and the partition unit 33 may be integrally provided with each other; however, the disclosure is not limited thereto.

[0059] The roller unit 100 may be detachably connected to the first suction unit 31 provided in the support frame 810 according to an example. As an example, the roller unit 100 may be connected to the support frame 810 to be rotatable around the one axis 110. For example, both end portions of the roller unit 100 may be detachably connected to the side portion of the support frame 810. In this case, the bearing unit 820 may be arranged at both end portions of the one axis 110, which is the center axis of the roller unit 100, to support the one axis 110.

[0060] According to an example, when the roller unit 100 is connected to the support frame 810, the fastening unit (not illustrated) may be fastened to the support frame 810 such that the roller unit 100 is fixed to the support frame 810. As an example, the fastening unit (not illustrated) may be provided in the form of a cap cover that is arranged at both end portions of the roller unit 100 and fastened to the support frame 810.

[0061] FIG. 9 is a cross-sectional view of a suction unit through which contaminants are sucked up, according to an example. FIG. 10 is a cross-sectional view of a suction unit through which contaminants are sucked up, according to an example.

[0062] Referring to FIGS. 7B and 9, the cleaning target surface H where the cleaning device 1 according to an example moves may include a textile material S such as a carpet or a rug. As an example, the first contaminant T_1 with high adhesion, such as hairs, textile strands, or pet hairs, may be easily adhered by electrostatic attraction to the textile material S included in an object with a rough surface, such as a carpet or a rug. Simultaneously, the first contaminant T_1 may not be easily separated from the surface of the textile material S to which the first contaminant T_1 has been adhered.

[0063] One end portion of the brush 200 according to an example may be arranged to be fixed to the outer circumferential surface 130 of the roller unit 100. Also, the

other end portion of the brush 200 may be arranged to face the cleaning target surface H. As an example, the brush 200 may include an elastic material having a certain elastic force. In this case, the length L of the brush 200 may be determined such that the other end portion of the brush 200 may be partially exposed to the outside of a lower frame 13 of the body unit 10. Accordingly, the other end portion of the brush 200 may be arranged to contact the cleaning target surface H and the textile material S placed over the cleaning target surface H. When the other end portion of the brush 200 contacts the cleaning target surface H and the textile material S, the brush 200 may be modified to correspond to the shape of the cleaning target surface H and the textile material S. In this case, the first contaminant T_1 such as hair located on the cleaning target surface H and the textile material S may adhere to the modified brush 200 and move to the first suction unit 31.

[0064] As described above, the partition unit 33 may be arranged to overlap a portion of the textile material S while maintaining a certain distance from the cleaning target surface H. According to an example, as illustrated in FIG. 7B, one end portion 335 of the partition unit 33 arranged to face the cleaning target surface H may be arranged to overlap a portion of the textile material S, while maintaining a certain distance from the cleaning target surface H. Accordingly, one end portion 335 of the partition unit 33 may move while contacting a portion of the textile material S, thereby additionally separating the first contaminant T_1 from the textile material S. However, the disclosure is not limited to this, and one end portion 335 of the partition unit 33 may be arranged to be spaced apart from the textile material S in the thickness direction (Z direction) of the cleaning device 1.

[0065] Also, a portion of the brush 200 arranged on the outer circumferential surface 130 of the roller unit 100 and the partition unit 33 may be arranged to overlap each other. As a portion of the brush 200 and the partition unit 33 are arranged to overlap each other, the suction area of the first suction unit 31 may be reduced. Because the brush 200 and the partition unit 33 are arranged to overlap each other, as the suction area of the first suction unit 31 decreases, the suction pressure of the first suction unit 31 may increase. Also, because the first contaminant T_1 passing through the reduced first suction unit 31 may pass through the first suction unit 31 while modifying the brush 200 having an elastic force, the area of the first suction unit 31 may be maintained within the range of the first distance D between the roller unit 100 and the partition unit 33. Thus, the first contaminant T_1 such as animal hair with high adhesion may be sucked up through the first suction unit 31.

[0066] Referring to FIGS. 7B and 10, according to an example, the second contaminant T_2 such as a cereal or a nanoblock, which is easily separated from the cleaning target surface H but has a larger shape than the first contaminant T_1, may not be easily adhered by electrostatic attraction to the textile material S included in an object with a rough surface, such as a carpet or a rug. Thus, the second contaminant T_2 may be easily separated from the surface of the textile material S to which the second contaminant T_2 has been adhered.

[0067] According to an example, the boundary range through which the first contaminant T_1 or the second contaminant T_2 may pass in the first suction unit 31 may be defined by the first distance D between the outer circumferential surface 130 of the roller unit 100 and one surface 331 of the partition unit 33 arranged to face the outer circumferential surface 130 of the roller unit 100. Accordingly, when the size of the second contaminant T_2 is greater than the first distance D, the second contaminant T_2 may not be sucked up by the first suction unit 31.

[0068] According to an example, the boundary range through which the second contaminant T_2 may pass in the second suction unit 32 may be the width P of the second suction unit 32. In this case, the width P of the second suction unit 32 may be greater than the first distance D between the roller unit 100 and the partition unit 33. Accordingly, the second suction unit 32 may have a relatively large suction area compared to the first suction unit 31. On the other hand, because a suction pressure may be formed in the first suction unit 31 and the second suction unit 32 by the same suction motor (not illustrated), the second suction unit 32 having a relatively large suction area may have a relatively low suction pressure. Thus, the second contaminant T_2, which is easily separated from the cleaning target surface H but has a larger shape than the first contaminant T_1, may be sucked up through the second suction unit 32.

[0069] A cleaning device according to an example may include a body unit 10 movable along one plane, a first suction unit 31 extending in a first direction and arranged under the body unit, a second suction unit 32 extending in the first direction and arranged under the body unit, a partition unit 33 extending in the first direction and arranged between the first suction unit and the second suction unit, a roller unit 100 arranged in the first suction unit, extending in the first direction, and arranged to be rotatable around one axis extending in the first direction, a brush 200 extending by a certain length from an outer circumferential surface of the roller unit, and a driving unit 300 configured to generate power such that the roller unit rotates around the one axis, wherein the outer circumferential surface of the roller unit and the partition unit may be arranged to be spaced apart from each other by a first distance, and the certain length of the brush may be greater than the first distance.

[0070] The partition unit 33 may be arranged to be inclined to have a first angle with respect to the one plane.

[0071] The first angle may be about 15 degrees to about 75 degrees.

[0072] One end portion of the partition unit 33 may be arranged at a height of about 0.5 mm to about 3 mm above another end portion of the brush 200 located at a lowest end portion in a thickness direction of the cleaning device.

[0073] A suction pressure of the first suction unit 31 may be greater than a suction pressure of the second suction unit 32.

[0074] A width of the second suction unit 32 in a second direction perpendicular to the first direction may be greater than the first distance between the outer circumferential surface of the roller unit 100 and the partition unit 33.

[0075] The first distance between the outer circumferential surface of the roller unit 100 and the partition unit 33 may be about 1 mm to about 5.2 mm.

[0076] A width of the second suction unit 32 in a second direction perpendicular to the first direction may be about 4 mm to about 20 mm.

[0077] The cleaning device may further include a support frame 810 in which the first suction unit 31, the second suction unit 32, and the partition unit 33 are arranged and which is detachable from the body unit 10, wherein the roller unit 100 may be arranged to be rotatable around the one axis with respect to the support frame 810.

[0078] The support frame 810 and the partition unit 33 may be integrally provided with each other.

[0079] The roller unit 100 may be arranged to be detachable from the support frame 810.

[0080] The cleaning device may further include a bearing unit 820 arranged at both end portions of the one axis to support the one axis.

[0081] A cross-section of the roller unit 100 taken in a second direction perpendicular to the first direction may include a circular shape, a radius of the circular shape may be about 6 mm to about 18 mm, and a length of the brush extending in a radial direction of the roller unit may be about 2.9 mm to about 8.7 mm.

[0082] The roller unit 100 may rotate around the one axis at a speed of about 500 rpm to about 1,500 rpm.

[0083] The cleaning device may further include a sensor unit 500 configured to sense a rotation speed of the roller unit, and a controller 700 configured to control an operation of the driving unit by receiving the rotation speed of the roller unit from the sensor unit.

[0084] The above embodiments of the disclosure are merely examples, and those of ordinary skill in the art may derive various modifications and other equivalent embodiments therefrom. Thus, the true technical scope of the disclosure should be defined by the technical concept of the disclosure described in the following claims.

Claims

1. A cleaning device comprising:

a body unit (10) movable along one plane;
a first suction unit (31) extending in a first direction and arranged under the body unit, and through which waste is suctionable;
a second suction unit (32) extending in the first direction and arranged under the body unit, and through which waste is suctionable;
a partition unit (33) extending in the first direction and arranged between the first suction unit and the second suction unit;
a roller unit (100) arranged in the first suction unit, extending in the first direction, and arranged to be rotatable around one axis extending in the first direction;
a brush (200) extending by a first length from an outer circumferential surface of the roller unit; and
a driving unit (300) configured to generate power such that the roller unit rotates around the one axis,
wherein the outer circumferential surface of the roller unit and the partition unit are arranged to be spaced apart from each other by a first distance, and
the first length of the brush extends from the outer circumferential surface of the roller unit is greater than the first distance.

2. The cleaning device of claim 1, wherein the partition unit (33) is inclined at a first angle with respect to the one plane.

3. The cleaning device of claim 2, wherein
the first angle is about 15 degrees to about 75 degrees.

4. The cleaning device of any one of claims 1-3, wherein
an end portion of the partition unit (33) is arranged at a height of about 0.5 mm to about 3 mm above another end portion of the brush (200) located at a lowest end portion in a direction toward the one plane.

5. The cleaning device of any one of claims 1-4, wherein a suction pressure of the first suction unit (31) is greater than a suction pressure of the second suction unit (32).

6. The cleaning device of any one of claims 1-5, wherein a width of the second suction unit (32) in a second direction perpendicular to the first direction is greater than the first distance between the outer circumferential surface of the roller unit (100) and the partition unit (33).

7. The cleaning device of any one of claims 1-6, wherein the first distance between the outer circumferential surface of the roller unit (100) and the partition unit (33) is about 1 mm to about 5.2 mm.

8. The cleaning device of any one of claims 1-7, where-

in a width of the second suction unit (32) in a second direction perpendicular to the first direction is about 4 mm to about 20 mm.

9. The cleaning device of any one of claims 1-8, further comprising:

a support frame (810) in which the first suction unit (31), the second suction unit (32), and the partition unit (33) are arranged and which is detachable from the body unit (10),
wherein the roller unit (100) is arranged to be rotatable with respect to the support frame (810).

10. The cleaning device of claim 9, wherein
the support frame (810) and the partition unit (33) are integrally provided with each other.

11. The cleaning device of claim 9, wherein
the roller unit (100) is arranged to be detachable from the support frame (810).

12. The cleaning device of claim 11, further comprising:
a bearing unit (820) respectively arranged at both end portions of the one axis so as to support rotation of the roller unit about the one axis.

13. The cleaning device of any one of claims 1-12, wherein

a cross-section of the roller unit (100) in a second direction perpendicular to the first direction is circular shape,
a radius of the circular shape is about 6 mm to about 18 mm, and
a length of the brush extending in a radial direction from the outer circumference surface of the roller unit is about 2.9 mm to about 8.7 mm.

14. The cleaning device of any one of claims 1-13, wherein
the roller unit (100) rotates around the one axis at a speed of about 500 revolutions per minute (rpm) to about 1,500 rpm.

15. The cleaning device of any one of claims 1-14, further comprising:

a sensor unit (500) configured to sense a rotation speed of the roller unit; and
a controller (700) configured to control an operation of the driving unit by receiving the rotation speed of the roller unit from the sensor unit.

FIG. 1

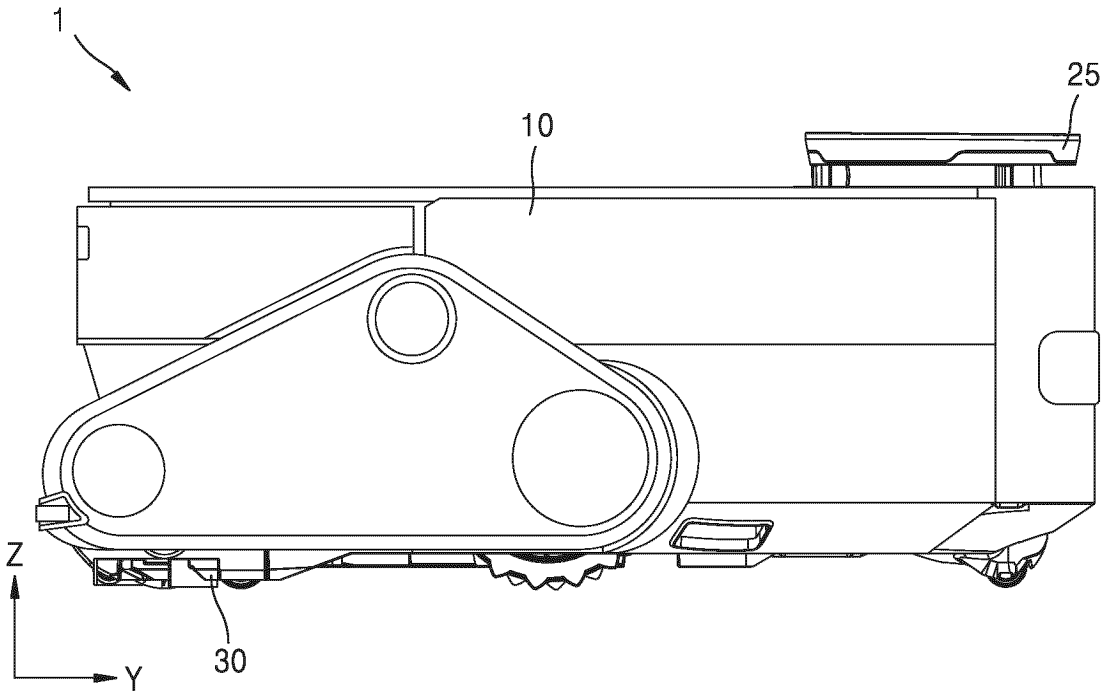


FIG. 2

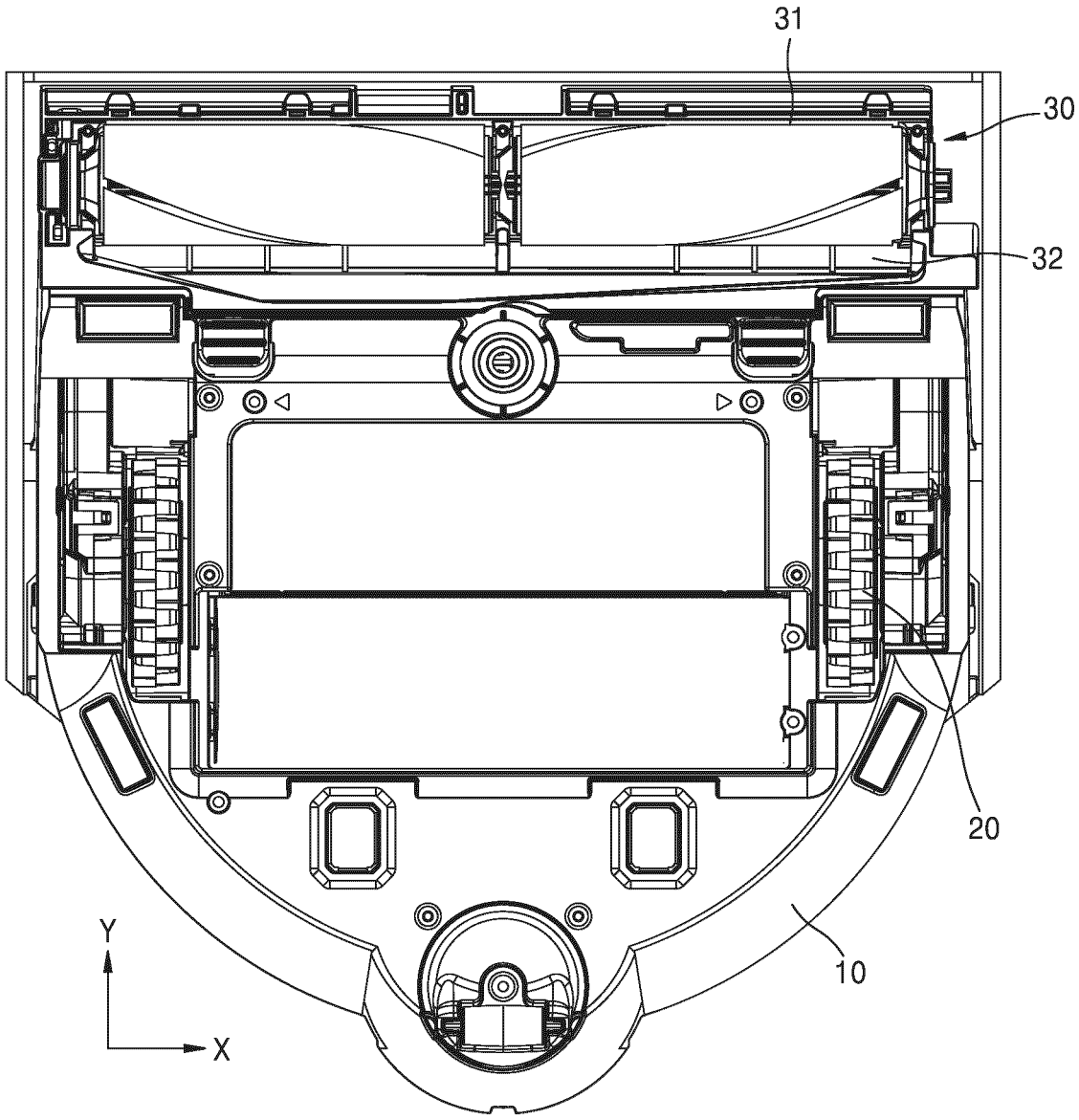


FIG. 3

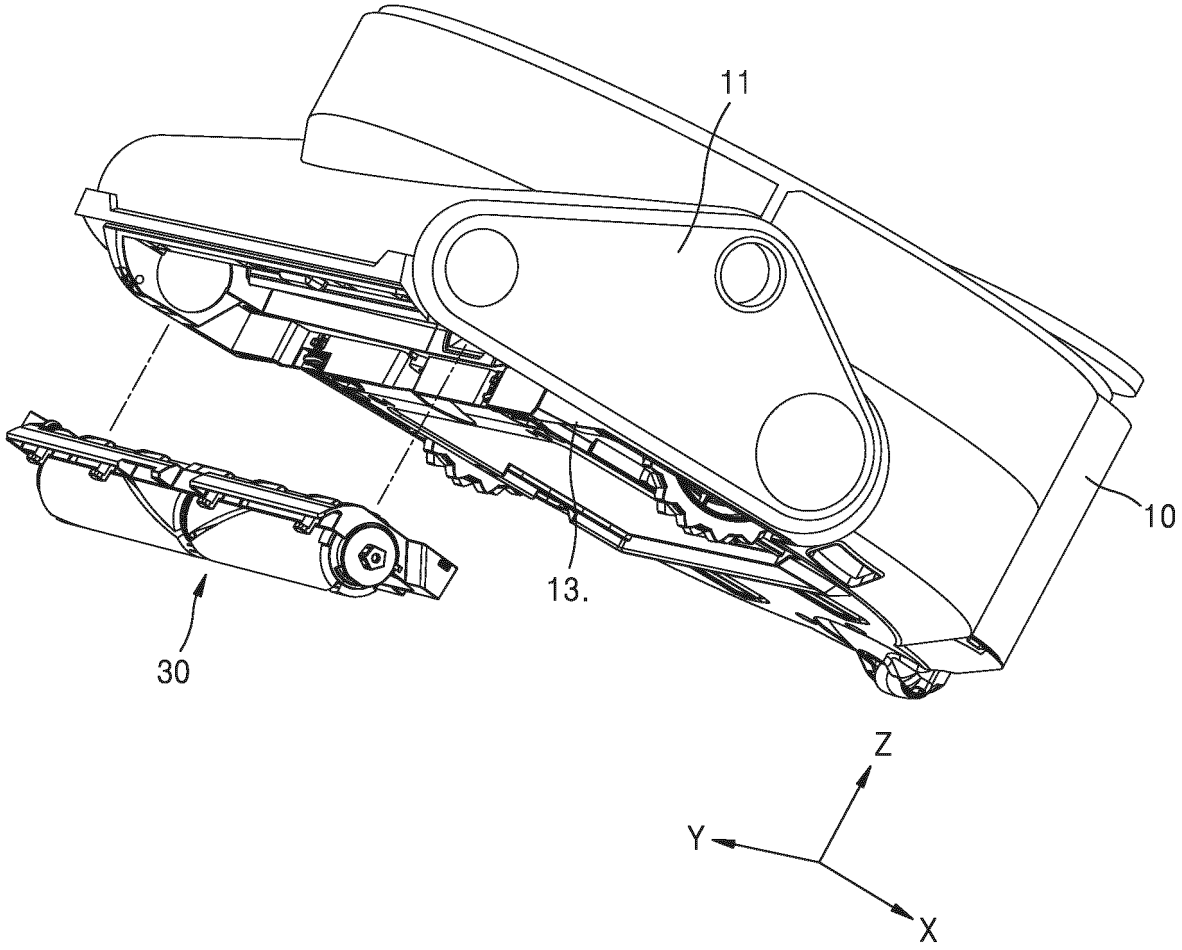


FIG. 4

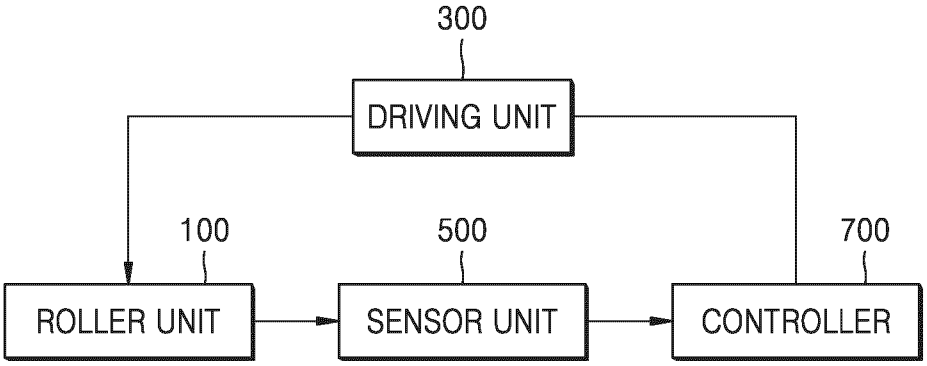

300
DRIVING UNIT
100
500
700
ROLLER UNIT
SENSOR UNIT
CONTROLLER

FIG. 5

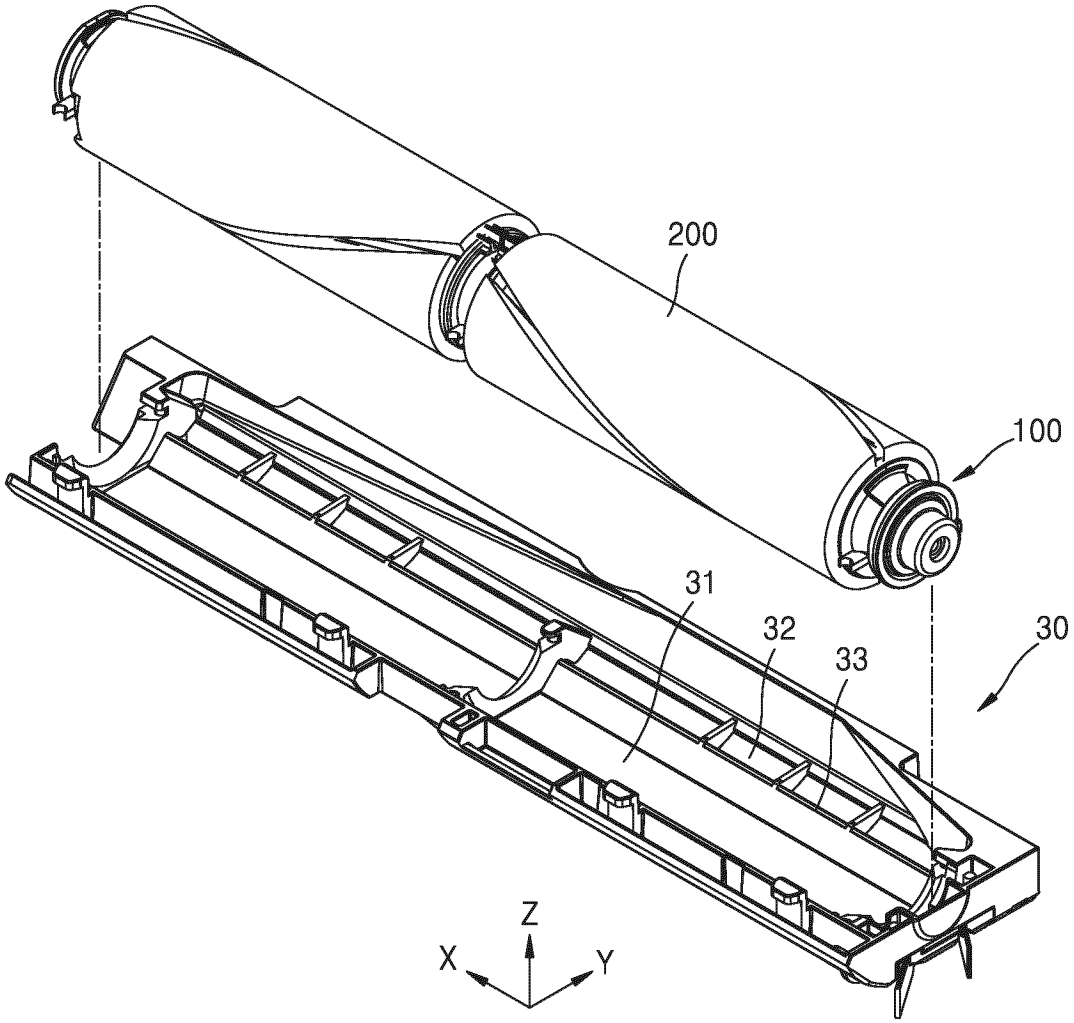


FIG. 6

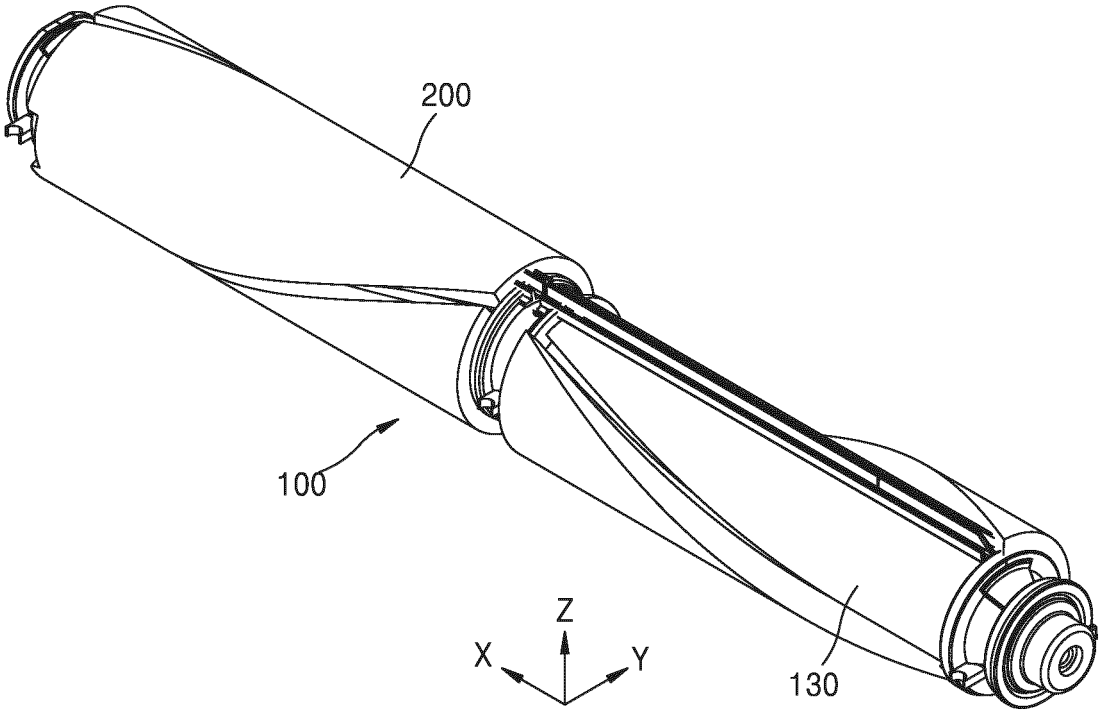


FIG. 7A

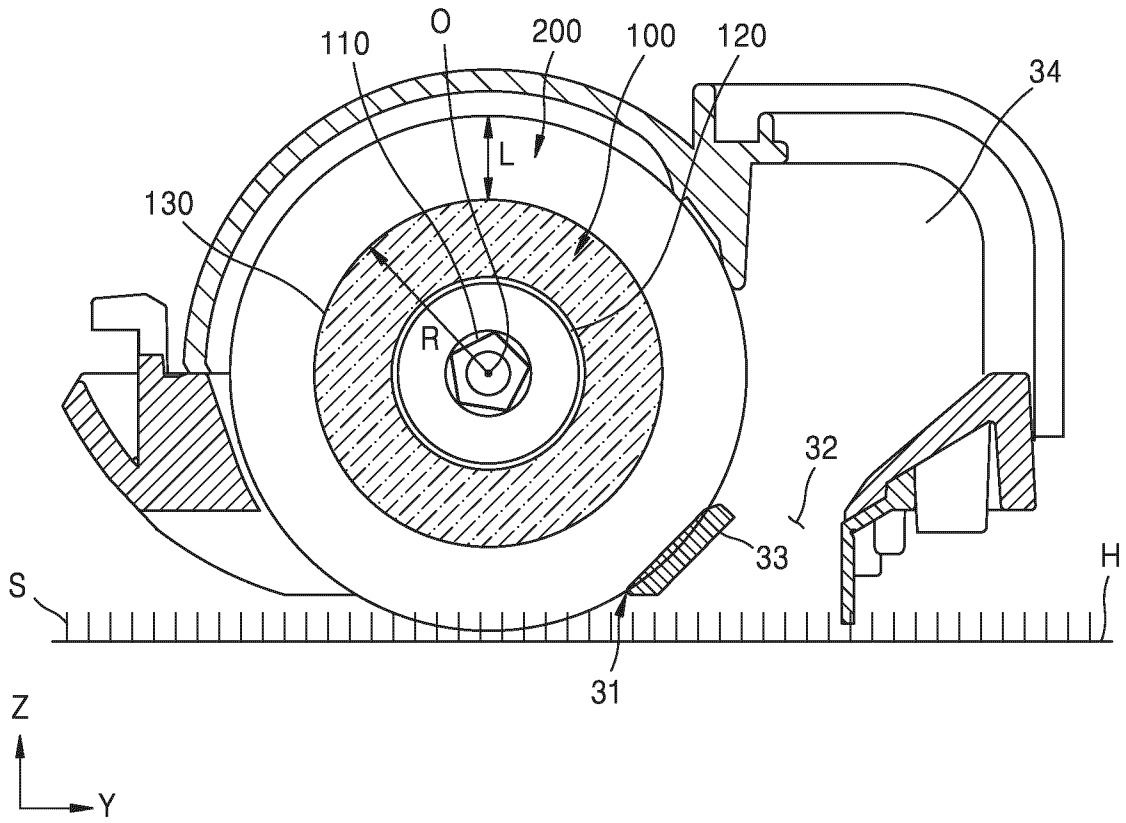


FIG. 7B

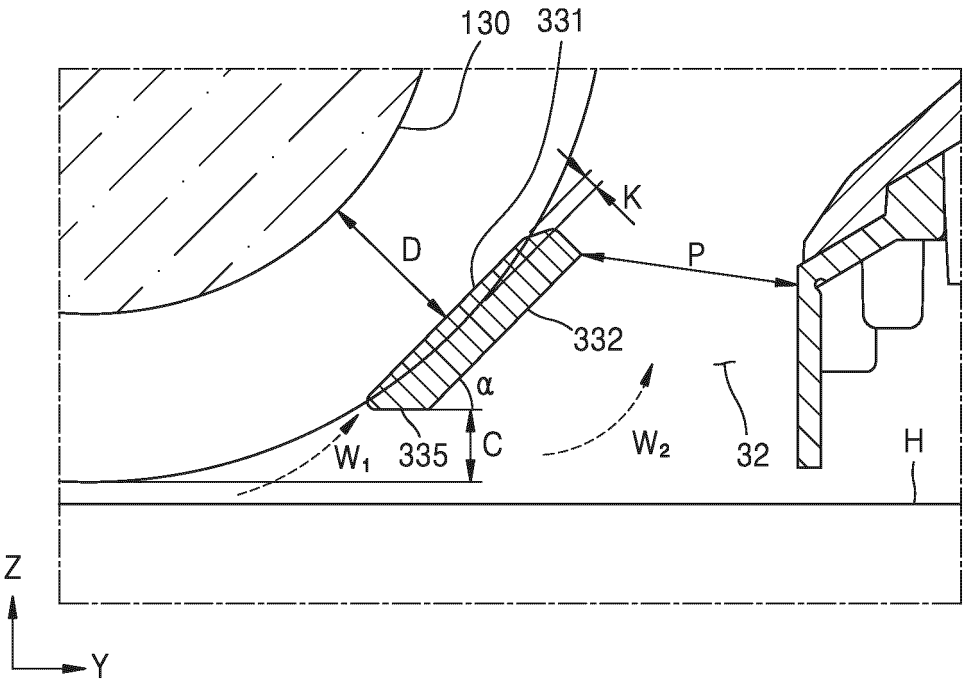


FIG. 8A

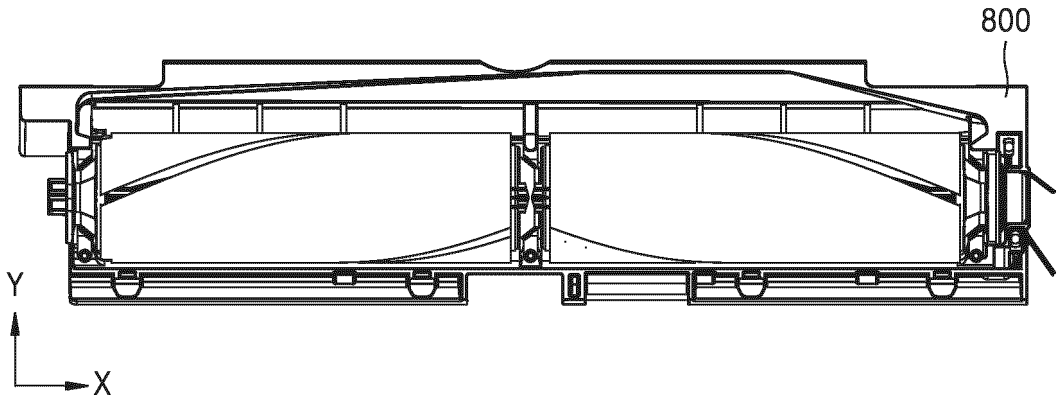


FIG. 8B

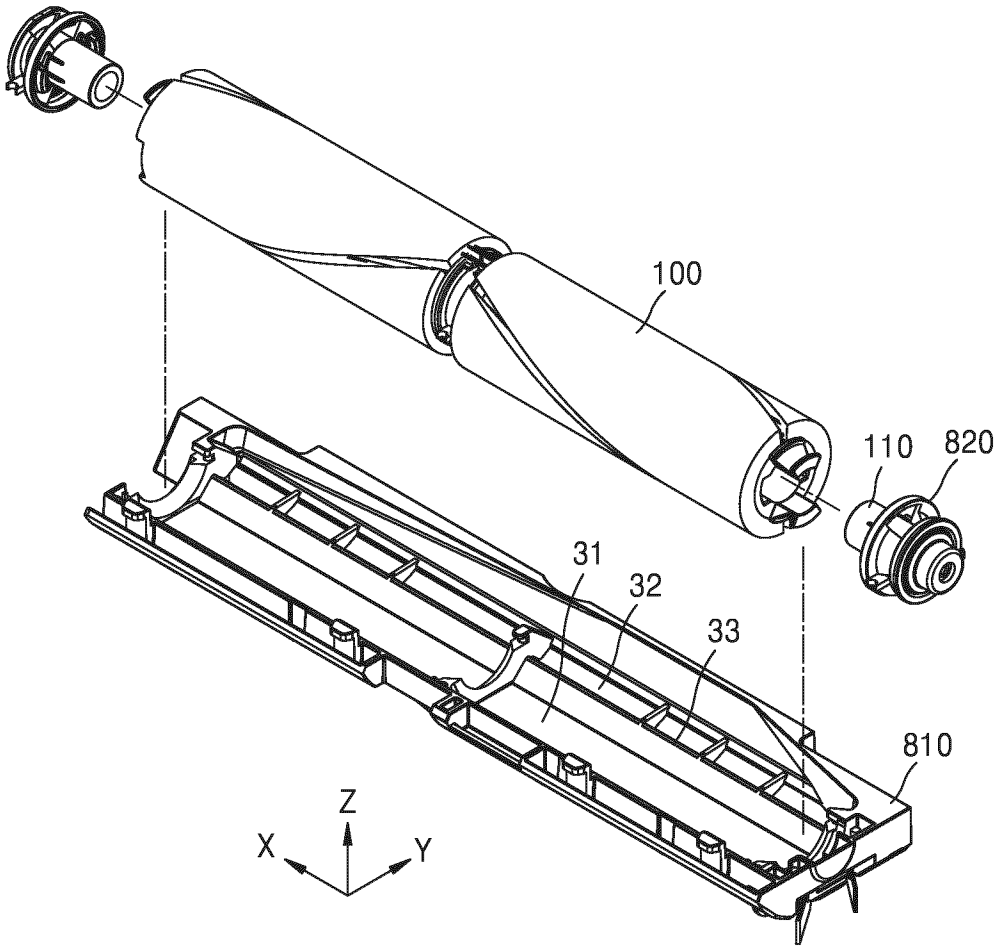


FIG. 9

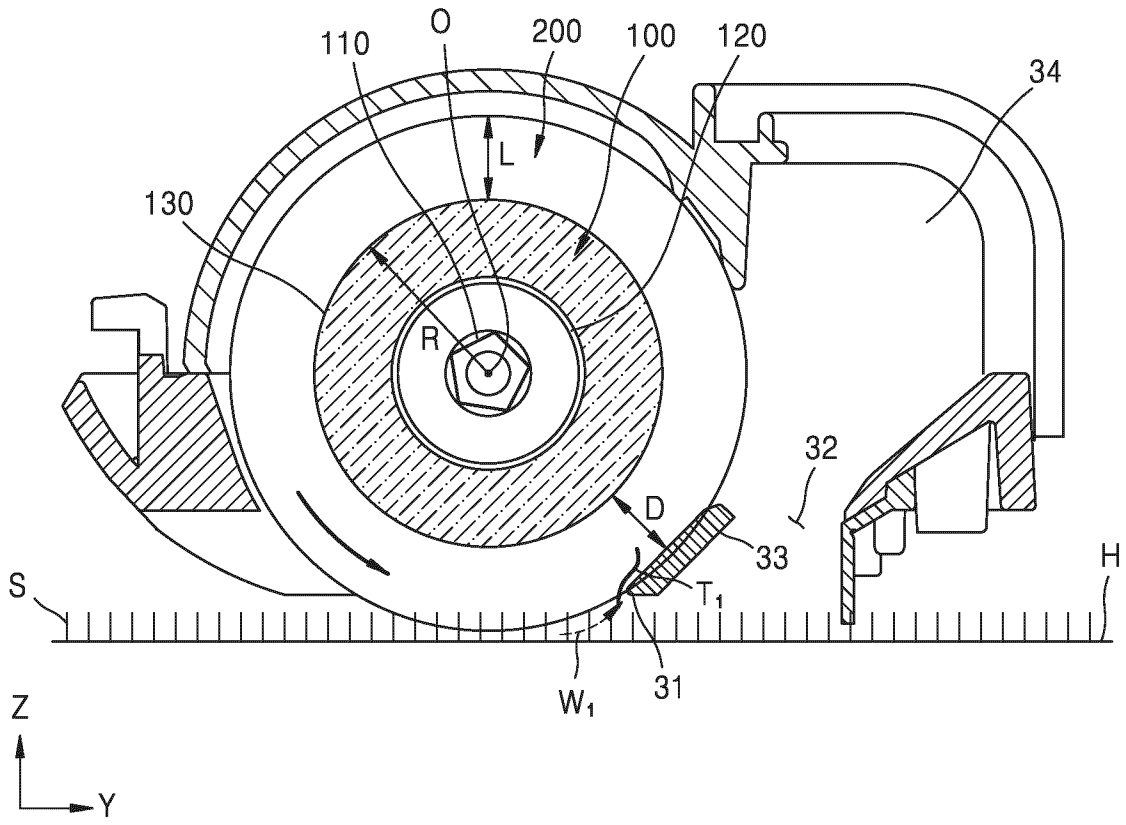
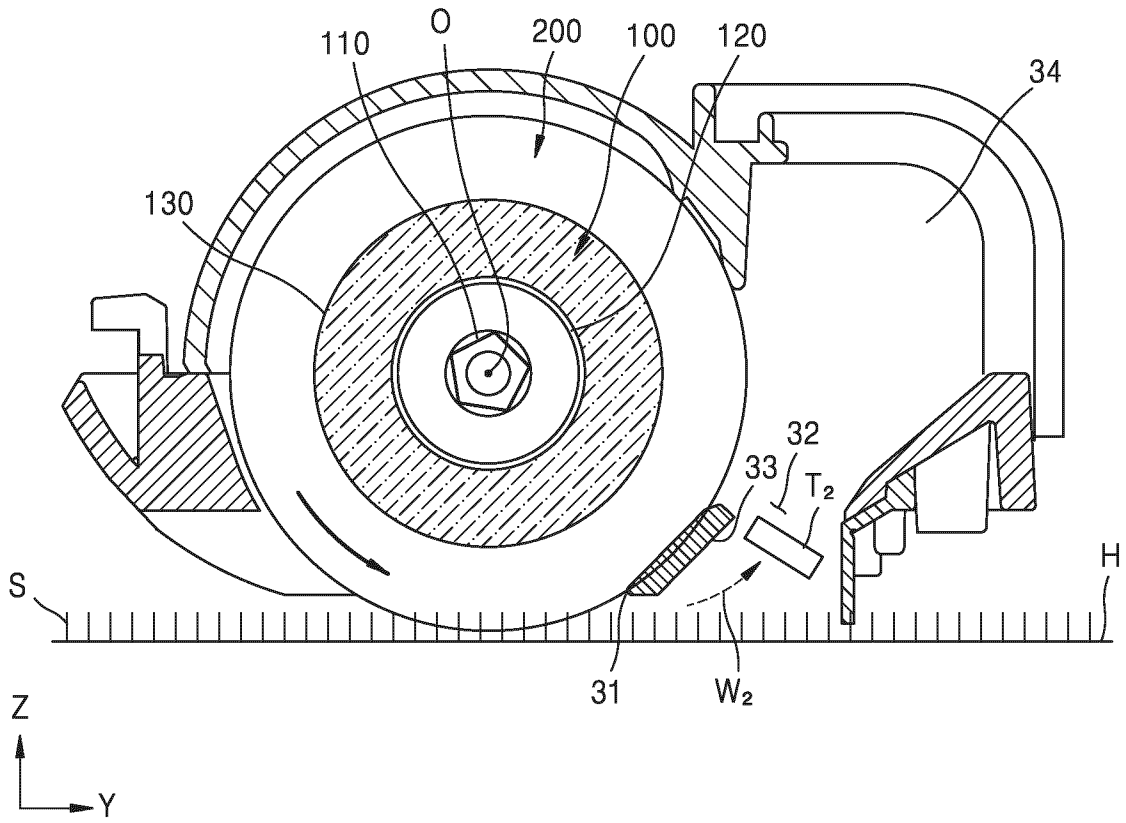


FIG. 10



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2023/017999

A. CLASSIFICATION OF SUBJECT MATTER

A47L 9/04(2006.01)i; **A47L 9/28**(2006.01)i; **A47L 7/02**(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A47L 9/04(2006.01); A47L 11/00(2006.01); A47L 9/00(2006.01); A47L 9/28(2006.01)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models: IPC as above
Japanese utility models and applications for utility models: IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS (KIPO internal) & keywords: 구획(partition), 롤러(roller), 브러시(brush), 흡입(intake), 입구(inlet), 탈착(detach), 속도센서(speed sensor), 청소 장치(cleaning device)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2019-107574 A (IRIS OHYAMA INC.) 04 July 2019 (2019-07-04) See paragraphs [0086]-[0096] and figures 13-16 and 18.	1-14
Y		15
Y	KR 10-2006-0112311 A (LG ELECTRONICS INC.) 01 November 2006 (2006-11-01) See paragraphs [0034]-[0036] and figures 1-3.	15
A	JP 2017-221702 A (DYSON TECHNOLOGY LTD.) 21 December 2017 (2017-12-21) See paragraphs [0053]-[0067] and figures 1-7.	1-15
A	CN 211355206 U (TIANYOU ELECTRIC (SUZHOU) CO., LTD.) 28 August 2020 (2020-08-28) See claims 1-9 and figures 1-11.	1-15
A	KR 10-1880089 B1 (SAMSUNG ELECTRONICS CO., LTD.) 23 July 2018 (2018-07-23) See paragraphs [0055]-[0074] and figures 1-13.	1-15

☐ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"D" document cited by the applicant in the international application
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
08 February 2024	**08 February 2024**

Name and mailing address of the ISA/KR	Authorized officer
Korean Intellectual Property Office **Government Complex-Daejeon Building 4, 189 Cheongsa-ro, Seo-gu, Daejeon 35208**	
Facsimile No. **+82-42-481-8578**	Telephone No.

Form PCT/ISA/210 (second sheet) (July 2022)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR2023/017999

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
JP 2019-107574 A	04 July 2019	CN 109316121 A	12 February 2019
		CN 113974482 A	28 January 2022
		JP 2019-025289 A	21 February 2019
		JP 2019-042586 A	22 March 2019
		JP 2019-107573 A	04 July 2019
		JP 2020-028810 A	27 February 2020
		JP 2020-028811 A	27 February 2020
		JP 2020-179205 A	05 November 2020
		JP 2022-009963 A	14 January 2022
		JP 6516820 B2	22 May 2019
		JP 6593957 B2	23 October 2019
		JP 6681096 B2	15 April 2020
		JP 6736192 B2	05 August 2020
		JP 6792299 B2	25 November 2020
		JP 6989962 B2	12 January 2022
KR 10-2006-0112311 A	01 November 2006	KR 10-0677275 B1	02 February 2007
JP 2017-221702 A	21 December 2017	AU 2014-298171 A1	10 March 2016
		AU 2014-298171 B2	01 February 2018
		AU 2014-298218 A1	10 March 2016
		AU 2014-298218 B2	06 July 2017
		AU 2017-101759 A4	01 February 2018
		AU 2017-101759 B4	29 March 2018
		AU 2017-101760 A4	01 February 2018
		AU 2017-101760 B4	07 June 2018
		AU 2017-101760 C4	07 January 2021
		AU 2017-101761 A4	01 February 2018
		AU 2017-101761 B4	07 June 2018
		AU 2017-101761 C4	19 November 2020
		AU 2017-101762 A4	01 February 2018
		AU 2017-101762 B4	07 June 2018
		AU 2017-101763 A4	01 February 2018
		AU 2017-101763 B4	07 June 2018
		AU 2017-101763 C4	07 January 2021
		AU 2017-279563 A1	18 January 2018
		AU 2017-279563 B2	12 March 2020
		AU 2017-279571 A1	18 January 2018
		AU 2017-279571 B2	05 March 2020
		AU 2017-279572 A1	18 January 2018
		AU 2017-279572 B2	19 September 2019
		AU 2017-279573 A1	18 January 2018
		AU 2017-279579 A1	18 January 2018
		AU 2017-279579 B2	12 March 2020
		CA 2919882 A1	05 February 2015
		CN 105592764 A	18 May 2016
		CN 105592764 B	19 March 2019
		CN 105592765 A	18 May 2016
		CN 105592765 B	19 September 2017
		CN 108354516 A	03 August 2018
		CN 108354517 A	03 August 2018
		CN 108354517 B	25 October 2019

Form PCT/ISA/210 (patent family annex) (July 2022)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR2023/017999

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
		CN	108354518	A	03 August 2018
		CN	108392139	A	14 August 2018
		CN	108392139	B	07 April 2023
		CN	108402997	A	17 August 2018
		CN	108402997	B	07 July 2020
		CN	108402998	A	17 August 2018
		EP	3027103	A1	08 June 2016
		EP	3027103	B1	04 November 2020
		EP	3027104	A2	08 June 2016
		EP	3027104	B1	17 August 2022
		EP	3138456	A1	08 March 2017
		EP	3138456	B1	28 September 2022
		GB	2532648	A	25 May 2016
		GB	2532648	B	18 April 2018
		GB	2532649	A	25 May 2016
		GB	2532649	B	22 November 2017
		GB	2551070	A	06 December 2017
		GB	2551070	B	06 June 2018
		GB	2551071	A	06 December 2017
		GB	2551071	B	25 July 2018
		GB	2551072	A	06 December 2017
		GB	2551072	B	16 May 2018
		GB	2551073	A	06 December 2017
		GB	2551073	B	27 June 2018
		GB	2551938	A	03 January 2018
		GB	2551938	B	27 June 2018
		JP	2016-525422	A	25 August 2016
		JP	2016-525423	A	25 August 2016
		JP	2017-213408	A	07 December 2017
		JP	2017-213409	A	07 December 2017
		JP	2017-213410	A	07 December 2017
		JP	6178510	B2	09 August 2017
		JP	6193495	B2	06 September 2017
		JP	6600668	B2	30 October 2019
		JP	6656212	B2	04 March 2020
		JP	6925585	B2	25 August 2021
		JP	6949344	B2	13 October 2021
		KR	10-1790651	B1	26 October 2017
		KR	10-2016-0036624	A	04 April 2016
		KR	10-2016-0037235	A	05 April 2016
		KR	10-2018-0029282	A	20 March 2018
		KR	10-2018-0029283	A	20 March 2018
		KR	10-2018-0030259	A	21 March 2018
		KR	10-2072535	B1	03 February 2020
		KR	10-2072536	B1	03 February 2020
		PH	12016500220	A1	25 April 2016
		PH	12016500220	B1	25 April 2016
		PH	12016500221	A1	25 April 2016
		PH	12016500221	B1	25 April 2016
		RU	2620750	C1	29 May 2017

Form PCT/ISA/210 (patent family annex) (July 2022)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR2023/017999

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
				US	10004370	B2	26 June 2018
				US	10117554	B2	06 November 2018
				US	10292556	B2	21 May 2019
				US	10786127	B2	29 September 2020
				US	2016-0174792	A1	23 June 2016
				US	2016-0183749	A1	30 June 2016
				US	2017-0340180	A1	30 November 2017
				US	2018-0255992	A1	13 September 2018
				WO	2015-015166	A1	05 February 2015
				WO	2015-015167	A2	05 February 2015
				WO	2015-015167	A3	21 May 2015
CN	211355206	U	28 August 2020	None			
KR	10-1880089	B1	23 July 2018	CN	102961085	A	13 March 2013
				CN	102961085	B	01 March 2017
				CN	102961086	A	13 March 2013
				CN	102961086	B	07 December 2016
				CN	102961088	A	13 March 2013
				CN	102961088	B	05 September 2017
				EP	2564749	A1	06 March 2013
				EP	2564749	B1	29 October 2014
				EP	2570064	A1	20 March 2013
				EP	2570064	B1	01 April 2015
				EP	2570067	A1	20 March 2013
				EP	2837317	A1	18 February 2015
				EP	2837317	B1	03 October 2018
				EP	2912982	A1	02 September 2015
				EP	2912982	B1	28 June 2017
				JP	2013-052238	A	21 March 2013
				JP	2013-052239	A	21 March 2013
				JP	2013-052240	A	21 March 2013
				KR	10-1778542	B1	18 September 2017
				KR	10-1970584	B1	27 August 2019
				KR	10-2013-0025309	A	11 March 2013
				KR	10-2013-0025310	A	11 March 2013
				KR	10-2013-0025320	A	11 March 2013
				US	2013-0055521	A1	07 March 2013
				US	2013-0056026	A1	07 March 2013
				US	2013-0056290	A1	07 March 2013
				US	9241602	B2	26 January 2016
				US	9526391	B2	27 December 2016

Form PCT/ISA/210 (patent family annex) (July 2022)