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(54) **VACUUM CLEANER**

(57) Disclosed is a cleaner includes a body forming an appearance or an exterior, a mop module, and a sweep module. The mop module is disposed at a lower side of the body, supports the body, and includes a pair of spin mops for rotating and mopping a floor. The sweep module is disposed at the body and sweeps up a foreign material on the floor by a rotation of an agitator. The sweep module includes a dust housing, the agitator, and a wheel assembly. The dust housing includes a collection opening surface opened to the floor and a storage space where the foreign material collected through the collection opening is stored. The agitator is exposed at the collection opening surface, is rotatably assembled to the dust housing, and moves the foreign material on the floor to the storage space when rotating. The wheel assembly is assembled to the dust housing and is in contact with the floor to support the dust housing. The wheel assembly includes a wheel body assembled to the dusting housing to be movable in a vertical direction, a wheel assembled to a lower side of the wheel body and in contact with the floor to support the wheel body, a wheel elastic member disposed between the dust housing and the wheel body and providing elastic force to the wheel body to move the wheel body, and a cliff sensor disposed at the body and detecting a movement of the wheel body when the wheel body is moved.

According to the present disclosure, the wheel assembly not only supports the body but also is used as a detection factor of the cliff sensor that detects a cliff, and thus, a number of elements or components can be reduced by function integration.

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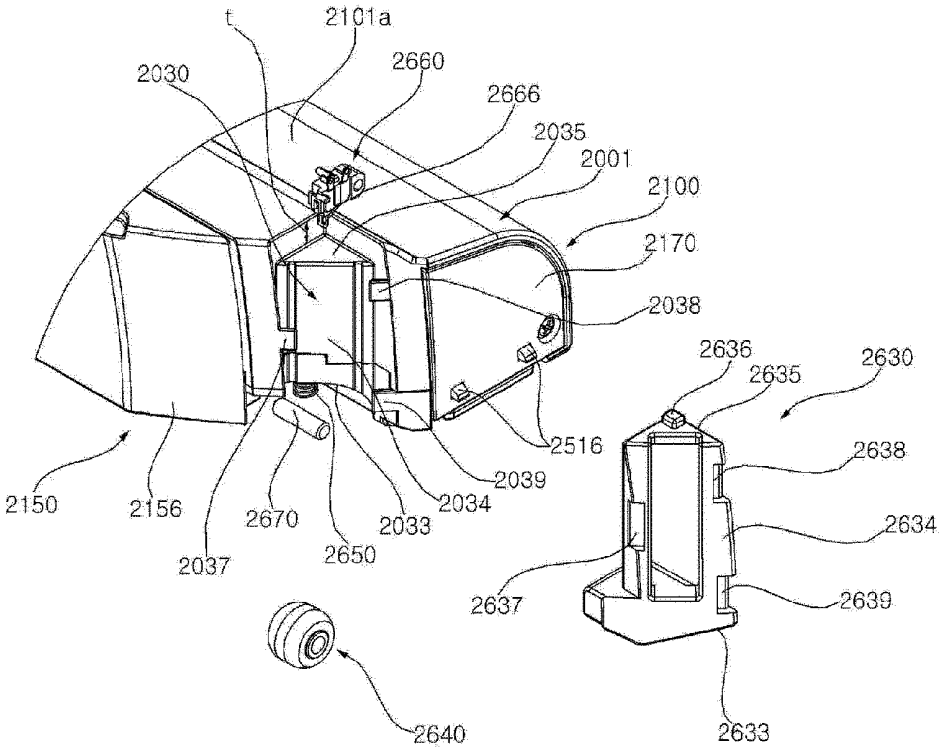
【Figure 23】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Description

BACKGROUND OF THE INVENTION

1. Field of the invention

[0001] The present disclosure relates to a cleaner for mopping or wiping a floor, and to a cleaner capable of recognizing a cliff through a vertical movement of a wheel supporting a main body.

2. Description of the Related Art

[0002] A cleaner is a device that cleans a floor by inhaling a foreign material such as a dust on the floor or wiping a foreign material on the floor. Recently, a cleaner capable of mopping a floor has been developed. In addition, a robot cleaner is a device that cleans while driving or traveling on its own.

[0003] In Korean Patent Publication No. 10-1602790 (hereinafter, referred to as Prior Art 1), a robot cleaner capable of traveling while performing wet-type cleaning using a wet-type cleaner is disclosed.

[0004] In Prior Art 1, the robot cleaner includes a pair of cleaners arranged in a left-right direction, and a driving unit that rotates each cleaner by providing driving force.

[0005] In Korean Patent Publication No. 10-0671897 (hereinafter, referred to as Prior Art 2), a switch-type sensor, which detects a floor by physical contact with the floor, is disposed at a bottom surface of a main body.

[0006] However, in the cleaner according to Prior Art 2, the switch-type sensor keeps in contact with the floor. Thus, noise and friction may be generated when the cleaner is operated.

[0007] Further, in the conventional art, since a robot cleaner proceeds only by friction force of spin mops and a water level of stored water in a water tank is variable, it may be difficult to effectively mop a floor and driving power may be not sufficient.

[0008] Particularly, it may be very difficult for the conventional wet-type robot to adjust a traveling direction by friction force with rotating mops. Accordingly, cleaning is performed only by a random driving, and cleaning by a pattern driving being able to meticulously clean is impossible.

[0009] Further, in the conventional art, since the cleaning is possible only by the random driving, meticulous cleaning at a corner of a floor or an area adjacent to a wall may be difficult.

SUMMARY OF THE INVENTION

[0010] The present disclosure is for providing a cleaner capable of reducing a size of a body while recognizing a cliff by a physical vertical movement of a wheel body supporting a main body through detecting a movement of a wheel, without installing a separate cliff sensor on the body.

[0011] The present disclosure is for providing a cleaner capable of recognizing a cliff by a physical vertical movement of a wheel through installing the wheel on a sweep module in which a dust housing and an agitator are integrated with each other.

[0012] When a body of a cleaner has a circular shape or a shape close to a circular shape, rotation in place is easy. When the rotation in place is easy, a cleaner can easily escape from an obstacle area or a corner. However, when the body of the cleaner has the circular shape, a width of an agitator is limited to be smaller than a diameter of the body so that the agitator is not disturbed by an obstacle during the body rotates. Accordingly, the present disclosure is for providing a cleaner being able to maximize a width of an agitator in a state that the agitator does not protrude from the body by disposing a storage space that stores a foreign material collected from the agitator at a front side than the agitator. Therefore, a size of an area to be cleaned at once is not reduced. In this instance, the cleaner according to the present disclosure makes rotation of the body easy by limiting the width of the agitator to be smaller than a diameter of the body.

[0013] The present disclosure is for providing a cleaner being able to make rotation of a body easy by a circular shape of the body. In this instance, the cleaner according to the present disclosure can reduce friction between an obstacle and spin mops, make rotation of the body easy, and maximize a size of an area to be cleaned at once when the body rotates by disposing rotation axes of a pair of spin mops to be eccentrical or deviated from a center of the body and disposing a part of each spin mop to be overlapped with the body vertically.

[0014] The present disclosure is also for providing a robot cleaner or a mobile robot being able to increase friction force between a mop and a floor regardless of a water-level change in a water tank for effective mopping and traveling and to perform a pattern driving that allows meticulous cleaning through accurate driving.

[0015] In a cleaner according to the present disclosure, a cliff sensor recognizes a cliff by detecting a physical vertical movement of a wheel supporting a main body.

[0016] In a cleaner according to the present disclosure, a wheel for supporting a floor is installed on a sweep module in which a dust housing and an agitator are integrated with each other, and the wheel is moved downward at a space without the floor by elastic force of a wheel elastic member. A cliff sensor detects the movement of the wheel.

[0017] Specifically, a cleaner according to the present disclosure includes a body, a mop module, and a sweep module. The mop module is disposed at a lower side of the body, supports the body, and includes a pair of spin mops for rotating and mopping a floor. The sweep module is disposed at the body and sweeps up a foreign material on the floor. The sweep module includes an agitator, a storage space, and a wheel assembly. The agitator rotates to collect the foreign material on the floor. The for-

eign material collected by the agitator is stored in the storage space. The wheel assembly includes wheel assemblies respectively disposed at both sides of the storage space to support the sweep module and be in contact with the floor. The wheel assembly includes a wheel body where a wheel is installed and being movable in a vertical direction, and a cliff sensor for detecting a movement of the wheel body.

[0018] The cliff sensor may be disposed at the body.

[0019] The wheel assembly may further include a wheel elastic member providing elastic force to the wheel body to move the wheel body.

[0020] In addition, a cleaner according to the present disclosure includes a body forming an appearance or an exterior, a mop module, and a sweep module. The mop module is disposed at a lower side of the body, supports the body, and includes a pair of spin mops for rotating and mopping a floor. The sweep module is disposed at the body and sweeps up a foreign material on the floor by a rotation of an agitator. The sweep module includes a dust housing, the agitator, and a wheel assembly. The dust housing includes a collection opening surface opened to the floor and a storage space where the foreign material collected through the collection opening is stored. The agitator is exposed at the collection opening surface, is rotatably assembled to the dust housing, and moves the foreign material on the floor to the storage space when rotating. The wheel assembly is assembled to the dust housing and is in contact with the floor to support the dust housing. The wheel assembly includes a wheel body assembled to the dusting housing to be movable in a vertical direction, a wheel assembled to a lower side of the wheel body and in contact with the floor to support the wheel body, a wheel elastic member disposed between the dust housing and the wheel body and providing elastic force to the wheel body to move the wheel body, and a cliff sensor disposed at the body and detecting a movement of the wheel body when the wheel body is moved.

[0021] The wheel elastic member may be compressed when the wheel is supported by the floor, while the wheel elastic member may provide the elastic force to the wheel body and press the wheel body to a lower side or downward when the wheel is not in contact with the floor.

[0022] The cliff sensor may be disposed at an upper side of the wheel body.

[0023] The wheel body may further include a contact portion protruding to an upper side. The cliff sensor may include a switch lead disposed at an upper side of the contact portion and in contact with the contact portion. The cliff sensor may be a micro-switch of detecting whether the wheel body moves or not through contact or non-contact of the switch lead and the contact portion.

[0024] The wheel body may further include a contact portion protruding to an upper side. The cliff sensor further may include a permanent magnet disposed at the contact portion. The cliff sensor may be a hall sensor of detecting whether the wheel body moves or not through proximity or non-proximity of the permanent magnet.

[0025] The wheel body may further include a detecting portion protruding to an upper side, and the cliff sensor may further include a light emitting portion and a light receiving portion. The detecting portion may be disposed between the light emitting portion and the light receiving portion. The cliff sensor may be a photo sensor of detecting whether the wheel body moves or not by detecting light emitted from the light emitting portion and then received at the light receiving portion.

[0026] The wheel assembly may be disposed at a front side than the agitator.

[0027] The cleaner may include a collection space and the storage space. The collection space may be disposed at an inside of the dust housing. The agitator may be installed on the collection space and the collection opening surface may be formed at the collection space. The storage space may be disposed at the inside of the dust housing, communicate with the collection space, and store the foreign material collected by the agitator. The wheel assembly may be disposed at a front side than the collection space.

[0028] The wheel assembly may be disposed at a side portion of the storage space.

[0029] The cleaner may further include a discharge surface penetrating the dust housing and forming a front surface of the storage space, and a dust cover covering the discharge surface and detachably assembled to the dust housing. The wheel assembly may be positioned at a front side than the collection space and may be positioned at a rear side than the dust cover.

[0030] The wheel body may further include an upper wheel body, a lower wheel body, and a side wheel body. A part of the upper wheel body may face an upper surface of the dust housing, a part of the lower wheel body may face a lower surface of the dust housing, and the side wheel body may connect the upper wheel body and the lower wheel body. The wheel elastic member may be disposed between the lower wheel body and the dust housing.

[0031] An upper installation portion that is concave downward or to a lower side from the upper surface of the dust housing may be further included. The upper wheel body may be disposed at an upper side of the upper installation portion. When the wheel body is moved downward by the wheel elastic member, the upper wheel body may be supported by the upper installation portion.

[0032] A contact portion protruding to an upper side from the upper wheel body may be further included. The cliff sensor may further include a switch lead disposed at an upper side of the contact portion and in contact with the contact portion. When the upper wheel body is supported by the upper installation portion, the contact portion and the switch lead may be separated or spaced apart from each other.

[0033] A guard protruding from the dust housing and disposed at an outside of the side wheel body and a guard groove formed at the side wheel body may be further

included. The guard is inserted into the guard groove.

[0034] The wheel may be installed on the lower wheel body.

[0035] The wheel assembly may include a first wheel assembly disposed at a left side in a traveling or driving direction and a second wheel assembly disposed at a right side in the traveling or driving direction. The first wheel assembly and the second wheel assembly may be bisymmetrical or lateral-symmetrical to each other.

[0036] The cleaner may further include a collection space and a storage space. The collection space may be disposed at an inside of the dust housing. The agitator may be installed on the collection space and the collection opening surface may be formed at the collection space. The storage space may be disposed at the inside of the dust housing, communicate with the collection space, and store the foreign material collected by the agitator. The first wheel assembly may be disposed at a left side of the storage space, and the second wheel assembly may be disposed at a right side of the storage space.

[0037] The first wheel assembly and the second wheel assembly may be disposed at a front side than the agitator.

[0038] The body may include a cover forming an appearance or an exterior, and a base disposed at a lower side of the cover. The sweep module may be installed on the base. The wheel assembly may be disposed at an outside of the dust housing and may be disposed at an inside of the cover.

[0039] The cleaner may further include a collection space and a storage space. The collection space may be disposed at an inside of the dust housing. The agitator may be installed on the collection space and a collection opening surface may be formed at the collection space. The storage space may be disposed at the inside of the dust housing, communicate with the collection space, and store the foreign material collected by the agitator. The wheel assembly may further include a first wheel assembly disposed at a left side in a traveling or driving direction and a second wheel assembly disposed at a right side in the traveling or driving direction. The collection space may be disposed at a front side than the mop module, and the storage space may be disposed at a front side than the collection space. The first wheel assembly may be disposed at a left side of the storage space, and the second wheel assembly may be disposed at a right side of the storage space.

[0040] Firstly, according to the present disclosure, a cliff sensor can recognize a cliff by detecting a physical vertical movement of a wheel supporting a main body.

[0041] Secondly, according the present disclosure, by installing a wheel supporting a floor on a sweep module in which a dust housing and an agitator are integrated with each other and moving the wheel downward by elastic force of a wheel elastic member at a space without the floor, a cliff sensor can detect a cliff by detecting the movement of the wheel.

[0042] Thirdly, according to the present disclosure, even if there is a material that reflects ultrasonic waves or light at a cliff, since a wheel directly applies a load to a floor, a cliff that cannot be visually confirmed can be physically confirmed.

[0043] Fourthly, according to the present disclosure, an occupancy of an inner space of a body can be minimized since a wheel assembly is disposed at the sweep module.

[0044] Fifthly, according to the present disclosure, a cliff can be detected at a front side in a traveling or driving direction of a cleaner since a wheel assembly is disposed at a front side of an agitator.

[0045] Sixthly, according to the present disclosure, sensitivity of a cliff sensor can be physically adjusted according to elastic force of a wheel elastic member since the wheel elastic member disposed at a lower side of a dust housing presses a wheel body downward.

[0046] Seventhly, according to the present disclosure, since a wheel assembly is disposed between an inside of a cover and an outside of a dust housing, a wheel body can be prevented from being separated out even if the wheel body is moved in a vertical direction or an up-down direction.

[0047] Eighthly, according to the present disclosure, a wheel assembly not only supports a body but also is used as a detection factor of a cliff sensor that detects a cliff, and thus, a number of elements or components can be reduced by function integration.

[0048] Ninthly, according to the present disclosure, by disposing an agitator close to a center of a body in a structure in which the agitator and a dust housing are integrated with each other, the agitator is not disturbed by an external obstacle and a width of the agitator in a left-right direction can be maximized. Thereby, a cleaning area can be maximized, a body can escape quickly when trapped in the obstacle, and the body can rotate easily.

[0049] Tenthly, according to the present disclosure, rotation of a cleaner can be easy by a circular shape of a body. A size of an area to be cleaned by a spin mop at once can be maximized and rotation of a body is not disturbed by a shape of the spin mop when the body rotates, since rotation axes of a pair of spin mops are eccentrical or deviated from a center of the body and a part of each spin mop is overlapped with the body vertically. That is, a part of each spin mop is exposed to an outside of the body. Even if the spin mop is exposed to the outside of the body, the spin mop has a circular shape, and thus, friction between an obstacle and the spin mop is reduced when the body rotates. Accordingly, the rotation of the body can be easy.

[0050] Eleventh, according to the present disclosure, a body has a circular shape and a dry-type module does not protrude to an outside of the body. Accordingly, the cleaner can be freely rotated at any position in a cleaning area. Also, an agitator can have a sufficiently large width, and thus, a cleaning range can be wide. Further, a mopping operation while collecting a foreign material having

a relatively large size can be performed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0051]

FIG. 1 is a perspective view of a cleaner according to a first embodiment of the present disclosure.
FIG. 2 is a left side view of the cleaner shown in FIG. 1.
FIG. 3 is a bottom perspective view of the cleaner shown in FIG. 1.
FIG. 4 is a front cross-sectional view of the cleaner shown in FIG. 1.
FIG. 5 is a perspective view of a sweep module shown in FIG. 3.
FIG. 6 is a bottom perspective view of the sweep module shown FIG. 5.
FIG. 7 is a right cross-sectional view of the sweep module shown in FIG. 5.
FIG. 8 is an exploded perspective view of the sweep module shown in FIG. 3.
FIG. 9 is an exploded perspective view of the sweep module viewed from a right side of FIG. 8.
FIG. 10 is a partially exploded perspective view of the sweep module shown in FIG. 5.
FIG. 11 is an enlarged perspective view of a first lever shown in FIG. 8.
FIG. 12 is an enlarged perspective view of a second lever shown in FIG. 9.
FIG. 13 is an enlarged perspective view of the second lever viewed from a left side of FIG. 12. FIG. 14 is a partially exploded perspective view of the sweep module showing a coupled structure of an agitator shown in FIG. 5.
FIG. 15 is an exploded perspective view showing an assembled structure of a driven coupling shown in FIG. 14.
FIG. 16 is a perspective view viewed from a left side of FIG. 15.
FIG. 17 is a right cross-sectional view showing the agitator of FIG. 14.
FIG. 18 is an exploded perspective view of a driving unit viewed from a left side of FIG. 14.
FIG. 19 is a plan view of the cleaner of FIG. 1 in a state that a case is removed.
FIG. 20 is a bottom view of the cleaner shown in FIG. 11.
FIG. 21 is a right cross-sectional view of the cleaner shown in FIG. 11.
FIG. 22 is an exploded perspective view of a wheel assembly shown in FIG. 5.
FIG. 23 is a partially enlarged view of the wheel assembly shown in FIG. 22.
FIG. 24 is an exploded perspective view of the wheel assembly viewed from a lower side of FIG. 22.
FIG. 25 is a partially enlarged view of the wheel assembly shown in FIG. 24.
FIG. 26 is an exploded perspective view of a first wheel assembly shown in FIG. 24 viewed from another direction.
FIG. 27 is an exemplary operation view of a wheel assembly according to a first embodiment of the present disclosure.
FIG. 28 is an exemplary operation view of a wheel assembly according to a second embodiment of the present disclosure.
FIG. 29 is an exemplary operation view of a wheel assembly according to a third embodiment of the present disclosure.
FIG. 30 is a bottom view showing the cleaner of FIG. 1 for explaining a weight center and lowest ends of spin mops according to the present disclosure.
FIG. 31 is a plan view of the cleaner of FIG. 1 viewed from an upper side in a state that a case is removed from the body for explaining the weight center according to the present disclosure.
FIG. 32 is a bottom view of a cleaner according to another embodiment of the present disclosure for explaining a relationship between a weight center and other components.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0052] Expressions referring to directions such as a front direction (a frontward direction or a forward direction) (F), a rear direction (a rearward direction) (R), a left direction (a leftward direction) (Le), a right direction (a rightward direction) (Ri), an upper direction (an up direction or an upward direction) (U), and a down direction (an downward direction) (D), or so on may be defined base on a driving direction of a cleaner (a vacuum cleaner). This is just for explaining the present disclosure with reference to the accompanying drawings to be clearly understood. Therefore, directions may be defined differently depending on where a reference is placed.

[0053] For example, a direction parallel to an imaginary line connecting a central axis of a left spin mop and a central axis of a right spin mop may be defined as a left-right direction. A direction perpendicular to the left-right direction and parallel to the central axes of the spin mops or has an error angle within 5 degrees with the central axes of the spin mops may be defined as an up-down direction or a vertical direction. A direction perpendicular to each of the left-right direction and the up-down direction may be defined as a front-back direction or a longitudinal direction. A front direction may mean a main traveling direction of a mobile robot or a main traveling direction of a pattern traveling of a mobile robot. In this instance, the main traveling direction may mean a vector sum value of directions traveling in a predetermined time.

[0054] A term of 'first', 'second', 'third', or so on in front of a component mentioned below is only to avoid confusion between the component being referred to and other component, and does not relate to an order, an impor-

tance, or a master-servant relationship between components. For example, an embodiment only having a second component without a first component may be possible.

[0055] A term of 'a mop' mentioned hereinafter may have any of materials such as fabric or paper, and may be a multi-use product being able to be used repeatedly through washing or a disposable product.

[0056] The present disclosure may be applied to a cleaner (for example, a vacuum cleaner) manually moved by a user or a robot cleaner traveling or driving on its own. Hereinafter, an embodiment will be described based on a robot cleaner.

[0057] FIG. 1 is a perspective view of a cleaner according to a first embodiment of the present disclosure. FIG. 2 is a left side view of the cleaner shown in FIG. 1. FIG. 3 is a bottom perspective view of the cleaner shown in FIG. 1. FIG. 4 is a front cross-sectional view of the cleaner shown in FIG. 1.

[0058] Referring to FIG. 1 to FIG. 4, a cleaner 1 according to an embodiment of the present disclosure may include a body 30 having a controller. The cleaner 1 may include a mop module 40 to mop a floor (a surface to be cleaned) while being in contact with the floor. The cleaner 1 may include a sweep module 2000 provided to collect a foreign material on the floor.

[0059] The mop module 40 may be disposed at a lower side of the body 30 and may support the body 30. The sweep module 2000 may be disposed at the lower side of the body 30 and may support the body 30. In the present embodiment, the body 30 may be supported by the mop module 40 and the sweep module 2000. The body 30 may form an appearance or an exterior. The body 30 may be arranged to connect the mop module 40 and the sweep module 2000.

[0060] The mop module 40 may form an appearance or an exterior. The mop module 40 is disposed at the lower side of the body 30. The mop module 40 is disposed at a rear side of the sweep module 2000. The mop module 40 provides driving force for a movement of the cleaner 1. In order to move the cleaner 1, the mop module 40 may be preferably disposed at the rear side of the cleaner 1.

[0061] The mop module 40 may be provided with at least one mop portion 411 to mop the floor while rotating. The mop module 40 may include at least one spin mop 41, and the spin mop 41 may rotate in a clockwise direction or a counterclockwise direction when viewed from an upper side. The spin mop 41 may be in contact with the floor.

[0062] In the present embodiment, the mop module 40 may include a pair of spin mops 41a and 41b. The pair of spin mops 41a and 41b may rotate in a clockwise direction or a counterclockwise direction when viewed from an upper side, and may mop the floor through rotation. When the pair of spin mops 41a and 41b are viewed from a front side of a traveling direction of the cleaner, a spin mop disposed at a left side may be referred to as a left spin mop 41a, and a spin mop disposed at a right side may be defined as a right spin mop 41b.

[0063] Each of the left spin mop 41a and the right spin mop 41b may be rotated with respect to its rotation axis. The rotation axis may be arranged in an up-down direction. The left spin mop 41a and the right spin mop 41b may be rotated independently of each other.

[0064] Each of the left spin mop 41a and the right spin mop 41b may include a mop portion 411, a rotating plate 412, and a spin shaft 414. Each of the left spin mop 41a and the right spin mop 41b may include a water container (a water receiving portion) 413.

[0065] The left spin mop 41a and the right spin mop 41b may be rotatably installed on a lower portion of the body 30, be in contact with a floor, and move the body 30.

[0066] Rotation axes osa and osb (see FIG. 30) of the pair of spin mops may cross a lower surface of the body and be vertically overlapped with the body. The rotation axes osa and osb of the pair of spin mops may be eccentrical or deviated from a center of the body, and a part of the left spin mop 41a and a part of the right spin mop 41b may be vertically overlapped with the body 30.

[0067] Therefore, according to the present disclosure, rotation of the body is not hindered or disturbed by a shape of the spin mop when the body rotates. That is, when a part of each spin mop is exposed to an outside of the body, the spin mop has a circular shape, and thus, friction between an obstacle and the spin mop is reduced when the body rotates. Accordingly, the rotation of the body can be easy.

[0068] That is, if entire portions of the left spin mop 41a and right spin mop 41b overlap vertically with the body 30, rotational motion of the body 30 is easy, but an area to be cleaned at once is too small. Thus, according to the present disclosure, the left spin mop 41a and the right spin mop 41b may be exposed at the outside of the body 30 to a degree that it does not disturb the rotation of the body 30, and an area to be cleaned by the left spin mop 41a and the right spin mop 41b can be maximized.

[0069] A ratio of an area where the left spin mop 41a or the right spin mop 41b is vertically overlapped with the body 30 may be preferably 85% to 95% of each spin mop. Considering a relationship with a sweep module, a position where each spin mop is exposed may be preferably positioned between a lateral side and a rear side of the body 30. A distance between a center of the body 30 and the rotation axis osa of the left spin mop 41a may be the same as a distance between the center of the body 30 and the rotation axis osb of the right spin mop 41b.

[0070] The sweep module 2000 may form an appearance or an exterior. The sweep module 2000 may be disposed at a front side of the mop module 40. In order to prevent a foreign material on the floor from first contacting the mop module 40, the sweep module 2000 may preferably disposed at the front side of the cleaner 1 in a traveling direction.

[0071] The sweep module 2000 may be spaced apart from the mop module 40. The sweep module 2000 may

disposed at the front side of the mop module 40 and be in contact with the floor. The sweep module 2000 may be installed on a lower portion of the body 30.

[0072] The sweep module 2000 may be completely overlapped with the body 30 vertically. In this instance, the phrase of "the sweep module 2000 is completely overlapped with body 30 vertically" may mean that an entire portion of the sweep module 2000 is vertically overlapped with the body 30 and the sweep module 2000 is not exposed to an outside of the body 30 when viewed from an upper side.

[0073] The sweep module 2000 may be in contact with the floor and may collect the foreign material at the front side of the sweep module 2000 to an inside when the cleaner 1 moves. The sweep module 2000 may be disposed at a lower side of the body 30. A width of the sweep module 2000 in a left-right direction may be smaller than a width of the mop module 40 in the left-right direction.

[0074] The body 30 may include a case 31 forming an appearance or an exterior and a base 32 disposed at a lower side of the case 31. An outer surface of the body 30 may form at least a part of a circle having a radius having an error with a reference radius within a reference error range. In this instance, the phrase of "a circle having a radius having an error with a reference radius within a reference error range" may include a case that the circle is a perfect circle and a case that the circle has a radius varied within an error range at each position having each center angle or at each region.

[0075] Specifically, when viewed from a vertical direction or in a top view, 50% or more of the body 30 may form a part of a circular shape, and the remaining portion of the body 30 may have a shape close to a circular shape in consideration of coupling with other components or elements. In this instance, the circular shape may not mean a complete circle of mathematical meaning, but may mean a circle of engineering meaning with error.

[0076] The case 31 may form a side surface and an upper surface of the body 30. The base 32 may form a bottom surface of the body 30.

[0077] In the present embodiment, the case 31 may have a cylindrical shape with an open bottom surface. When viewed in a top view, an overall shape of the case 31 may be a circular shape. Since the case 31 has a plane shape of a circular shape, a rotation radius when rotating can be minimized.

[0078] Based on or with respect to a center of the circle shape, a rotation center of the spin mop is disposed at a rear side and the agitator is disposed at a front side.

[0079] The case 31 may include an upper wall 311 having an overall shape in a circular shape, and a side wall 312 formed integrally with the upper wall 311 and extending downward from an edge of the upper wall 311.

[0080] A part of the sidewall 312 may be open. An opened portion of the side wall 312 may be defined as a water-tank insertion opening (a water-tank insertion hole or a water-tank insertion portion) 313, and a water tank 81 may be detachably installed through the water-tank insertion opening 313. The water-tank insertion opening 313 may be disposed at a rear side based on the traveling direction of the cleaner. Since the water tank 81 is inserted through the water-tank insertion opening 313, the water-tank insertion opening 313 may be preferably disposed close to the mop module 40.

[0081] The mop module 40 may be coupled to the base 32. A wheel assembly 2600 may be coupled to the base 32. A controller Co and a battery Bt may be disposed in an inner space formed by the case 31 and the base 32. In addition, a mop driving unit (a mop driver) 60 may be disposed on the body 30. A water supply module 80 may be disposed at the body 30.

[0082] The base 32 may include a base body 321, a base guard 322, and an insertion hole 323. The base body 321 may cover the opened bottom surface of the case 31. The base guard 322 may be formed along an outer edge of the base body 321 and protrude downward from the edge of the base body 321. The insertion hole 323 may penetrate through the base body 321 in an up-down direction, and the sweep module 2000 may be detachably inserted into the insertion hole 323.

[0083] FIG. 5 is a perspective view of the sweep module shown in FIG. 3. FIG. 6 is a bottom perspective view of the sweep module shown FIG. 5. FIG. 7 is a right cross-sectional view of the sweep module shown in FIG. 5. FIG. 8 is an exploded perspective view of the sweep module shown in FIG. 3. FIG. 9 is an exploded perspective view of the sweep module viewed from a right side of FIG. 8. FIG. 10 is a partially exploded perspective view of the sweep module shown in FIG. 5.

[0084] With reference to FIG. 5 to FIG. 10, the sweep module 2000 may be detachably mounted or installed on the body 30 through the insertion hole 323. The sweep module 2000 may be positioned at a front side than the mop module 40 and collect a foreign material at the front side of the mop module 40. The sweep module 2000 may be detachably assembled with the base 32. The sweep module 2000 in an assembled state with the base 32 may be separated from the base 32 through a lever 2500.

[0085] An installation space 325 in which the sweep module 2000 is mounted is formed at the base 32. In the present embodiment, a storage housing 326 forming the installation space 325 may be further provided. The storage housing 326 may be assembled with the base 32 and may be disposed at an upper side of the insertion hole 323.

[0086] The storage housing 326 may protrude to an upper side from the base body 321.

[0087] A lower side of the storage housing 326 may be opened to communicate with the insertion hole 323. An interior space of the storage housing 326 provides the installation space 325. The installation space 325 of the storage housing 326 corresponds to a shape of the sweep module 2000.

[0088] The sweep module 2000 may include a dust housing 2100, an agitator 2200, a driving unit 2300, a driving coupling 2320, a driven coupling 2220, and a lever

2500. The dust housing 2100 may be detachably assembled with the body 30, and a foreign material may be stored in the dust housing 2100. The agitator 2200 may be rotatably assembled with the dust housing 2100. The driving unit 2300 may be installed on the body 30 and provide rotational force to the agitator 2200. The driving coupling 2320 may be disposed at the driving unit 2300 and transmit the rotational force of the driving unit 2300 to the agitator 2200. The driven coupling 2220 may transmit the rotational force of the driving coupling 2320 to the agitator 2200. The lever 2500 may be disposed at the dust housing 2100. The lever 2500 may couple or separate the driving coupling 2320 and the driven coupling 2220 by receiving operation force.

[0089] The dust housing 2100 accommodates the agitator 2200. A foreign material collected through the rotation of the agitator 2200 may be stored in the dust housing 2100. That is, the dust housing 2100 provides an installation and operation structure of the agitator 2200, and also provides a storage space for a foreign material.

[0090] The dust housing 2100 may include a collection space 2102 for a rotation of the agitator 2200 and a storage space 2104 for storing a foreign material. The dust housing 2100 may longitudinally extend in a left-right direction. A width of the dust housing 2100 may be narrower than a width of the mop module 40.

[0091] The dust housing may be formed by separately fabricating a structure for the collection space 2102 and a structure for the storage space 2104 and assembling them each other. In the present embodiment, the collection space 2102 and the storage space 2104 are disposed in the dust housing 2100, and a partition 2145 for partitioning the collection space 2102 and the storage space 2104 may be disposed.

[0092] In the present embodiment, the dust housing 2100 may include an upper housing 2110, a lower housing 2140, a dust cover 2150. The upper housing 2110 may provide an upper outer shape. The lower housing 2140 may be disposed at a lower side of the upper housing 2110 and be coupled to the upper housing 2110. The dust cover 2150 may detachably assembled with at least one of the upper housing 2110 and the lower housing 2140.

[0093] The collection space 2102 and the storage space 2104 are formed by assembling the upper housing 2110 and the lower housing 2140. That is, the upper housing 2110 may provide an upper partial space of the collection space 2102 and an upper partial space of the storage space 2104, and the lower housing 2140 may provide the remaining lower space of the collection space 2102 and the remaining lower space of the storage space 2014.

[0094] In the present embodiment, the collection space 2102 may be positioned at a rear side of the storage space 2104.

[0095] That is, the storage space 2104 is positioned at a front side of the collection space 2102, and the dust cover 2150 is positioned at a front side than the upper housing 2110.

[0096] In addition, the storage space 2014 may be disposed at a front side of the agitator 2200. When the body of the cleaner has a circular shape or a shape close to a circular shape, rotation in place is easy. When the rotation in place is easy, the cleaner can easily escape from an obstacle area or a corner. However, when the body of the cleaner has a circular shape, a width of an agitator is limited to be smaller than a diameter of the body so that the agitator is not disturbed by the obstacle during the body rotates. Accordingly, in the present disclosure, rotation of the body can be easy by limiting the width of the agitator to be smaller than the diameter of the body. Also, the width of the agitator can be maximized in a state that the agitator does not protrude from the body by disposing the storage space that stores a foreign material collected from the agitator at a front side than the agitator. Therefore, a size of an area to be cleaned at once is not reduced.

[0097] The upper housing 2110 and the lower housing 2140 may be integrally assembled. The upper housing 2110 and the lower housing 2140 that are integrally assembled may be defined as a housing assembly 2001.

[0098] The dust cover 2150 is detachably assembled with the housing assembly. When the dust cover 2150 is separated from the housing assembly, the storage space 2104 is exposed to an outside. The foreign material stored in the storage space 2104 may be discarded when the dust cover 2150 is separated.

[0099] The upper housing 2110 provides an upper surface, a left upper surface, a right upper surface, and a rear surface of the dust housing 2100. The upper housing 2110 forms an upper side of the collection space 2102 and the storage space 2104. The upper housing 2110 provides upper partial portions of the collection space 2102 and the storage space 2104.

[0100] The upper housing 2110 may include a first upper housing portion 2112, a second upper housing portion 2114, a third upper housing portion 2116, and a fourth housing portion 2118. The first upper housing portion 2112 may form an upper wall of the storage space 2104. The second upper housing portion 2114 may be integrally connected with the first upper housing portion 2112 and forms an upper wall and a rear wall of the collection space 2102. The third upper housing portion 2116 may provide a part of a left wall of the collection space 2102 and the storage space 2104, and the fourth upper housing portion 2118 may provide a part of a right wall of the collection space 2102 and the storage space 2104.

[0101] A shape of the first upper housing 2112 is not limited. However, since the second upper housing portion 2114 accommodates the agitator 2200, the second upper housing portion 2114 may have a shape corresponding to a shape of the agitator 2200.

[0102] At least a part of the second upper housing portion 2114 may have a curvature center at a rotation axis of the agitator 2200. At least a part of the second upper housing portion 2114 may have an arc shape.

[0103] In the present embodiment, the second upper housing portion 2114 may have a radius of curvature R1 greater than a diameter of the agitator 2200. An outer edge of the agitator 2200 may be preferably in contact with an inner surface of the second upper housing portion 2114.

[0104] A foreign material collected through a contact of the agitator 2200 and the second upper housing portion 2114 may be moved to the storage space 2104 along the inner surface of the second upper housing portion 2114. When the agitator 2200 and the second upper housing 2114 are spaced apart from each other, the foreign material collected by the agitator 2200 may fall back to the floor.

[0105] A collection opening surface 2101 may be formed at the lower housing 2140. The collection opening surface 2101 may be exposed to the floor. The agitator 2200 may penetrate the collection opening surface 2101 and protrude to a down side than the collection opening surface 2101.

[0106] The collection opening surface 2101 may be disposed at a rear side than the storage space 2102.

[0107] The lower housing 2140 may be disposed at a lower side of the upper housing 2110 and may be spaced apart from the upper housing 2110 to form a storage opening surface 2103. In the present embodiment, the lower housing 2140 and the upper housing 2110 may be spaced apart from each other in the up-down direction.

[0108] The lower housing 2140 may include a first lower housing portion 2142, a third lower housing portion 2146, a fourth lower housing portion 2148, and a partition 2145. The first lower housing portion 2142 may form a lower wall of the storage space 2104 and has the collection opening surface 2101 where the foreign material is collected. The third lower housing portion 2146 may provide a rest of the left wall of the collection space 2102 and the storage space 2104, and the fourth lower housing portion 2148 may provide a rest of the right wall of the collection space 2102 and the storage space 2104, The partition 2145 may be integral with the first lower housing portion 2142, and may partition the collection space 2102 and the storage space 2104.

[0109] In the present embodiment, the first lower housing portion 2142, the third lower housing portion 2146, the fourth lower housing portion 2148, and the partition 2145 may be formed to have an integral structure. Unlike the present embodiment, any one of the first lower housing portion 2142, the third lower housing portion 2146, the fourth lower housing portion 2148, or the partition 2145 may be separately manufactured and then be assembled.

[0110] A left wall 2011 of the housing assembly 2001 may be provided through assembling the third lower housing portion 2146 and the third upper housing portion 2116. A right wall 2012 of the housing assembly 2001 may be provided through assembling the fourth lower housing portion 2148 and the fourth upper housing portion 2118.

[0111] A left rotation axis of the agitator 2200 may penetrate the left wall 2011 of the housing assembly, and a right rotation axis of the agitator 2200 may penetrate the right wall 2012 of the housing assembly.

[0112] The partition 2145 may protrude to an upper side from the first lower housing portion 2142. A length of the partition 2145 in the left-right direction may correspond to or relate to a length of the agitator 2200 in the left-right direction. The length of the partition 2145 in the left-right direction may be greater than the length of the agitator 2200 in the left-right direction.

[0113] The partition 2145 may include a first partition portion 2145a and a second partition portion 2145b. The first partition portion 2145a may protrude to an upper side from the first lower housing portion 2142, form the collection opening surface 2101, and partition the collection space 2102 and the storage space 2104. The first partition portion 2145a may be not in contact with the agitator 2200. The second partition portion 2145b may extend to an upper side from the first partition portion 2145a, partition the collection space 2102 and the storage space 2104, and be in contact with the agitator 2200.

[0114] The first partition portion 2145a may protrude to the upper side from the first lower housing portion 2142. The collection opening surface 2101 may be formed between the first partition portion 2145a and a rear end 2140b of the first lower housing portion 2142.

[0115] A length L1 of the collection opening surface 2101 in a front-rear direction may be smaller than a diameter of the agitator 2200. Since the length L1 of the collection opening surface 2101 in the front-rear direction is smaller than the diameter of the agitator 2200, the agitator 2200 cannot be drawn out to an outside through the collection opening surface 2101.

[0116] The agitator 2200 may be mounted on an upper side of the lower housing portion 2140, and a lower end of the agitator 2200 may protrude to an outside of the collection opening surface 2101 and thus may be in contact with the floor.

[0117] The first partition portion 2145a may be not in contact with the agitator 2200.

[0118] However, the second partition portion 2145b may be in contact with the agitator 2200.

[0119] The second partition portion 2145b may have an arc shape. A curvature center of the second partition 2145b may be positioned at a rotation axis Ax of the agitator 2200. A radius of curvature R2 of the second partition 2145b may be equal to or smaller than a diameter of the agitator 2200.

[0120] The second partition portion 2145b may have a curved surface facing the agitator 2200. An upper end 2147a of the second partition portion 2145b may be positioned higher than the rotation axis Ax of the agitator 2200.

[0121] The upper end 2147a of the second partition portion 2145b may protrude to a rear side of the first partition portion 2145a.

[0122] The upper end 2147a of the second partition

portion 2145b may be sharply formed. An inclined surface 2147b may be formed at the upper end 2147a of the second partition portion 2145b. The inclined surface 2147b may separate a foreign material attached to a surface of the agitator 2200 and guide the foreign material to the storage space 2104.

[0123] When assembling the upper housing 2110 and the lower housing 2140, a discharge surface 2105 that is opened to a front side may be formed. The discharge surface 2105 may be formed at a front surface of the housing assembly 2001, and a dust cover 2150 may open and close the discharge surface 2105.

[0124] The dust cover 2150 may be disposed at a front side of the housing assembly 2001 and may cover the discharge surface 2105. The foreign material in the storage space 2104 may be discharged to an outside of the sweep module 2000 through the discharge surface 2105.

[0125] The dust cover 2150 may be detachably assembled with the housing assembly 2001. In the present embodiment, the dust cover 2150 and the housing assembly 2001 may be assembled through a mutually-engaged structure (a mutually-fastened structure, a mutually-locked structure, or a mutually-hooked structure). The mutually-engaged structure may be released by operation force of a user.

[0126] For the mutually-engaged structure of the dust cover 2150 and the housing assembly 2001, a protrusion 2151 may be formed at one of the dust cover 2150 and the housing assembly 2001, and an engaged groove 2152 may be formed at the other of the dust cover 2150 and the housing assembly 2001.

[0127] In the present embodiment, the engaged groove 2152 is formed at the dust cover 2150, and the protrusion 2151 is formed at the housing assembly 2001.

[0128] A number of engaged grooves 2152 corresponds to a number of protrusions 2151. A plurality of protrusions 2151 may be disposed. The protrusions 2151 may be disposed at the upper housing 2110 and the lower housing 2140, respectively.

[0129] In the present embodiment, two protrusions 2151 are disposed at the upper housing 2110, and two protrusions 2151 are also disposed at the lower housing 2140.

[0130] If it is necessary to distinguish, protrusions disposed at the upper housing 2110 are referred to as upper protrusions 2151a and 2151b, and protrusions disposed at the lower housing 2140 are referred to as lower protrusions 2151c and 2151d.

[0131] The upper protrusions 2151a and 2151b protrude to an upper side at an upper surface of the upper housing 2110. The lower protrusion 2151c and 2151d protrude to a lower side at a bottom surface of the lower housing 2140.

[0132] At the dust cover 2150, upper engaged grooves 2152a and 2152b corresponding to the upper protrusions 2151a and 2151b are formed, and lower engaged groove 2152c and 2152d corresponding to the lower protrusions 2151c and 2151d are formed.

[0133] The dust cover 2150 may include a front cover portion 2153, a top cover portion 2154, a left cover portion 2155, and a right cover portion 2156, and a bottom cover portion 2157. The front cover portion 2153 may be disposed to face the discharge surface 2105. The top cover portion 2154 may protrude from an upper edge of the front cover portion 2153 toward the housing assembly. The left cover portion 2155 may protrude from a left edge of the front cover portion 2153 toward the housing assembly, and the right cover portion 2156 may protrude from a right edge of the front cover portion 2153 toward the housing assembly. The bottom cover portion 2157 may protrude from a lower edge of the front cover portion 2153 toward the housing assembly side.

[0134] The dust cover 2150 may have a concave insertion space from a rear side to a front side.

[0135] The upper engaged groove 2152a and 2152b are formed at the top cover portion 2154. The lower engaged groove 2152c and 2152d are formed at the bottom cover portion 2157. The upper engaged groove 2152a and 2152b and the lower engaged groove 2152c and 2152d may be preferably disposed to be opposite to each other.

[0136] The upper engaged groove 2152a and 2152b or the lower engaged groove 2152c and 2152d may have a shape of a groove or a hole.

[0137] The housing assembly 2001 may have an insertion portion 2160 being inserted into the insertion space and being in close contact with an inner surface of the dust cover 2150. The insertion portion 2160 may be located at a front side of the upper housing 2110 and the lower housing 2140.

[0138] The insertion portion 2160 may include a top insertion portion 2164, a left insertion portion 2165, a right insertion portion 2166, and a bottom insertion portion 2167. The top insertion portion 2164 may form an upper side of the discharge surface 2105 and protrude to a front side. The left insertion portion 2165 may form a left side of the discharge surface 2105 and protrude to a front side. The right insertion portion 2166 may form a right side of the discharge surface 2105 and protrude to a front side. The bottom insertion portion 2167 may form a lower side of the discharge surface 2105 and protrude to a front side.

[0139] In the present embodiment, the top insertion portion 2164, the left insertion portion 2165, the right insertion portion 2166, and the bottom insertion portion 2167 are connected. Unlike the present embodiment, the top insertion portion 2164, the left insertion portion 2165, the right insertion portion 2166, and the bottom insertion portion 2167 may be separated. An area of the insertion portion 2160 may become narrower as it goes from a rear side to a front side.

[0140] The top insertion portion 2164 may be in close contact with the top cover portion 2154, the left insertion portion 2165 may be in close contact with the left cover portion 2155, the right insertion portion 2166 may be in close contact with the right cover portion 2156, and the

bottom insertion portion 2167 may be in close contact with the bottom cover portion 2157.

[0141] In the present embodiment, the upper protrusions 2151a and 2111b are formed at the top insertion portion 2164, and the lower protrusions 2151c and 2151d are formed at the bottom insertion portion 2167.

[0142] The upper protrusions 2151a and 2151b may be inserted into the upper engaged groove 2152a and 2152b from a lower side to an upper side of the upper engaged groove 2152a and 2152b to form a mutually-engaged structure. The lower protrusions 2151c and 2151d may be inserted into the lower engaged groove 2152c and 2152d from an upper side to a lower side of the lower engaged groove 2152c and 2152d to form a mutually-engaged structure.

[0143] By operation force of a user to pull the dust cover 2150, the dust cover 2150 or the insertion portion 2160 is elastically deformed and thus the mutually-engaged structure is released.

[0144] The agitator 2200 may be disposed to be rotated in the housing assembly 2001.

[0145] The agitator 2200 may be disposed between the upper housing 2110 and the lower housing 2140. The agitator 2200 may be disposed at the upper housing 2110. In the present embodiment, the agitator 2200 is disposed at the lower housing 2140 and rotates while being supported by the lower housing 2140.

[0146] A rotation axis of the agitator 2200 is disposed in the left-right direction and the agitator 2200 may rotate forward or backward.

[0147] The housing assembly 2001 may further include a first journal 2010 and a second journal 2020 supporting the agitator 2200. The first journal 2010 is disposed at a left side of the housing assembly 2001, and the second journal 2020 is disposed at a right side of the housing assembly 2001.

[0148] The first journal 2010 and the second journal 2020 penetrate the housing assembly 2001 in the left-right direction and communicate with the collection space 2102.

[0149] In the present embodiment, the first journal 2010 and the second journal 2020 may have a cylindrical shape. Unlike the present embodiment, at least one of the first journal and the second journal may have a semi-cylindrical shape. When the first journal and the second journal have a semi-cylindrical shape, the first journal and the second journal are arranged to support the rotation axis of the agitator 2200 at a lower side.

[0150] The dust housing 2100 may be mounted on the installation space 325 of the base 32, and a lever 2500 may be disposed to couple or separate the base 32 and the dust housing 2100.

[0151] FIG. 11 is an enlarged perspective view of the first lever shown in FIG. 8. FIG. 12 is an enlarged perspective view of the second lever shown in FIG. 9. FIG. 13 is an enlarged perspective view of the second lever viewed from a left side of FIG. 12.

[0152] Referring to FIG, 9 to FIG. 13, the lever 2500 may be disposed between the base 32 and the dust housing 2100 and may form a mutually-engaged structure with respect to the base 32 and the dust housing 2100. The lever 2500 may form a mutually-engaged structure with the dust housing 2100 in a direction of gravity and suppress the dust housing 2100 from being separated from a lower side of the base 32.

[0153] A plurality of levers 2500 may be disposed, and form a mutually-engaged structure at a plurality of places of the dust housing 2100. In the present embodiment, the lever 2500 includes a first lever 2510 and a second lever 2520, and the first lever 2510 and the second lever 2520 are arranged in the left-right direction.

[0154] The first lever 2510 is disposed at a left side of the dust housing 2100, and the second lever 2520 is disposed at a right side of the dust housing 2100.

[0155] Operation mechanisms of the first lever 2510 and the second lever 2520 are the same, and only operation directions of the first lever 2510 and the second lever 2520 are opposite to each other.

[0156] The first lever 2510 disposed at the left side is moved to the right side to release the mutually-engaged structure with the base 32, and the second lever 2520 disposed at the right side is moved to a left side to release the mutually-engaged structure with the base 32.

[0157] The sweep module 2000 may include a first lever 2510, a second lever 2520, a first-lever elastic member 2541, and a second-lever elastic member 2542. The first lever 2510 may be disposed at one side of the housing assembly to be relatively movable in the left-right direction. The second lever 2520 may be disposed at the other side of the housing assembly to be relatively movable in the left-right direction. The first-lever elastic member 2541 may be disposed between the first lever 2510 and the dust housing 2100 and provide elastic force to the first lever 2510. The second-lever elastic member 2252 may be disposed between the second lever 2520 and the dust housing 2100 and provide elastic force to the second lever 2520.

[0158] Since the first lever 2510 and the second lever 2520 may have the same or similar structures, a structure of the first lever will be described as an example.

[0159] In the present embodiment, the dust housing 2100 may be provided with a first side cover 2170 covering or shielding the first lever 2510 and a second side cover 2180 covering or shielding the second lever 2520.

[0160] Unlike the present embodiment, the first lever 2510 and the second lever 2520 may be exposed to an outside of the dust housing 2100 without the first side cover 2170 and the second side cover 2180. Also, unlike the present embodiment, the first side cover 2170 may be disposed at a right side and the second side cover 2180 may be disposed at a left side.

[0161] The first side cover 2170 may be coupled to a left side of the housing assembly 2001. The first side cover 2170 may have a shape corresponding to a left shape of the housing assembly 2001. The first side cover 2170 may shield a shaft member 2201 of the agitator

2200 from being exposed to an outside. The first side cover 2170 may cover or shield most of the first lever 2510 and exposes only a portion for the mutually-engaged structure with the base 32.

[0162] The first side cover 2170 may include a first side cover body 2173, a through hole 2171 or 2172, a hook portion 2174, a journal-coupled portion 2175, and a fastening portion 2176. The first side cover body 2173 may be in close contact with one side of the housing assembly 2001. The through hole 2171 or 2172 may be disposed to penetrate the first side cover body 2173. The hook portion 2174 may protrude from the first side cover body 2173 toward the housing assembly 2001 and may be hooked-coupled with the housing assembly 2001. The journal-coupled portion 2175 may protrude from the first side cover body 2173 toward the housing assembly 2001 and be mutually coupled to the journal 2010 (the first journal 2010 in the present embodiment). The fastening portion 2176 may couple the first side cover body 2173 and the housing assembly 2001 by a fastening member (not shown).

[0163] The fastening portion 2176 and the hook portion 2174 are disposed at opposite sides based on the journal-coupled portion 2175. A plurality of hook portions 2174 may be arranged in an up-down direction.

[0164] The journal-coupled portion 2175 may be inserted into an inner diameter of the first journal 2010.

[0165] The first lever 2510 may include an upper lever body 2512, a lower lever body 2514, and a lever engaging portion 2516. The upper lever body 2512 may be disposed between the housing assembly 2001 and the first side cover 2170 and be elastically supported by the first-lever elastic member 2541. The lower lever body 2514 may be disposed between the housing assembly 2001 and the first side cover 2170, be integral with the upper lever body 2512, be exposed to an outside of the housing assembly 2001, and receive operation force of a user. The lever engaging portion 2516 may protrude from the upper lever body 2512 and be disposed to penetrate the through holes 2171 and 2172 of the first side cover 2170.

[0166] The upper lever body 2512 may be disposed in an up-down direction, and the lower lever body 2514 may be disposed in a horizontal direction.

[0167] The lower lever body 2514 may be disposed to be exposed to an outside of the dust housing 2100. The lower lever body 2514 may be positioned at a lower side of the upper lever body 2512. The lower lever body 2514 may be exposed to an outside of a lower surface of the lower housing 2140.

[0168] In the present embodiment, an operation portion 2519 protruding to a lower side from the lower lever body 2514 may further provided. Since the operation portion 2519 longitudinally extends in the front-rear direction, the operation portion 2519 may easily receive operation force of a user in the left-right direction.

[0169] A user may move the first lever 2510 by pushing the operation unit 2519 in the left-right direction.

[0170] The lever engaging portion 2516 may protrude from the upper lever body 2512 to an outside (a side opposite to the agitator). Since a number of the lever engaging portions 2516 corresponds to a number of through holes, a first lever engaging portion 2516a and a second lever engaging portion 2516b are disposed in the present embodiment.

[0171] The lever engaging portion 2516 has a structure that forms a mutually-engaged structure in a direction of gravity and minimizes forming a mutually-engaged structure in an opposite direction of gravity. Therefore, an upper surface of the lever engaging portion 2516 may have a round shape or an inclined surface to a lower side, and a lower surface of the lever engaging portion 2516 may have a flat surface.

[0172] If the levers 2510 and 2520 are not returned to initial positions when the levers 2510 and 2520 move, the sweep module 2000 may be separated from a fixed position because the mutually engaged structure is not formed. To prevent this, the sweep module 2000 may further include a structure for guiding a horizontal movement of the first lever 2510.

[0173] The sweep module 2000 may include a first guide 2545, a first guide hole 2518, a second guide 2547, and a second guide hole 2528. The first guide 2545 may protrude to the first lever 2510 at one side (a left side in the present embodiment) of the dust housing 2100 and mutually interfere with the first lever 2510 to guide a movement direction of the first lever 2510. The first guide hole 2518 may be formed at the first lever 2510, and the first guide 2545 may be inserted into the first guide hole 2518 so that the movement of the first guide 2545 is guided. The second guide 2547 may protrude to the second lever 2520 at the other side (a right side in the present embodiment) of the dust housing 2100 and mutually interfere with the second lever 2520 to guide a movement direction of the second lever 2520. The second guide hole 2528 may be formed at the second lever 2520, and the second guide 2547 may be inserted to the second guide hole 2528 so that the movement of the second guide 2547 is guided.

[0174] The first guide 2545 may be formed in the movement direction of the first lever 2510, and the second guide 2547 may be formed in the moving direction of the second lever 2520. Thus, the first guide 2545 and the second guide 2547 may be formed in a horizontal direction. The first guide hole 2518 and the second guide hole 2528 may be formed in the horizontal direction to correspond to the first guide 2545 and the second guide 2547.

[0175] The guide holes 2518 and 2528 may be disposed at either the upper lever body 2512 or the lower lever body 2514. In the present embodiment, the guide holes 2518 and 2528 are formed to penetrate the upper lever body 2512 in the horizontal direction.

[0176] One end of the first-lever elastic member 2541 is supported by the dust housing 2100, and the other end of the first-lever elastic member 2541 is supported by the first lever 2510. The first-lever elastic member 2541 elastically supports the first lever 2510 toward an outside of

the dust housing 2100.

[0177] The sweep module 2000 may further include a structure for preventing displacement of the lever elastic members 2541 and 2542.

[0178] In order to maintain an operation position of the first-lever elastic member 2541, the sweep module 2000 may include a first position fixing portion 2517 and a second position fixing portion 2544. The first position fixing portion 2517 may be disposed at the first lever 2510 and may be inserted into the other end of the first-lever elastic member 2541. The second position fixing portion 2544 may be disposed at the dust housing 2100 and one end of the first-lever elastic member 2541 may be inserted into the second position fixing portion 2544.

[0179] In the present embodiment, the first-lever elastic member 2541 and the second-lever elastic member 2542 may be formed of a coil spring. In the present embodiment, the first position fixing portion 2517 may have a boss shape, and the second position fixing portion 2544 may have a groove shape.

[0180] The first position fixing portion 2517 may be inserted into the first-lever elastic member 2541, and the first position fixing portion 2517 may allow the first-lever elastic member 2541 to move in the left-right direction. Thus, a movement of the first-lever elastic member 2541 in the front-rear direction or in the up-down direction may be suppressed.

[0181] The second position fixing portion 2544 may have a groove shape, and the first-lever elastic member 2541 may be inserted into the second position fixing portion 2544. The second position fixing portion 2544 may allow the first-lever elastic member 2541 to move in the left-right direction. Thus, a movement of the first-lever elastic member 2541 in the front-rear direction or in the up-down direction may be suppressed.

[0182] In the present embodiment, the second position fixing portion 2544 may be disposed between the first journal 2010 and the first guide 2545. The second position fixing portion 2544 may include a first position fixing part 2544a and a second position fixing part 2544b. The first position fixing part 2544a may have a concave shape at a portion of a lower side of the first journal 2010, and the second position fixing part 2544b may have a concave shape at a portion of an upper side of the first guide 2545.

[0183] When viewed from a later side, each of the first position fixing part 2544a and the second position fixing part 2544b may have a curved surface, and a curvature center of each of the first position fixing part 2544a and the second position fixing part 2544b may be positioned at an inside of the first-lever elastic member 2541.

[0184] A radius of curvature of each of the first position fixing part 2544a and the second position fixing part 2544b may be larger than a diameter of the first-lever elastic member 2541.

[0185] When the first lever 2510 is moved toward the housing assembly 2001 by operation force of a user, the lever engaging portion 2516 releases the mutually-engaged structure with the base 32. In this instance, since the first-lever elastic member 2541 elastically supports the first lever 2510, when the operation force of the user is removed, the first lever 2510 is moved back to the first side cover 2170 and the lever engaging portions 2516 are exposed to an outside of the through holes 2171 and 2172.

[0186] The sweep module 2000 may be maintained in a state mounted on the base 32 through the mutually-engaged structure of the lever engaging portion 2516 protruding to an outside of the through holes 2171 and 2172 and the base 32.

[0187] When the mutually-engaged structure between the lever engaging portion 2516 and the base 32 is released, the sweep module 2000 can be separated from the base 32.

[0188] In the present embodiment, since the first lever 2510 and the second lever 2520 are disposed at the left and right sides of the sweep module 2000, respectively, the sweep module 2000 can be separated from the body 30 only when both of the mutual engagements of the first lever 2510 and the second lever 2520 are released.

[0189] The first lever 2510 provides the mutually-engaged structure with the base 32 and releases the mutually-engaged structure with the base 32. The second lever 2520 provides not only an act of the first lever 2510 but also a connection structure with the driving unit 2300.

[0190] The second lever 2520 may include an upper lever body 2522, a lower lever body 2524, a lever engaging portion 2526, and an operation portion 2529. The upper lever body 2522 may be disposed between the housing assembly 2001 and the second side cover 2180 and be elastically supported by the second-lever elastic member 2542. The lower lever body 2524 may be disposed between the housing assembly 2001 and the second side cover 2180, be integral with the upper lever body 2522, be exposed to an outside of the housing assembly 2001, and receive operation force of a user. The lever engaging portion 2526 may protrude from the upper lever body 2522 and be disposed to penetrate through holes 2181 and 2182 of the second side cover 2180. The operation portion 2529 may protrude to a lower side from the lower lever body 2524.

[0191] When it is necessary to distinguish the lever engaging portion 2516 of the first lever from the lever engaging portion 2526 of the second lever, the lever engaging portion 2516 of the first lever is referred to as one-side lever engaging portion, and the lever engaging portion 2526 of the second lever is referred to as the other-side lever engaging portion.

[0192] The lever engaging portion 2526 may protrude from the lower lever body 2522 to an outside (a side opposite to the agitator). The lever engaging portion 2526 may include a first lever engaging portion 2526a and a second lever engaging portion 2526b.

[0193] The lever engaging portion 2526 may form a mutually-engaged structure with an engaged groove 3266 formed at the storage housing 326 of the base 32.

[0194] Since the lever engaging portion 2526 includes the first lever engaging portion 2526a and the second lever engaging portion 2526b, the engaged groove 3266 may include a first engaged groove 3266a and a second engaged groove 3266b to correspond to them. With respect to the lever engaging portion 2516 of the first lever 2510, an engaged groove (not shown) having the same structure may be formed. The first engaged groove 3266a and the second engaged groove 3266b may be formed at a sidewall 3262 of the storage housing 326.

[0195] The first engaged groove 3266a and the second engaged groove 3266b may be positioned at a lower side than a driven coupling 2220 and a driving coupling 2320.

[0196] In the present embodiment, mutually-engaged structures are formed in a direction of gravity through the engaged grooves and the lever engaging portions at one side and the other side of the sweep module 2000, respectively.

[0197] Unlike in the present embodiment, only the first lever 2510 in which the driven coupler is not disposed may form the mutually-engaged structure downward with the base 32. The other side of the sweep module 2000 may be supported by the body 30 through the driving coupling 2320 and the driven coupling 2220 described later.

[0198] In the present embodiment, the sweep module 2000 may be detachably coupled to the body 30 by the engaged groove at one side, the one-side lever engaging portion, the engaged groove at the other side, and the other-side lever engaging portion, the driving coupling 2320, and the driven coupling 2220.

[0199] The second side cover 2180 may include a second side cover body 2183, a through hole 2181 or 2182, a hook portion 2184, a fastening portion 2186, and an opening surface 2185. The second side cover body 2183 may be in close contact with the other side (a right side in the present embodiment) of the housing assembly 2001. The through hole 2181 or 2182 may be disposed to penetrate the second side cover body 2183. The hook portion 2184 may protrude from the second side cover body 2183 toward the housing assembly 2001 and may be hooked-coupled with the housing assembly 2001. The fastening portion 2186 may couple the second side cover body 2183 and the housing assembly 2001 by a fastening member (not shown). In order to transmit driving force of the driving unit 2300 to the agitator 2200, the driving unit 2300 may penetrate the opening surface 2185.

[0200] The opening surface 2185 may be disposed in the left-right direction. A first coupler 2310 of the driving unit 2300, which will be described later, may be inserted through the opening surface 2185.

[0201] The sweep module 2000 may include a second guide 2547, a second guide hole 2528, a third position fixing portion 2527, and a fourth position fixing portion 2546. The second guide 2547 may protrude to the second lever 2520 at the other side (a right side in the present embodiment) of the dust housing 2100 and mutually interfere with the second lever 2520 to guide a movement direction of the second lever 2520. The second guide hole 2528 may be formed at the second lever 2520, and the second guide 2547 may be inserted to the second guide hole 2528 so that the movement of the second guide 2547 is guided. The second position fixing portion 2527 may be disposed at the second lever 2520 and may be inserted into the other end of the second-lever elastic member 2542. The fourth position fixing portion 2546 may be disposed at the dust housing 2100 and one end of the second-lever elastic member 2542 may be inserted into the fourth position fixing portion 2546.

[0202] The agitator 2200 may include an agitator assembly 2210, a driven coupling 2220, a coupling elastic member 2230, a coupling stopper 2270. The agitator assembly 2210 may sweep a foreign material on a floor into the collection space 2102 through rotation. The driven coupling 2220 may receive rotational force from the driving unit 2300 and may be relatively movably disposed between the driving unit 2300 and the agitator assembly 2210. The coupling elastic member 2230 may be disposed between the agitator assembly 2210 and the driven coupling 2220, provide elastic force to the driven coupling 2220, and press the driven coupling 2220 toward the driving unit 2300. The coupling stopper 2270 may penetrate the driven coupling 2220 and be coupled to the agitator assembly 2210, and form a mutually-engaged structure with the driven coupling 2220 in a left-right direction to prevent the driven coupling 2220 from being separated.

[0203] The agitator assembly 2210 may include an agitator body 2240, a shaft member 2201, a collection member 2250, and a bearing 2600. The agitator body 2240 may be disposed at the collection space 2102, and be rotated by receiving the rotational force of the driving unit 2300. The shaft members 2201 may be disposed at one side and the other side of the agitator body 2240, respectively, provide a rotation center of the agitator body 2240, and be rotatably supported by the dust housing 2100. The collection member 2250 may be installed on an outer circumferential surface of the agitator body 2240 and sweep a foreign material into the collection space 2102. The bearing 2600 may provide rolling friction to the shaft member 2201.

[0204] In the present embodiment, the driven coupling 2220 may be assembled detachably with a lever (the second lever 2520 in the present embodiment) and the shaft member 2201 and may move together with the lever. In the present embodiment, the coupling of the driven coupling 2220 with the driving unit 2300 may be released by operation force of a user applied to the second lever 2520.

[0205] The driven coupling 2220 may move toward the shaft member 2201, and the coupling with the driving unit 2300 may be released. The driven coupling 2220 may relatively move in a horizontal direction between the agitator assembly 2210 and the driving unit 2300.

[0206] The agitator body 2240 may be disposed in the left-right direction. The agitator body 2240 may be dis-

posed at an inside of the collection space 2102.

[0207] The collection member 2250 may be formed along an outer circumferential surface of the agitator body 2240. The collection member 2250 may protrude radially outward from the outer circumferential surface of the agitator body 2240. The collection member 2250 may rotate together with the agitator body 2240 when the agitator body 2240 rotates. The collection member 2250 may penetrate the collection opening surface 2101 and be in contact with the floor. The collection member 2250 may be composed of a plurality of brushes.

[0208] When the agitator assembly 2210 rotates, the collection member 2250 may be contact with the foreign material on the floor and move the foreign material into the collection space 2102.

[0209] FIG. 14 is a partially exploded perspective view of the sweep module showing a coupled structure of the agitator shown in FIG. 5. FIG. 15 is an exploded perspective view showing an assembled structure of the driven coupling shown in FIG. 14. FIG. 16 is a perspective view viewed from a left side of FIG. 15. FIG. 17 is a right cross-sectional view showing the agitator of FIG. 14. FIG. 18 is an exploded perspective view of the driving unit viewed from a left side of FIG. 14.

[0210] Referring to FIG. 12 to FIG. 18, the shaft members 2201 may be disposed at one side and the other side of the agitator body 2240, respectively. The shaft member 2201 may form a center of rotation of the agitator assembly 2210.

[0211] The shaft member 2201 may be disposed in the left-right direction. The shaft member 2201 may penetrate left and right sides of the collection space 2102.

[0212] In the present embodiment, the shaft member 2201 may penetrates the left wall 2011 and the right wall 2012 of the dust housing 2100. The shaft member 2201 may be integral with the agitator body 2240.

[0213] In the present embodiment, the shaft member 2201 may be separably or detachably assembled with the agitator body 2240. The shaft member 2201 and the agitator body 2240 may form a mutually-engaged structure in a rotation direction of the agitator 2200, but may be separated in a rotation-axis direction (a left-right direction in the present embodiment) of the agitator 2200.

[0214] The agitator assembly 2210 and the shaft member 2201 may be detachably assembled, Therefore, only the agitator assembly 2210 can be replaced. That is, the agitator assembly 2210 may be separated from the dust housing 2100 in a state that each shaft member 2201 is assembled to the dust housing 2100.

[0215] Since the agitator 2200 is a consumable element, the agitator 2200 may be periodically replaced. Through a coupling structure of the shaft member 2201 and the agitator body 2240, only the agitator body 2240 may be separated from the dust housing 2100 without an entire separation of the agitator 2200. The shaft member 2201 and the agitator body 2240 maintain a state of a mutually-engaged structure.

[0216] The shaft member 2201 may include a rotating shaft body 2202, a shaft portion 2203, and a coupling guide 2204. The rotating shaft body 2202 may be mutually coupled to the agitator body 2240. The shaft portion 2203 may protrudes from the rotating shaft body 2202 toward the driving unit 2300, provide a rotation center of the agitator 2200, and be coupled with the bearing 2260. The coupling guide 2204 may protrude from the shaft portion 2203 toward the driving portion 2300 more and penetrate the driven coupling 2220. The coupling stopper 2270 may be coupled to the coupling guide 2204.

[0217] The rotating shaft body 2202 may have a disk shape. The shaft portion 2203 may protrude from the rotating shaft body 2202 toward the driving portion 2300.

[0218] A diameter or a size of the shaft portion 2203 may be smaller than a diameter of the rotating shaft body 2202.

[0219] The shaft portion 2203 may have a cylindrical shape. An outer surface of the shaft portion 2203 may be inserted into the bearing 2260. The shaft portion 2203 may be inserted into and supported by the bearing 2260.

[0220] The coupling guide 2204 may further protrude from the shaft portion 2203 toward the driving portion 2300 more. Curvature centers of the coupling guide 2204 and the shaft portion 2203 may be located on the same rotation center.

[0221] A diameter of the coupling guide 2204 may be smaller than a diameter of the shaft portion 2203, and a first step 2205 may be formed between the coupling guide 2204 and the shaft portion 2203 due to a diameter difference.

[0222] One end of the coupling elastic member 2230 may be supported by the first step 2205.

[0223] The coupling guide 2204 may further include a through portion 2206 penetrating the driven coupling 2220. A coupling stopper 2270 may be fixed to the through portion 2206.

[0224] The driven coupling 2220 may move in the left-right direction along the coupling guide 2204. Since the driven coupling 2220 is elastically supported by the coupling elastic member 2230, the driven coupling 2220 may be kept in close contact with the driving unit 2300 when external force is not applied.

[0225] In the present embodiment, the coupling guide 2204 may have a circular columnar shape, and the through portion 2206 may have a polygonal column shape (a hexagonal column shape in the present embodiment).

[0226] The through portion 2206 may be inserted into the driven coupling 2220 and form a mutually-engaged structure in a rotation direction of the agitator 2200.

[0227] On the other hand, the shaft member 2201 is provided with a key groove 2207 for a mutually-engaged structure with the agitator body 2240. The key groove 2207 may be disposed on an opposite side of the shaft portion 2203 based on or with respect to the rotating shaft body 2202. The key groove 2207 may be disposed at a side facing the agitator body 2240. The key groove 2207 may have a shape of an atypical polygon. The key groove

2207 may be open in a radial direction of the rotation axis.

[0228] A key 2247, which is inserted into the key groove 2207, may be formed at the agitator body 2240. The key 2247 may protrude toward the shaft member 2201 or the driven coupling 2220.

[0229] The driven coupling 2220 may include a coupling body 2222, a first guide groove 2224, a second guide groove 2226, a second step 2225, and a power transmission groove 2228. The coupling body 2222 may be coupled with a lever (the second lever 2520 in the present embodiment). The first guide groove 2224 may be formed at one side (a left side in the present embodiment) of the coupling body 2222 to have a concave shape, The coupling guide 2204 may be inserted and the coupling elastic member 2230 may be inserted into the first guide groove 2224. The second guide groove 2226 may communicate with the first guide groove 2224, and penetrate the coupling body 2222. The through portion 2206 may be inserted to the second guide groove 2226. The second step 2225 may be disposed between the first guide groove 2224 and the second guide groove 2226, and the first step 2205 may be supported by the second step 2225. The power transmission groove 2228 may be formed at the other side (the right side in the present embodiment) of the coupling body 2222 to have a concave shape. The driving coupling 2320 coupled to the driving unit 2300 may be detachably inserted into the power transmission groove 2228.

[0230] A diameter of the first guide groove 2224 may be larger than a diameter of the coupling elastic member 2230. A diameter of the coupling elastic member 2230 may be larger than a diameter of the coupling guide 2204 and smaller than a diameter of the first guide groove 2224.

[0231] The first guide groove 2224 may have a circular hollow shape.

[0232] The second guide groove 2226 may have a shape corresponding to a shape of the through portion 2206. In the present embodiment, the second guide groove 2226 has a hollow shape which side surface has a hexagonal shape.

[0233] The coupling body 2222 may be provided with a groove 2223, which has a concave shape to an inside in a radial direction at an outer side surface. A diameter of the groove 2223 may be smaller than an outer surface diameter of the coupling body 2222.

[0234] A coupling groove 2523 may be formed at the upper lever body 2522 of the second lever 2520. The coupling groove 2523 may be inserted into the groove 2223 and thus may be engaged with the driven coupling 2220.

[0235] The groove 2223 may be perpendicular to a rotation center of the agitator 2200.

[0236] The second lever 2520 may be coupled to or separated from the driven coupling 2220 in the up-down direction and form a mutually-engaged structure with the driven coupling 2220 in the left-right direction.

[0237] The second lever 2520 may further include a first extension portion 2522a and a second extension portion 2522b extending from an upper side of the upper lever body 2522. The coupling groove 2523 may be formed between the first extension portion 2522a and the second extension portions 2522b.

[0238] The first extension portion 2522a and the second extension portion 2522b are structures for more robust assembly with the driven coupling 2220. The first extension portion 2522a and the second extension portion 2522b may be contact with one side surface 2223a and the other side surface 2223b of the groove 2223.

[0239] The coupling stopper 2270 may penetrate the driven coupling 2220 and may be fastened to the through portion 2206. The driven coupling 2220 may move in the left-right direction between the coupling stopper 2270 and the shaft member 2201.

[0240] A head 2702 of the coupling stopper 2270 may interfere with the power transmission groove 2228 of the driven coupling 2220 and prevent the driven coupling 2220 from being separated to a right side. A coupling portion 2274 of the coupling stopper 2270 may be inserted into and fastened to a fastening groove 2207 of the through portion 2206.

[0241] The driving coupling 2320 may be inserted into the power transmission groove 2228 and may be coupled to the power transmission groove 2228 to transmit rotational force. The power transmission groove 2228 may have any of various shapes or forms. In the present embodiment, the power transmission groove 2228 may have a hexagonal groove when viewed from a lateral side.

[0242] A diameter of the power transmission groove 2228 may be larger than a diameter of the second guide groove 2226. The power transmission groove 2228 and the second guide groove 2226 may communicate with each other. The first guide groove 2224 may be disposed at one side of the second guide groove 2226 to be communicated with the second guide groove 2226 and the power transmission groove 2228 may be disposed at the other side of the second guide groove 2226 to be communicated with the second guide groove 2226.

[0243] The power transmission groove 2228 may be open toward the other side, and the first guide groove 2224 may be open toward one side.

[0244] When the driven coupling 2220 is coupled to the upper lever body 2522, the power transmission groove 2228 may be positioned at the other side of the upper lever body 2522 and the first guide groove 2224 may be positioned at one side of the upper lever body 2522.

[0245] The second lever 2520 may form a mutually-engaged structure with the driven coupling 2220 with respect to a direction perpendicular to the shaft member 2201. In addition, the lever engaging portion 2526 of the second lever 2520 may form a mutually-engaged structure with the base 32.

[0246] When the driving coupling 2320 and the driven coupling 2220 are mutually coupled, the driven coupler 2220 may protrude to an outside of the dust housing

2100. Specifically, the driven coupling 2220 may penetrate the opening surface 2185 of the second side cover 2180 and may protrude to an outside than the second side cover 218.

[0247] By the operation of the second lever 2520, the driven coupling 2220 may be moved to the same position with the opening surface 2185 or to an inside than the opening surface 2185. When the driven coupling 2220 is moved to the same portion with the opening surface 2185 or to the inside than the opening surface 2185, the driven coupling 2220 can be prevented from being interfered with the base 32 and the dust housing 2100 can be easily separated.

[0248] Therefore, a moving distance of the second lever 2520 may be greater than a thickness of the driven coupler 2220 and the driving coupling 2320 in a coupled state.

[0249] When the second lever 2520 is pressed toward the agitator 2200, the second lever 2520 moves toward the agitator 2200. Thus, the mutually-engaged structure of the lever engaging portion 2526 and the base 32 is released and the dust housing 2100 is in a state being able to be separated from the base 32.

[0250] In addition, when the second lever 2520 is pressed toward the agitator 2200, the coupling elastic member 2230 may be compressed and the driven coupling 2220 may move toward the agitator 2200.

[0251] When the driven coupling 2220 moves toward the agitator 2200 by the second lever 2520, the driven coupling 2220 and the driving unit 2300 are physically separated and the dust housing 2100 is in a state being able to be separated from the base 32.

[0252] Since the sweep module 2000 according to the present embodiment has a structure in which the agitator 2200 is installed on the inside of the sweep module 2000, the dust housing 2100 should be physically separated from the driving unit 2300 when the dust housing 2100 is separated from the base 32.

[0253] The movement of the second lever 2520 not only releases the coupling of the dust housing 2100 and the base 32 but also releases the coupling of the driven coupling 2220 and the driving unit 2300 at the same time.

[0254] In this instance, since the second lever 2520 is hidden or shield inside the dust housing 2100 and only the operation unit 2529 is exposed to the outside, a coupling structure of the driven coupling 2220 is not exposed to the outside. In particular, since the second side cover 2180 shields or blocks most of the second lever 2520, damage to the second lever 2520 due to external impact can be minimized.

[0255] Even if the second lever 2520 is repeatedly used, the second lever 2520 moves only at an inside of the dust housing 2100 and thus separation or damage of the second lever 2520 can be minimized.

[0256] In addition, since the side covers 2170 and 2180 shield or cover the levers 2510 and 2520 inside the dust housing 2100, an intrusion of an external foreign material or the like to portions where the levers 2510 and 2520 can be minimized. Accordingly, reliability according to the operation can be ensured.

[0257] Then, when the operation force applied to the second lever 2520 is removed, the driven coupling 2220 moves toward the other side by elastic force of the coupling elastic member 2230.

[0258] In this instance, since the shaft member 2201 penetrates through the driven coupling 2220 and the coupling stopper 2270 is coupled to the shaft member 2201, the driven coupling 2220 can be prevented from being separated from the shaft member 2201. That is, the driven coupling 2220 may move along an axis direction of the shaft member 2201, but may be prevented from being separated from the shaft member 2201 by the coupling stopper 2270.

[0259] The driving unit 2300 may include a drive housing 2310, a sweep motor 2330, a power transmission assembly 2340, and a driving coupling 2320. The drive housing 2310 may be assembled with the body 30. The sweep motor 2330 may be assembled with a drive housing 2310. The power transmission assembly 2340 may be disposed at an inside of the drive housing 2310 and be assembled with the sweep motor 2330 to receive rotational force. The driving coupling 2320 may be coupled to the power transmission assembly 2340 and be selectively engaged with the driven coupling 2220.

[0260] Since the agitator 2200 is disposed inside the sweep module 2000 and the sweep motor 2330 is disposed inside the body 30, the driving coupling 2320 and the driven coupling 2220 transmitting the rotational force to the agitator 2200 may have selectively-detachable structure. If the driving coupling 2320 and the driven coupling 2220 are not detachable, the dust housing 2100 cannot be separated from the body 30.

[0261] The drive housing 2310 may be fixed to the body 30. The drive housing 2310 is fixed to the base 32 in the present embodiment. The drive housing 2310 is a structure for installing the power transmission assembly 2340 and the sweep motor 2330.

[0262] The drive housing 2310 may have any of various shapes of forms. In the present embodiment, the drive housing 2310 shields or covers the power transmission assembly 2340 therein, and exposes only the sweep motor 2330 and the driving coupling 2320 to the outside.

[0263] The drive housing 2310 may include a first drive housing 2312 and a second drive housing 2314, a coupling-installed portion 2315, and a hole 2316. The first drive housing 2312 and the second drive housing 2314 may form an outer shape. The coupling-installed portion 2315 may be disposed at one of the first drive housing 2312 and the second drive housing 2314, and the driving coupling 2320 may be disposed at the coupling-installed portion 2315. The hole 2316 may be disposed at one of the first drive housing 2312 and the second drive housing 2314, and a motor shaft of the sweep motor 2330 may penetrate the hole 2316.

[0264] The power transmission assembly 2340 may

be disposed between the first drive housing 2312 and the second drive housing 2314.

[0265] In the present embodiment, the first drive housing 2312 is disposed at one side (toward the agitator 2200), and the second drive housing 2314 is disposed at the other side (at an outside).

[0266] In the present embodiment, the coupling-installed portion 2315 is disposed at the first drive housing 2312. The driving coupling 2320 is disposed at the coupling-installed portion 2315 and is connected to the power transmission assembly 2340. The driving coupling 2320 may rotate in a state that the driving coupling is installed on the coupling installation unit 2315.

[0267] The driving coupling 2320 has a shape corresponding to a shape of the power transmission groove 2228 of the driven coupling 2220. In the present embodiment, the driving coupling 2320 has a hexagonal shape when viewed from a lateral side. The driving coupling 2320 may be selectively engaged with the driven coupling 2220 through the opening surface 2185 of the second side cover 2180.

[0268] The driving coupling 2320 may protrude toward the second side cover 2180 than one side (a left side) of the first drive housing 2312 in a state that the driving coupling 2320 is assembled to the drive housing 2310.

[0269] A rotation center of the driving coupling 2320 is disposed at the left-right direction and may match the rotation center of the agitator 2200.

[0270] In the present embodiment, the first drive housing 2312 may have a space formed therein, and the power transmission assembly 2340 may be rotatably installed in the space. The second drive housing 2314 may have a shape or a form of a cover covering the first drive housing 2312.

[0271] The drive housing 2310 may further include a first fastening portion 2317 and a second fastening portion 2318. The first fastening portion 2317 and the second fastening portion 2318 may be disposed at the first drive housing 2312. The first fastening portion 2317 and the second fastening portion 2318 may be formed so that a fastening member is installed on the first fastening portion 2317 or the second fastening portion 2318 in an up-down direction.

[0272] A motor axis of the sweep motor 2330 may be disposed in the left-right direction. The sweep motor 2330 may be disposed at one side or the other side of the drive housing 2310.

[0273] The sweep motor 2330 may be disposed toward an inside of the body 30 based on or with respect to the drive housing 2310. A volume of the body 30 may be minimized by arranging the sweep motor 2330 at a side of the agitator 2200.

[0274] In the present embodiment, a motor axis direction Mx of the sweep motor 2330 and a rotation axis Ax of the agitator 2200 may be parallel. In the present embodiment, a rotation center of the agitator 2200, a rotation center of the shaft member 2201, a center of the driven coupling 2220, and a center of the driving coupling 2320 are located on a line of the rotation axis Ax of the agitator 2200.

[0275] In the present embodiment, the sweep motor 2330 is positioned at an upper side than the dust housing 2100. The sweep motor 2330 is positioned at a rear side than the dust housing 2100. The sweep motor 2330 is positioned at an upper side than the installation space 325 and the storage housing 326 of the base 32.

[0276] The power transmission assembly 2340 may include a plurality of gears. A number and a shape of gears included in the power transmission assembly 2340 may be various depending on a number of revolutions and transmitted torque.

[0277] FIG. 19 is a plan view of the cleaner of FIG. 1 in a state that a case is removed. FIG. 20 is a bottom view of the cleaner shown in FIG. 19. FIG. 21 is a right cross-sectional view of the cleaner shown in FIG. 19.

[0278] Referring to FIG. 19 to FIG. 21, the sweep module 2000 may further include a housing elastic member 327 that provides elastic force to the dust housing 2100. The housing elastic member 327 may be disposed at the installation space 325.

[0279] The housing elastic member 327 may be disposed at the base 32, and more particularly, may be installed on the storage housing 326. In the present embodiment, the housing elastic member 327 may be a plate spring. In order to install the housing elastic member 327 of the plate spring, an installation structure for fitted-fixing may be disposed at the storage housing 326.

[0280] The housing elastic member 327 may elastically support an upper surface of the dust housing 2100.

[0281] The storage housing 326 is provided with an elastic-member storage portion 328 that protrudes to an upper side to have a convex shape at the installation space 325. An elastic-member storage space 328b in which the housing elastic member 327 is accommodated may be formed at a lower side of the elastic-member storage portion 328.

[0282] The elastic member storage portion 328 may further include an elastic-member opening surface 328a opened in an up-down direction. The elastic-member opening surface 328a may communicate with the elastic-member storage space 328b and the installation space 325.

[0283] In addition, an elastic-member support portion 329, which is disposed at a lower side of the elastic-member storage space 328b and is connected to the storage housing 326, may be further disposed.

[0284] The elastic-member support portion 329 may be positioned at a lower side than the elastic-member storage portion 328.

[0285] The housing elastic member 327 may be inserted between the elastic-member storage portion 328 and the elastic-member support portion 329. The housing elastic member 327 may be exposed to an upper side of the storage housing 326 through the elastic-member opening surface 328a.

[0286] The housing elastic members 327 may be po-

sitioned at both sides of the elastic-member support portion 329, respectively.

[0287] The elastic member storage portion 328 may longitudinally extend in the left-right direction, and the elastic-member support portion 329 may be disposed in the left-right direction.

[0288] The housing elastic member 327 may include a first elastic portion 327a, a second elastic portion 327b, and a third elastic portion 327c. The first elastic portion 327a may be positioned at an upper side of the elastic-member support portion 329. The second elastic portion 327b may extend to one side (a left side in the present embodiment) from the first elastic portion 327a and be disposed in the elastic-member storage space 328b. The third elastic portion 327c may extend to the other side (a right side in the present embodiment) from the first elastic portion 327a and be disposed in the elastic-member storage space 328b.

[0289] Each of the second elastic portion 327b and the third elastic portion 327c may be bent from the first elastic portion 327a.

[0290] The second elastic portion 327b and the third elastic portion 327c may be positioned at a lower side of the elastic-member storage portion 328. The second elastic portion 327b may be disposed to be inclined toward a left down side, and the third elastic portion 327c may be disposed to be inclined toward a right down side.

[0291] When the dust housing 2100 is inserted into the installation space 325, the second elastic portion 327b and the third elastic portion 327c may elastically support an upper surface of the dust housing 2100.

[0292] When the mutually-engaged structure of the dust housing 2100 and the base 32 is released by the first lever 2510 and the second lever 2520, the second elastic portion 327b and the third elastic portion 327c push the dust housing 2100 to a lower side and moves the dust housing 2100 to an outside of the storage housing 326.

[0293] By the elastic force of the housing elastic member 327, a user can easily separate the dust housing 2100 from the installation space 325.

[0294] Since the elastic-member support portion 329 supports the housing elastic member 327, the housing elastic member 327 can be prevented from being separated to the installation space 325. Even if the dust housing 2100 is repeatedly mounted and separated, the housing elastic member 327 is firmly supported by the elastic-member support portion 329.

[0295] FIG. 22 is an exploded perspective view of the wheel assembly shown in FIG. 5. FIG. 23 is a partially enlarged view of the wheel assembly shown in FIG. 22. FIG. 24 is an exploded perspective view of the wheel assembly viewed from a lower side of FIG. 22. FIG. 25 is a partially enlarged view of the wheel assembly shown in FIG. 24. FIG. 26 is an exploded perspective view of a first wheel assembly shown in FIG. 24 viewed from another direction.

[0296] Referring to FIG. 22 to FIG. 26, the sweep module 2000 according to the present embodiment further includes a wheel assembly 2600. The wheel assembly 2600 supports a load of the body 30 and reduces friction when the cleaner is driving or travelling.

[0297] The wheel assembly 2600 according to the present embodiment is assembled to the dust housing 2100 and is movable in a vertical direction or an up-down direction while being assembled to the dust housing 2100. Through the vertical movement of the wheel assembly 2600, a cliff where the cleaner cannot move is recognized.

[0298] Since the body 30 according to the present embodiment is supported by a pair of spin mops 41, the body 30 does not tilt forward even if the wheel assembly 2600 does not support the body 30.

[0299] The wheel assembly 2600 detects a cliff at a front side in a traveling or driving direction of the cleaner. The wheel assembly 2600 detect a cliff, and also, supports a front side of the body 30 during normal driving and reduces friction with the floor.

[0300] The wheel assembly 2600 may include a first wheel assembly 2610 disposed at one side (a left side) of the dust housing 2100 and a second wheel assembly 2020 disposed at the other side (a right side) of the dust housing 2100.

[0301] The first wheel assembly 2610 and the second wheel assembly 2620 are bisymmetrical or lateral-symmetrical to each other. Since structures or so on of the first wheel assembly 2610 and the second wheel assembly 2620 are the same, the first wheel assembly 2610 will be described as an example.

[0302] When it is necessary to distinguish elements or components of the first wheel assembly 2610 and the second wheel assembly 2620, an element or a component of the first wheel assembly 2610 is referred to as a "first" element or a "first" component, and an element or a component of the second wheel assembly 2620 is referred to as a "second" element or a "second" component.

[0303] The first wheel assembly is disposed at a left side in a traveling direction of the cleaner, and the second wheel assembly is disposed at a right side in the traveling direction of the cleaner. The first wheel assembly 2610 may be disposed at a left side of the storage space 2104, and the second wheel assembly 2620 may be disposed at a right side of the storage space 2014.

[0304] The wheel assembly 2600 may include a wheel body 2630, a wheel 2640, a wheel elastic member 2650, and a cliff sensor 2660. The wheel body 2630 may be assembled to the dust housing 2100 to be movable in a vertical direction or an up-down direction. The wheel 2640 may be assembled to a lower side of the wheel body 2630 and be in contact with a floor to support the wheel body 2630. The wheel elastic member 2650 may be disposed between the dust housing 2100 and the wheel body 2630 and provide elastic force to the wheel body 2630 toward a lower side or downward. The cliff sensor 2660 may detect a movement of the wheel body 2630 when the wheel body 2630 is moved toward the

lower side or downward.

[0305] The wheel body 2630 may be installed on the dust housing 2100 to be movable in a vertical direction or an up-down direction with respect to the dust housing 2100. When the cleaner is driving or travelling, the wheel body 2630 is in close contact with an upper side and keeps in contact with the cliff sensor 2660.

[0306] When the wheel body 2630 is moved downward, the cliff sensor 2660 and the wheel body 2630 are separated from each other, and the cliff sensor 2660 detects the separation of the cliff sensor 2660 and the wheel body 2630. When the wheel 2640 is positioned on a space having a depth larger than a vertical movement distance of the wheel body 2630, the wheel body 2630 and the cliff sensor 2660 are separated from each other.

[0307] In this embodiment, a controller of the cleaner detects the separation of the wheel body 2630 and the cliff sensor 2660 and determines a cliff through the detection of the separation.

[0308] In the present embodiment, the wheel body 2630 may be disposed at an outer side portion of the storage space 2104. The wheel body 2630 may be disposed at a front side of the collection space 2012. The wheel body 2630 may be positioned at a front side of the agitator 2200. The wheel body 2630 may be positioned at a rear side of the dust cover 2150.

[0309] Two wheel bodies 2630 may be disposed at a left side and at a right side, and a separation distance of the two wheel bodies 2630 may be smaller than a width of the agitator 2200 in a left-right direction.

[0310] Specifically, the first wheel assembly 2610 may be disposed between the left cover portion 2155 and the first side cover 2170. The second wheel assembly 2620 may be disposed between the right cover portion 2156 and the second side cover 2180.

[0311] The wheel assembly may be disposed between the case 31 and the dust housing 2100. Specifically, a wheel body may be disposed between an inside of the case 31 and an outside of the dust housing 2100.

[0312] A first wheel body 2631 and the left cover portion 2155 may preferably form a continuous flat or curved surface. A second wheel body 2632 and the right cover portion 2156 may preferably form a continuous flat or curved surface.

[0313] When viewed in a top view, since the body 30 has a shape close to a circular shape, the wheel body 2630 may be preferably disposed within a diameter based on a center of the body 30. The wheel body 2630 may be positioned at an inside of the case 31.

[0314] The wheel body 2630 may include an upper wheel body 2635, a side wheel body 2634, and a lower wheel body 2633.

[0315] The upper wheel body 2635 is movable in a vertical direction with respect to an upper surface of the dust housing 2100. When the upper wheel body 2635 is moved downward, the upper wheel body 2635 is in close contact with an upper surface of the dust housing 2100 and is supported by the dust housing 2100. Accordingly, a movement of the upper wheel body 2635 downward is limited.

[0316] The lower wheel body 2633 is movable in a vertical direction with respect to a lower surface of the dust housing 2100. When the wheel assembly 2600 is moved upward, the lower wheel body 2635 is in close contact with the lower surface of the dust housing 2100 and is supported by the dust housing 2100. Accordingly, a movement of the lower wheel body 2633 upward is limited.

[0317] The side wheel body 2634 connects the upper wheel body 2635 and the lower wheel body 2633.

[0318] A contact portion 2636 being in contact with the cliff sensor 2660 is formed at the upper wheel body 2635. The cliff sensor 2660 may include a switch lead (a lead switch, a reed switch, or another contact portion) 2666 protruding downward or to a lower side toward the contact portion 2636.

[0319] A wheel-body installation portion 2030 on which the wheel body 2630 is mounted is formed at an outer surface of the dust housing 2100.

[0320] The wheel-body installation portion 2030 includes an upper installation portion 2035 facing the upper wheel body 2635, a side installation portion 2034 facing the side wheel body 2634, and a lower installation portion 2033 facing the lower wheel body 2633.

[0321] The upper installation portion 2035 may be concave downward or to a lower side from an upper surface 2101a of the dust housing 2100. A detection distance t of the wheel body 2630 may be formed between the upper installation portion 2035 and the upper surface 2101a.

[0322] The lower installation portion 2033 may be concave upward or to an upper side from a lower surface 2101b of the housing assembly 2001. The wheel 2640 is accommodated in the lower installation portion 2033.

[0323] The wheel 2640 may be installed on a lower side of the lower installation portion 2033. A wheel installed space 2641, which is concave from a lower side to an upper side, may be formed at the lower installation portion 2033.

[0324] The wheel 2640 is inserted into the wheel installation space 2641.

[0325] The wheel assembly 2600 may further include a wheel shaft 2670. The wheel shaft 2670 may provide a rotation center of the wheel 2640 and may couple the wheel 2640 and the wheel body 2630 so that the wheel 2640 is rotatable.

[0326] The wheel shaft 2670 may be disposed in a left-right direction and may be inserted into the wheel installed space 2641. In the present embodiment, the wheel shaft 2670 may penetrate the wheel 2640 and may be rotatably installed on the wheel body 2630.

[0327] The wheel elastic member 2650 may be disposed between the dust housing 2100 and the wheel body 2630. Specifically, the wheel elastic member 2650 may be disposed between the lower wheel body 2633 and the lower installation portion 2033.

[0328] The wheel elastic member 2650 presses the lower wheel body 2633 downward. When the wheel 2640 is not supported by the floor, the wheel body 2630 is moved downward by the elastic force of the wheel elastic member 2650. When the wheel body 2630 is moved downward, the upper wheel body 2635 is supported by the upper installation portion 2035 and the movement of the wheel body 2630 is stopped.

[0329] In the present embodiment, a guard is disposed to limit a vertical movement of the wheel body 2630 and to prevent the wheel body 2630 from being separated from the dust housing 2100.

[0330] A plurality of guard grooves 2637, 2638, and 2639 may be disposed at the side wheel body 2634 of the wheel body 2630 in a vertical direction.

[0331] The dust housing 2100 may have a plurality of guards 2037, 2038, and 2039. The plurality of guards 2037, 2038, and 2039 may be disposed at an outside of the guard grooves 2637, 2638 and 2639, and may be inserted into the guard grooves 2637, 2638, 2639.

[0332] Lengths of the guard groove 2637, 2638, and 2639 in a vertical direction and the detection distance t may be the same as each other.

[0333] In the present embodiment, the cliff sensor 2660 may be a micro switch. Unlike the present embodiment, various sensors may be used as the cliff sensor 2660.

[0334] As shown in FIG. 27, when the wheel assembly 2600 is not supported by the floor during operation of the cleaner, the wheel body 2630 is moved downward by the elastic force of the wheel elastic member 2650, and the contact portion 2636 and the switch lead 2666 are separated from each other.

[0335] When the contact portion 2636 and the switch lead 2666 are separated, a controller may detect the separation of the contact portion 2636 and the switch lead 2666 and may stop the driving of the cleaner or move the cleaner in a reverse direction or backward.

[0336] Since the first wheel assembly 2610 is disposed at the left side of the dust housing 2100 and the second wheel assembly 2620 is disposed at the right side of the dust housing 2100, each of the first wheel assembly 2610 and the second wheel assembly 2620 may generate a signal.

[0337] The controller may control a driving or traveling direction of the cleaner through the signal detected by the first wheel assembly 2610 or the second wheel assembly 2620.

[0338] Since the wheel assembly 2600 is supported by a physical contact of the wheel 2640 and the floor, detection using the wheel assembly 2600 is more reliable than detection using ultrasonic waves or infrared rays. For example, when a paper is positioned on a cliff, a sensor using ultrasonic waves or infrared rays does not detect the cliff and the cleaner is driven to the cliff.

[0339] However, in the wheel assembly 2600 as in the present embodiment, the wheel body 2630 is moved downward when the wheel 2640 enters the cliff, and the cliff sensor 2660 can detect the movement of the wheel body 2630. According to the present embodiment, a weight center (a center of gravity) of the cleaner is positioned at a rear side, the cleaner can sufficiently move in a reverse direction or backward even if when the wheel 2640 detects a cliff and is floating in the air.

[0340] FIG. 28 is an exemplary operation view of a wheel assembly according to a second embodiment of the present disclosure.

[0341] In the present embodiment, a photo sensor is used for a cliff sensor 2670 of a wheel assembly 2600'.

[0342] The photo sensor may be provided with a light emitting portion 2671 and a light receiving portion 2672, and the wheel body 2630' may be provided with a detecting portion 2636'. The detecting portion 2636' may be disposed at a position of the contact portion 2636 in the first embodiment, and the detecting portion 2636' may protrudes upward or to an upper side. The detecting portion 2636' may be disposed between the light emitting portion and the light receiving portion.

[0343] When the wheel 2640 is not supported by the floor, the detecting portion 2636' is moved downward, and the light receiving portion 2672 receives a signal transmitted from the light emitting portion 2671 and thus a cliff is detected.

[0344] The other portions are the same as in the first embodiment, and thus, a detailed description thereof will be omitted.

[0345] FIG. 29 is an exemplary operation view of a wheel assembly according to a third embodiment of the present disclosure.

[0346] In the present embodiment, a hall sensor is used for a cliff sensor 2680 of a wheel assembly 2600". A permanent magnet having magnetic force may be disposed at a position of the contact portion 2636 of the first embodiment.

[0347] When a wheel 2640 is supported by a floor, the hall sensor 2780 detects the permanent magnet. When the wheel 2640 is not supported by the floor, the contact portion 2636 is moved downward, the permanent magnet is moved downward and is spaced from the hall sensor 2780 according to the downward movement of the contact portion 2636, and thus, the hall sensor 2780 does not detect the permanent magnet.

[0348] When the hall sensor 2780 does not detect the permanent magnet, a controller determines that the wheel 2640 is float in the air.

[0349] The other portions are the same as in the first embodiment, and thus, a detailed description thereof will be omitted.

[0350] When bottoms of the pair of spin mops 41a and 41b provided to be symmetrical to each other with respect to the central longitudinal line Po are parallel to a horizontal plane, a robot cleaner may not stably drive and a driving control may be difficult. Therefore, according to the present disclosure, each spin mop 41 is inclined downward toward an outside front side. Hereinafter, an inclination and a motion of a spin mop 41 will be described.

[0351] The central longitudinal line Po means a line parallel to a front-rear direction and passing through a geometric center Tc of a body. The central longitudinal line Po may be defined as a line passing through the geometric center Tc of the body while being perpendicular to an imaginary line connecting a central axis of the left spin mop and a central axis of the right spin mop.

[0352] Referring to FIG. 30, a point where the spin rotation axis Osa of the left spin mop 41a and a lower surface of the left spin mop 41a cross is shown, and a point where the spin rotation axis Osb of the right spin mop 41b and a lower surface of the right spin mop 41b intersect is shown. When viewed from a lower side, among rotational directions of the left spin mop 41a, a clockwise direction is defined as a first normal direction w1f and a counterclockwise direction is defined as a first reverse direction wlr. When viewed from a lower side, among rotational directions of the right spin mop 41b, a clockwise direction is defined as a second normal direction w2f and a counterclockwise direction is defined as a second reverse direction w2r. In addition, when viewed from a lower side, 'an acute angle between an inclined direction of a lower surface of the left spin mop 41a and a left-right direction axis' and 'an acute angle between an inclined direction of a lower surface of the right spin mop 41a and a left-right direction axis' are defined as inclination-direction angles Agla and Aglb, respectively. The inclination-direction angle Agla of the left spin mop 41a and the inclination-direction angle Aglb of the right spin mop 41b may be the same. Further, referring to FIG. 6, 'an angle between a lower surface I of the left spin mop 41a and an imaginary horizontal surface H' and 'an angle between a lower surface I of the right spin mop 41b and an imaginary horizontal surface H' are defined as inclination angles Ag2a and Ag2b.

[0353] A right end of the left spin mop 41a and a left end of the right spin mop 41b may be in contact with each other or adjacent or close to each other. Therefore, an area where mopping or wiping is not performed between the left spin mop 41a and the right spin mop 41b can be reduced.

[0354] When the left spin mop 41a rotates, a point Pla that receives the greatest friction force from a floor or a ground at a lower surface of the left spin mop 41a may be positioned at a left side of a rotation center Osa of the left spin mop 41a. Among the lower surface of the left spin mop 41a, a greater load may be transmitted to the floor or the ground at the point Pla than the other point. Thus, the greatest friction force may be generated at the point Pla. In the present embodiment, the point Pla is disposed at a left front side of the rotation center Osa. In another embodiment, the point Pla may be disposed at an exact left side or at a left rear side based on the rotation center Osa.

[0355] When the right spin mop 41b rotates, a point Plb that receives the greatest friction force from a floor or a ground at a lower surface of the right spin mop 41b may be positioned at a right side of a rotation center Osb of the right spin mop 41b. Among the lower surface of the right spin mop 41b, a greater load may be transmitted to the floor or the ground at the point Plb than the other point. Thus, the greatest friction force may be generated at the point Plb. In the present embodiment, the point Plb is disposed at a right front side of the rotation center Osb. In another embodiment, the point Pla may be disposed at an exact right side or at a right rear side based on the rotation center Osb.

[0356] The lower surface of the left spin mop 41a and the lower surface of the right spin mop 41b may be inclined, respectively. The inclination angle Ag2a of the left spin mop 41a and the inclination angle Ag2b of the right spin mop 41b may be an acute angle. The inclination angles Ag2a and Ag2b may be small so that points having the greatest friction force are positioned at the points Pla and Plb and entire portions of lower surfaces of the mop portions 411 are in contact with or touch the floor according to rotational motion of the left spin mop 41a and the right spin mop 41b.

[0357] The lower surface of the left spin mop 41a forms a downward slope as a whole in a left direction. The lower surface of the right spin mop 41b forms a downward slope as a whole in a right direction. Referring to FIG. 6, the lowest point Pla at the lower surface of the left spin mop 41a is positioned at a left side portion. The highest point Pha at the lower surface of the left spin mop 41a is positioned at a right side portion. The lowest point Plb at the lower surface of the right spin mop 41b is positioned at a right side portion. The highest point Phb at the lower surface of the right spin mop 41b is positioned at a right side portion.

[0358] According to the embodiment, an inclination-direction angles Agla and Aglb may be 0 degrees. Further, according to the embodiment, when viewed from a lower side, a lower surface of the left spin mop 41a may be inclined to have an inclined-direction angle Agla in a clockwise direction with respect to a left-right direction axis, and a lower surface of the right spin mop 41b may be inclined to have an inclined-direction angle Aglb in a counterclockwise direction with respect to the left-right direction axis. In the present embodiment, when viewed from a lower side, a lower surface of the left spin mop 41a is inclined to have an inclined-direction angle Agla in a counterclockwise direction with respect to the left-right direction axis, and a lower surface of the right spin mop 41b is inclined to have an inclined-direction angle Aglb in a clockwise direction with respect to the left-right direction axis.

[0359] The movement of the cleaner 1 is achieved by friction force with the floor or the ground generated by the mop module 40.

[0360] The mop module 40 may generate 'a forward-moving friction force' for moving the body 30 in a front direction, or 'a rearward-moving friction force' for moving the body 30 in a rear direction. The mop module 40 may generate 'a left-moment friction force' to rotate or turn the body 30 left, or 'a right-moment friction force' to rotate

or turn the body 30 right. The mop module 40 may generate friction force in which any one of the forward-moving friction force and the rearward-moving friction force is combined with any one of the left moment friction force and the right moment friction force.

[0361] In order for the mop module 40 to generate the forward-moving friction force, the left spin mop 41a may rotate at a predetermined rpm R1 in the first normal direction w1f and the right spin mop 41b may rotate at the predetermined rpm R1 in the second normal direction w2f.

[0362] In order for the mop module 40 to generate the rearward-moving friction force, the left spin mop 41a may rotate at a predetermined rpm R2 in the first reverse direction w1r and the right spin mop 41b may rotate at the predetermined rpm R2 in the second reverse direction w2r.

[0363] In order for the mop module 40 to generate the right-moment friction force, the left spin mop 41a may rotate at a predetermined rpm R3 in the first normal direction wlf, and the right spin mop 41b may rotate in the second reverse direction w2r, may stop without rotation, or may rotate at a rpm R4 smaller the rpm R3 in the second normal direction w2f.

[0364] In order for the mop module 40 to generate the left-moment friction force, the right spin mop 41b may rotate at a predetermined rpm R5 in the second normal direction w2f, and the left spin mop 40b may rotate in the first reverse direction wlr, may stop without rotation, or may rotate at a rpm R6 smaller the rpm R5 in the second normal direction w1f.

[0365] Hereinafter, an arrangement of components or elements for improving friction force of the spin mops 41 arranged at a left side and a right side, improving stability in a left-right direction and a front-rear direction, and achieving stable driving regardless of a water level in a water tank 81.

[0366] Referring to FIGS. 30 and 31, so as to increase the friction force by a spin mop 41 and limit occurrence of eccentricity in one direction when the mobile robot rotates, a mop motor 61 and a battery Bt that are relatively heavy may be disposed on an upper portion of a spin mop 41.

[0367] Specifically, a left-mop motor 61a may be disposed on a left spin mop 41a (at an upper side of the left spin mop 41a), and a right-mop motor 61b may be disposed on a right spin mop 41b (at an upper side of the right spin mop 41b). That is, at least a part of the left-mop motor 61a may be vertically overlapped with the left spin mop 41a. Preferably, an entire portion of the left-mop motor 61a may be vertically overlapped with the left spin mop 41a. At least a part of the right-mop motor 61b may be vertically overlapped with the right spin mop 41b. Preferably, an entire portion of the right-mop motor 61b may be vertically overlapped with the right spin mop 41b.

[0368] More specifically, the left-mop motor 61a and the right-mop motor 61b may be vertically overlapped with an imaginary central horizontal line HL connecting a spin rotation axis Osa of the left spin mop 41a and a spin rotation axis Osb of the right spin mop 41b. Preferably, a weight center (a center of gravity) MCa of the left-mop motor 61a and a weight center (a center of gravity) MCb of the right-mop motor 61b may be vertically overlapped with the imaginary central horizontal line HL connecting the spin rotation axis Osa of the left spin mop 41a and the spin rotation axis Osb of the right spin mop 41b. Alternatively, a geometric center of the left-mop motor 61a and a geometric center of the right-mop motor 61b may be vertically overlapped with the imaginary central horizontal line HL connecting the spin rotation axis Osa of the left spin mop 41a and the spin rotation axis Osb of the right spin mop 41b. The left-mop motor 61a and the right-mop motor 61b may be symmetrical with respect to a central longitudinal line Po.

[0369] Since the weight center MCa of the left-mop motor 61a and the weight center MCb of the right-mop motor 61b do not deviate from the spin mop 41, and the left-mop motor 61a and the right-mop motor 61b are symmetrical to each other. Accordingly, the friction force of the spin mop 41 can be enhanced and running performance and a left-right balance can be maintained.

[0370] Hereinafter, the spin rotation axis Osa of the left spin mop 41a is referred to as a left spin rotation axis Osa, and the spin rotation axis Osb of the right spin mop 41b is referred to as a right spin rotation axis Osb..

[0371] The water tank 81 is disposed at a rear side than the central horizontal line HL, and an amount of water in the water tank 81 is variable. In order to maintain a stable front-rear balance regardless of a water level of the water tank 81, the left-mop motor 61a may be deviated to a left side from the left spin rotation axis Osa. The left-mop motor 61a may be deviated to a left front side from the left spin rotation axis Osa. Preferably, the geometric center of the left-mop motor 61a or the weight center MCa of the left-mop motor 61a may be deviated to the left side from the left spin rotation axis Osa, or the geometric center of the left-mop motor 61a or the weight center MCa of the left-mop motor 61a may be deviated to the left front side from the left spin rotation axis Osa.

[0372] The right-mop motor 61b may be deviated to a right direction from the right spin rotation axis Osb. The right-mop motor 61b may be deviated to a right front side from the right spin rotation axis Osb. Preferably, the geometric center of the right-mop motor 61b or the weight center MCb of the right-mop motor 61b may be deviated to the right side from the right spin rotation axis Osb, or the geometric center of the right-mop motor 61b or the weight center MCb of the right-mop motor 61b may be deviated to the right front side from the right spin rotation axis Osb.

[0373] Since the left-mop motor 61a and the right-mop motor 61b apply pressure at a position deviated from an outer front side from a center of each spin mop 41, pressure is concentrated on the outer front side of each spin mop 41. Therefore, running performance can be improved by the rotational force of the spin mop 41.

[0374] The left spin rotation axis Osa and the right spin rotation axis Osb are disposed at a rear side than the center of the body 30. The central horizontal line HL may be disposed at a rear side of the geometric center Tc of the body 30 and a weight center (a center of gravity) WC of the mobile robot. The left spin rotation axis Osa and the right spin rotation axis Osb are spaced apart at the same distance from the central longitudinal line Po.

[0375] A left driving joint 65a may be disposed on the left spin mop 41a (at an upper side of the left spin mop 41a), and a right driving joint 65a may be disposed on the right spin mop 41b (at an upper side of the right spin mop 41b).

[0376] In the present embodiment, one battery Bt may be installed. At least a part of the battery Bt may be disposed on the left spin mop 41a and the right spin mop 41b (at upper sides of the left spin mop 41a and the right spin mop 41b). The battery Bt that is relative heavy is disposed on the spin mop 41 (at the supper side of the spin mop 41) to improve friction force by the spin mop 41 and reduce eccentricity caused by the rotation of the mobile robot.

[0377] Specifically, a part of a left portion of the battery Bt may be vertically overlapped with the left spin mop 41a, and a part of a right portion of the battery Bt may be vertically overlapped with the right spin mop 41b. The battery Bt may be vertically overlapped with the central horizontal line HL and may be vertically overlapped with the central longitudinal line Po.

[0378] More specifically, a weight center (a center of gravity) BC of the battery Bt or a geometric center of the battery Bt may be disposed at the central longitudinal line Po and may be disposed at the central horizontal line HL. The weight center BC of the battery Bt or the geometric center of the battery Bt may be disposed at the central longitudinal line Po, may be disposed at a front side of the central horizontal line HL, and may be disposed at a rear side of the geometric center Tc of the body 30.

[0379] The weight center of the battery Bt or the geometric center of the battery Bt may be disposed at a front side than the water tank 81 or a weight center PC of the water tank 81. The weight center BC of the battery Bt or the geometric center Tc of the battery Bt may be disposed at a rear side than a weight center (a center of gravity) SC of the sweep module 2000.

[0380] One battery Bt is disposed at a middle portion between the left spin mop 41a and the right spin mop 41b and is disposed at the central horizontal line HL and the central longitudinal line Po. The battery Bt that is heavy holds centers during rotation of the spin mops 41 and provides weight on the spin mop 41, thereby improving friction force by the spin mop 41.

[0381] A height of the battery Bt (a height of a lower end of the battery Bt) may be the same as heights of the left-mop motor 61a and the right-mop motor 61b (heights of lower ends of the left-mop motor 61a and the right-mop motor 61b). Alternatively, the battery Bt may be disposed on the same plane as the left-mop motor 61a and the right-mop motor 61b. The battery Bt may be disposed between the left-mop motor 61a and the right-mop motor 61b. The battery Bt may be disposed at an empty space between the left-mop motor 61a and the right-mop motor 61b.

[0382] At least a part of the water tank 81 may be disposed on the left spin mop 41a and the right spin mop 41b (at upper sides of the left spin mob 41a and the right spin mop 41b). The water tank 81 may be disposed at a rear side than the central horizontal line HL and may be vertically overlapped with the central longitudinal line Po.

[0383] More specifically, a weight center (a center of gravity) PC of the water tank 81 or a geometric center of the water tank 81 may be disposed at the central longitudinal line Po and may be positioned at a front side than the central horizontal line HL. As another example, the weight center PC of the water tank 81 or the geometric center of the water tank 81 may be disposed at the central longitudinal line Po and may be positioned at a rear side than the central horizontal line HL. In this instance, the phrase that the weight center PC of the water tank 81 or the geometric center of the water tank 81 is disposed at the rear side than the central horizontal line HL may mean that weight center PC of the water tank 81 or the geometric center of the water tank 81 is vertically overlapped with a region deviated rearward from the central horizontal line HL. The weight center PC of the water tank 81 or the geometric center of the water tank 81 may be vertically overlapped with the body 30 without going beyond the body 30.

[0384] The weight center PC of the water tank 81 or the geometric center of the water tank 81 may be disposed at a rear side than the weight center BC of the battery Bt. The weight center of the water tank 81 PC or the geometric center of the water tank 81 may be disposed at a rear side than the weight center SC of the sweep module 2000.

[0385] A height of the water tank 81 (a height of a lower end of the water tank 81) may be the same as heights of the left-mop motor 61a and the right-mop motor 61b (heights of lower ends of the left-mop motor 61a and the right-mop motor 61b). Alternatively, the water tank 81 may be disposed on the same plane as the left-mop motor 61a and the right-mop motor 61b. The water tank 81 may be disposed at an empty space between the left-mop motor 61a and the right-mop motor 61b.

[0386] The sweep module 2000 may be disposed at a front side than the spin mops 41, the battery Bt, the water tank 81, the mop driving unit 60, the right-mop motor 61b, and the left-mop motor 61a at the body.

[0387] The weight center SC of the sweep module 2000 or a geometric center of the sweep module 2000 may be disposed at the central longitudinal line Po and may be disposed at a front side than the geometric center Tc of the body 30. When viewed from an upper side, the body 30 may have a circular shape and the base 32 may have a circular shape. The geometrical center Tc of the body 30 may means a center of the body 30 when the

body 30 has the circular shape. Specifically, when viewed from an upper side, the body 30 may have a circular shape with a half-diameter error of less than 3%.

[0388] Specifically, the weight center SC of the sweep module 2000 or the geometric center of the sweep module 2000 may be disposed at the central longitudinal line Po, and may be disposed at a front side than the weight center BC of the battery Bt, the weight center PC of the water tank 81, the weight center MCa of the left-mop motor 61a, the weight center MCb of the right-mop motor 61b, and the weight center WC of the mobile robot.

[0389] Preferably, the weight center SC of the sweep module 2000 or the geometric center of the sweep module 2000 may be disposed at a front side than the central horizontal line HL and a front end of the spin mops 41.

[0390] The sweep module 2000 may include a dust housing 2100 having a storage space 2104, an agitator 2200, and a sweep motor 2330 as described above.

[0391] The agitator 2200 may be rotatably installed on the dust housing 2100 and may be disposed at a rear side than the storage space 2104. Therefore, the agitator 2200 may have an appropriate length to cover the left and right spin mops 41a and 41b and not to protrude to an outside of the body.

[0392] A rotation axis of the agitator 2200 may be parallel to the central horizontal line HL, and a center of the agitator 2200 may be positioned at the imaginary central longitudinal line Po. Therefore, a large foreign material flowing into the spin mops 41 can be effectively removed by the agitator 2200. The rotation axis of the agitator 2200 may be disposed at a front side of the geometric center Tc of the body 30. A length of the agitator 2200 may be preferably longer than a distance between the left spin rotation axis Osa and the right spin rotation axis Osb. The rotation axis of the agitator 2200 may be disposed to be adjacent to a front end of the spin mop 41.

[0393] A left caster 58a and a right caster 58b being in contact with the floor may be further provided at both ends of the dust housing 2100. The left caster 58a and the right caster 58b are rolled while being in contact with the floor and may move up and down by elastic force. The left caster 58a and the right caster 58b may support the sweep module 2000 and a part of the body. The left caster 58a and the right caster 58b may protrude from a lower end of the dust housing 2100 to a lower side.

[0394] In this instance, the left caster 58a and the right caster 58b may broadly mean the first wheel assembly 2610 and the second wheel assembly 2620 of FIG. 1 to FIG. 29, and narrowly mean the left and right wheels 2640.

[0395] The left caster 58a and the right caster 58b are disposed at a line parallel to the central horizontal line HL, and may be disposed at a front side than the central horizontal line HL and the agitator 2200. An imaginary line connecting the left caster 58a and the right caster 58b may be disposed at a front side than the central horizontal line HL, the agitator 2200, and the geometric center Tc of the body 30. The left caster 58a and the right caster 58b may be bisymmetrical to each other with respect to the central longitudinal line Po. The left caster 58a and the right caster 58b may be spaced apart at the same distance from the central longitudinal line Po.

[0396] The geometric center Tc of the body 30, the weight center WC of the mobile robot, the weight center SC of the sweep module 2000, and the weight center BC of the battery Bt may be disposed in an imaginary quadrangle formed by sequentially connecting the left caster 58a, the right caster 58b, the right spin rotation axis Osb, and the left spin rotation axis Osa. The battery Bt, which is relatively heavy, the left spin rotation axis Osa, and the right spin rotation axis Osb may be disposed to be adjacent to the central horizontal line HL. Then, a main load of the mobile robot may be applied to the spin mops 41 and a remaining sub-load may be the left caster 58a and the right caster 58b.

[0397] The sweep motor 2330 may disposed at the central longitudinal line Po. When the sweep motor 2330 is disposed at one side based on the central longitudinal line Po, the pump 85 is disposed at the other side based on the central longitudinal line Po (refer to FIG. 19) so that a sum weight center of the sweep motor 2330 and the pump 85 may be disposed on the central longitudinal line Po.

[0398] Therefore, the weight center of the mobile robot at a relatively front side is maintained regardless of the water level of the water tank 81 disposed at a rear side, thereby increasing friction force by the spin mop 41. Also, the weight center WC of the mobile robot is disposed to be adjacent to the geometric center Tc of the body 30 and thus stable driving can be achieved.

[0399] A weight center (a center of gravity) COC of a controller Co or a geometric center of the controller Co may be disposed at a front side than the geometric center Tc of the body 30 and the central horizontal line HL. At least a 50% or more portion of the controller Co may be vertically overlapped with the sweep module 2000.

[0400] The weight center WC of the mobile robot may be disposed at the central longitudinal line Po, may be disposed at a front side than the central horizontal line HL, may be disposed at a front side than the weight center BC of the battery Bt, and may be disposed at a front side than the weight center PC of the water tank 81, may be disposed at a rear side than the weight center SC of the sweep module 2000, and may be disposed at a rear side than the left caster 58a and the right caster 58b.

[0401] By disposing components or elements symmetrically with respect to the central longitudinal line Po or considering weights of the components or elements, the weight center WC of the mobile robot is disposed at the central longitudinal line Po. Accordingly, stability in a left-right direction can be improved.

[0402] FIG. 32 is a bottom view of a mobile robot according to another embodiment of the present disclosure for explaining a relationship between a weight center and other components.

[0403] Referring to FIG. 32, an embodiment will be de-

scribed. A difference compared to the embodiment described with reference to FIG. 30 will be mainly described. A component or an element that is not described with respect to FIG. 32 may be regarded as the same as that of the embodiment described with reference to FIG. 30.

[0404] A weight center WC of a mobile robot and a geometric center Tc of a body 30 may be disposed in an imaginary second quadrangle SQ2 formed by sequentially connecting a left caster 58a, a right caster 58b, a right spin rotation axis Osb, and a left spin rotation axis Osa. A weight center MCa of a left-mop motor, a weight center MCb of a right-mop motor, and a weight center PC of a water tank may be disposed at an outside of the imaginary second quadrangle SQ2.

[0405] Also, a weight center WC of a mobile robot, a geometric center Tc of a body 30, a weight center BC of a battery Bt may be disposed in an imaginary second quadrangle SQ2 formed by sequentially connecting a left caster 58a, a right caster 58b, a right spin rotation axis Osb, and a left spin rotation axis Osa.

[0406] In addition, a weight center WC of a mobile robot, a geometric center Tc of a body 30, and a weight center SC of a sweep module 2000, may be disposed in an imaginary second quadrangle SQ2 formed by sequentially connecting a left caster 58a, a right caster 58b, a right spin rotation axis Osb, and a left spin rotation axis Osa.

[0407] Further, a weight center WC of a mobile robot, a geometric center Tc of a body 30, a weight center SC of a sweep module 2000, and a weight center BC of a battery Bt may be disposed in an imaginary second quadrangle SQ2 formed by sequentially connecting a left caster 58a, a right caster 58b, a right spin rotation axis Osb, and a left spin rotation axis Osa.

[0408] The weight center WC of the mobile robot, the geometric center TC of the body, the weight center SC of the sweep module 2000, and the weight center BC of the battery Bt may be disposed in the second quadrangle SQ2, and the weight center MCa of the left-mop motor and the weight center MCb of the right-mop motor may be disposed at an outside of the second quadrangle SQ2. Then, the mobile robot can apply appropriate friction force to the mop portion while stably travelling.

[0409] The weight center WC of the mobile robot and the geometric center TC of the body may be disposed in the second quadrangle SQ2, and the weight center MCa of the left-mop motor and the weight center MCb of the right-mop motor may be disposed at an outside of the second quadrangle SQ2. Then, the mobile robot can apply appropriate friction force to the mop portion while stably travelling.

[0410] The weight center WC of the mobile robot and the geometric center TC of the body may be disposed in an imaginary first quadrangle SQ1 formed by sequentially connecting the left caster 58a, the right caster 58b, the lowest point at a lower surface of the right spin mop 41b, and the lowest point at a lower surface of the left spin mop 41a. The weight center MCa of the left-mop motor and the weight center MCb of the right-mop motor may be disposed at an outside of the first quadrangle SQ1.

[0411] The wheel body 2630 and the storage space may be disposed at a front side than the center (the geometric center TC) of the body.

[0412] A ratio of an area where the left spin mop 41a or the right spin mop 41b is vertically overlapped with the body 30 may be preferably 85% to 95% of each spin mop. Specifically, an angle A11 between a line L11 connecting a right end of the right spin mop 41b and a vertical line VL parallel to the central longitudinal line Po at the right end of the body may be 0 to 5 degrees.

[0413] A length of a portion of each spin mop 41 exposed to an outside of the body may be preferably 1/7 to 1/2 of a radius of each spin mop 41. The length of the portion of each spin mop 41 exposed to the outside of the body may mean a distance from one end of each spin mop 41 exposed to the outside of the body to an end of the body in a radial axis.

[0414] A distance between a geometric center TC and one end of the portion of each spin mop 41 exposed to the outside of the body may be greater than an average radius of the body.

[0415] Considering a relationship with a sweep module, a portion of each spin mop exposed to the outside may be located between a lateral side of the body 30 and a rear side of the body 30. That is, quadrants are sequentially positioned in a clockwise direction when viewed from a lower side of the body, the portion of each spin mop exposed to the outside may be a 2/4 quadrant or a 3/4 quadrant of the body 30.

Claims

1. A cleaner, comprising:

a body;
a mop module disposed at a lower side of the body, supporting the body, and including a pair of spin mops for rotating and mopping a floor; and
a sweep module disposed at the body and sweeping up a foreign material on the floor,
wherein the sweep module comprises:

an agitator of rotating to collect the foreign material on the floor;
a storage space where the foreign material collected by the agitator is stored; and
a wheel assembly including wheel assemblies respectively disposed at both sides of the storage space to support the sweep module and be in contact with the floor, and

wherein the wheel assembly comprises:

a wheel body where a wheel is installed,

wherein the wheel body being movable in a vertical direction; and
a cliff sensor for detecting a movement of the wheel body.

2. The cleaner of claim 1, wherein the cliff sensor is disposed at the body.

3. The cleaner of claim 1, wherein the wheel assembly further comprises:
a wheel elastic member providing elastic force to the wheel body to move the wheel body.

4. The cleaner of claim 1, wherein the cliff sensor is disposed at an upper side of the wheel body.

5. The cleaner of claim 1, wherein the wheel body further includes a contact portion protruding to an upper side,
wherein the cliff sensor includes a switch lead disposed at an upper side of the contact portion and in contact with the contact portion, and
wherein the cliff sensor is a micro-switch of detecting whether the wheel body moves or not through contact or non-contact of the switch lead and the contact portion.

6. The cleaner of claim 1, wherein the wheel body further includes a contact portion protruding to an upper side,

wherein the cliff sensor further includes a permanent magnet disposed at the contact portion, and
wherein the cliff sensor is a hall sensor of detecting whether the wheel body moves or not through proximity or non-proximity of the permanent magnet.

7. The cleaner of claim 1, wherein the wheel body further includes a detecting portion protruding to an upper side,

wherein the cliff sensor further includes a light emitting portion and a light receiving portion,
wherein the detecting portion is disposed between the light emitting portion and the light receiving portion, and
wherein the cliff sensor is a photo sensor of detecting whether the wheel body moves or not by detecting light emitted from the light emitting portion and then received at the light receiving portion.

8. The cleaner of claim 1, wherein the wheel body is positioned at a front side than the agitator.

9. The cleaner of claim 1, wherein the wheel body comprises two wheel bodies respectively disposed at a left side and a right side, and
wherein a separation distance of the two wheel bodies is smaller than a width of the agitator in a left-right direction.

10. The cleaner of claim 1, wherein the mop module is disposed at a rear side than the sweep module.

11. The cleaner of claim 1, wherein the wheel body and the storage space are disposed at a front side than a center of the body.

12. A cleaner, comprising:

a body forming an appearance or an exterior;
a mop module disposed at a lower side of the body, supporting the body, and including a pair of spin mops for rotating and mopping a floor; and
a sweep module disposed at the body and sweeping up a foreign material on the floor by a rotation of an agitator,
wherein the sweep module comprises:

a dust housing including a collection opening surface opened to the floor and a storage space where the foreign material collected through the collection opening is stored;
the agitator exposed at the collection opening surface, rotatably assembled to the dust housing, and moving the foreign material on the floor to the storage space when rotating; and
a wheel assembly assembled to the dust housing and in contact with the floor to support the dust housing, and

wherein the wheel assembly comprises:

a wheel body assembled to the dusting housing to be movable in a vertical direction;
a wheel assembled to a lower side of the wheel body and in contact with the floor to support the wheel body;
a wheel elastic member disposed between the dust housing and the wheel body and providing elastic force to the wheel body to move the wheel body; and
a cliff sensor disposed at the body and detecting a movement of the wheel body when the wheel body is moved.

13. The cleaner of claim 12, wherein the wheel elastic member is compressed when the wheel is supported by the floor, and
wherein the wheel elastic member provides the elas-

tic force to the wheel body and presses the wheel body to a lower side or downward when the wheel is not in contact with the floor.

14. The cleaner of claim 12, wherein the cliff sensor is disposed at an upper side of the wheel body.

15. The cleaner of claim 12, wherein the wheel body further includes a contact portion protruding to an upper side,

wherein the cliff sensor includes a switch lead disposed at an upper side of the contact portion and in contact with the contact portion, and
wherein the cliff sensor is a micro-switch of detecting whether the wheel body moves or not through contact or non-contact of the switch lead and the contact portion.

16. The cleaner of claim 12, wherein the wheel body further includes a contact portion protruding to an upper side,

wherein the cliff sensor further includes a permanent magnet disposed at the contact portion, and
wherein the cliff sensor is a hall sensor of detecting whether the wheel body moves or not through proximity or non-proximity of the permanent magnet.

17. The cleaner of claim 1, wherein the wheel body further includes a detecting portion protruding to an upper side,

wherein the cliff sensor further includes a light emitting portion and a light receiving portion,
wherein the detecting portion is disposed between the light emitting portion and the light receiving portion, and
wherein the cliff sensor is a photo sensor of detecting whether the wheel body moves or not by sensing light emitted from the light emitting portion and then received at the light receiving portion.

18. The cleaner of claim 12, wherein the wheel assembly is disposed at a front side than the agitator.

19. The cleaner of claim 12, further comprising:

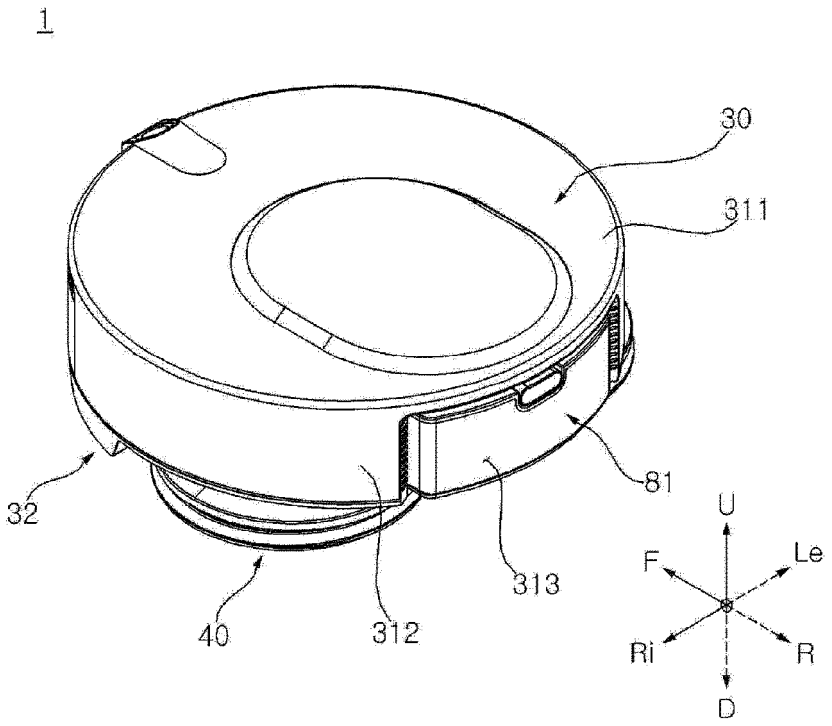
a collection space disposed at an inside of the dust housing, wherein the agitator being installed on the collection space and the collection opening surface being formed at the collection space; and
the storage space disposed at the inside of the dust housing, communicating with the collection space, and storing the foreign material collected by the agitator,
wherein the wheel assembly is disposed at a front side than the collection space.

20. The cleaner of claim 19, wherein the wheel assembly is disposed at a side portion of the storage space.

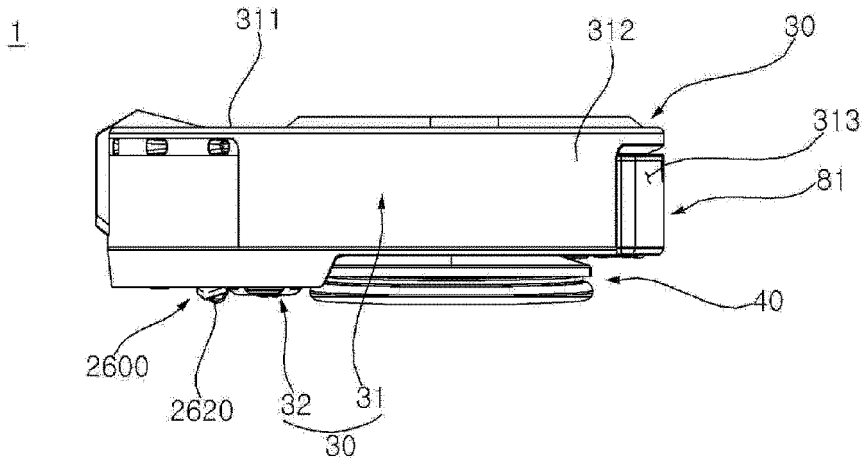
21. The cleaner of claim 19, further comprising:

a discharge surface penetrating the dust housing and forming a front surface of the storage space; and
a dust cover covering the discharge surface and detachably assembled to the dust housing,
wherein the wheel assembly is positioned at a front side than the collection space and is positioned at a rear side than the dust cover.

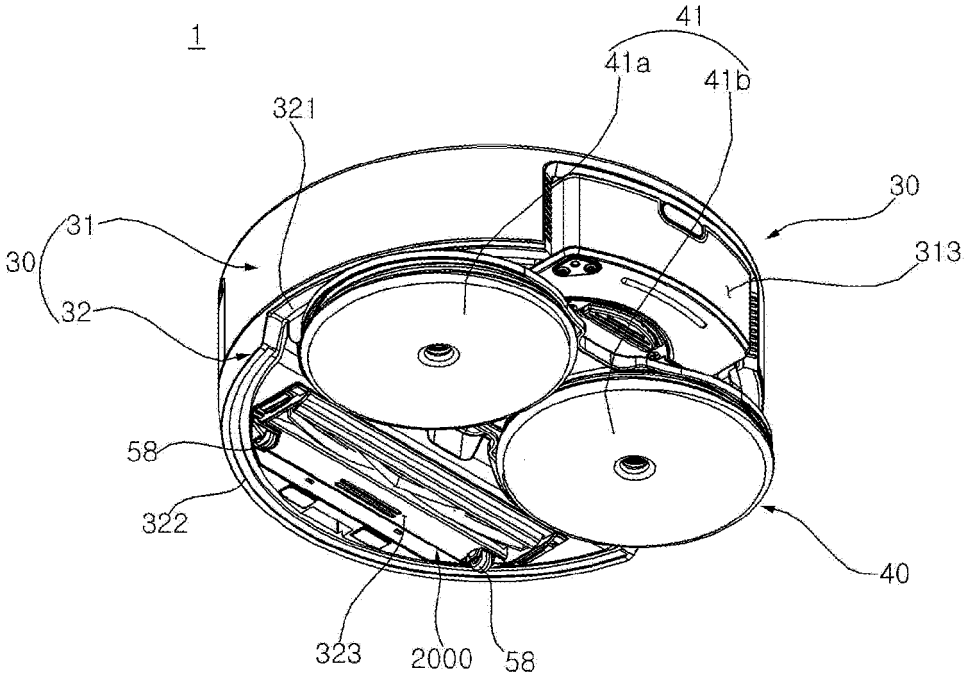
【Figure 1】



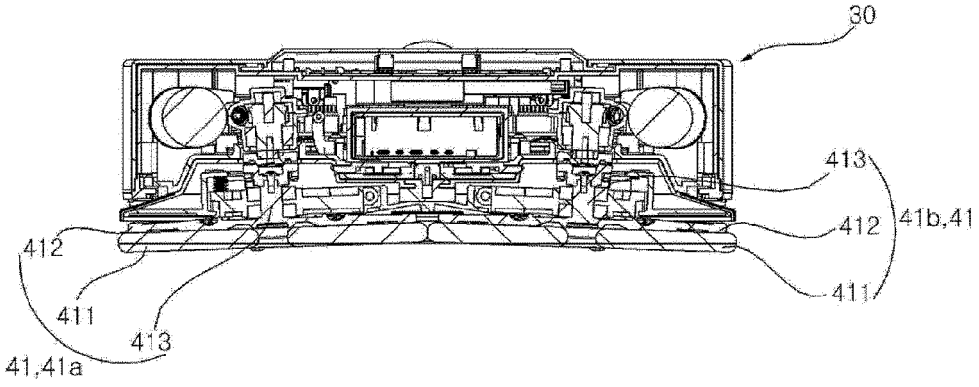
【Figure 2】



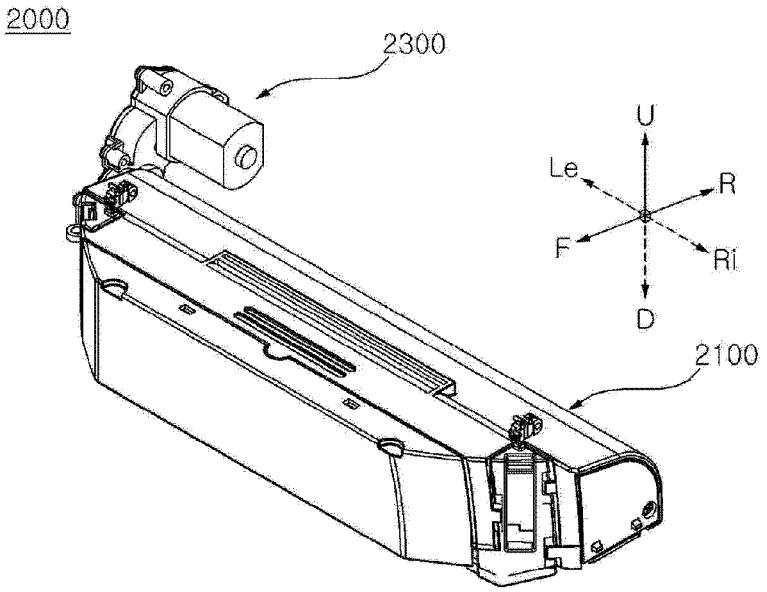
【Figure 3】



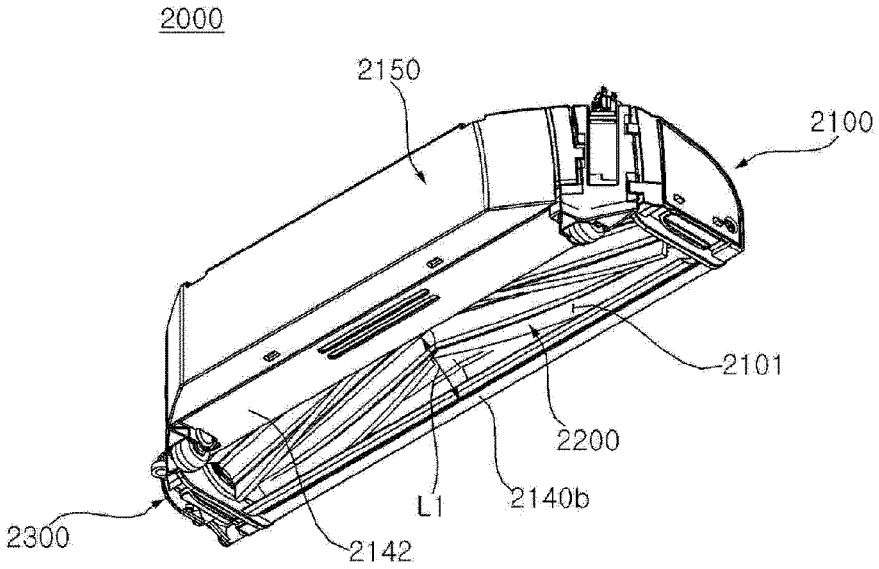
【Figure 4】



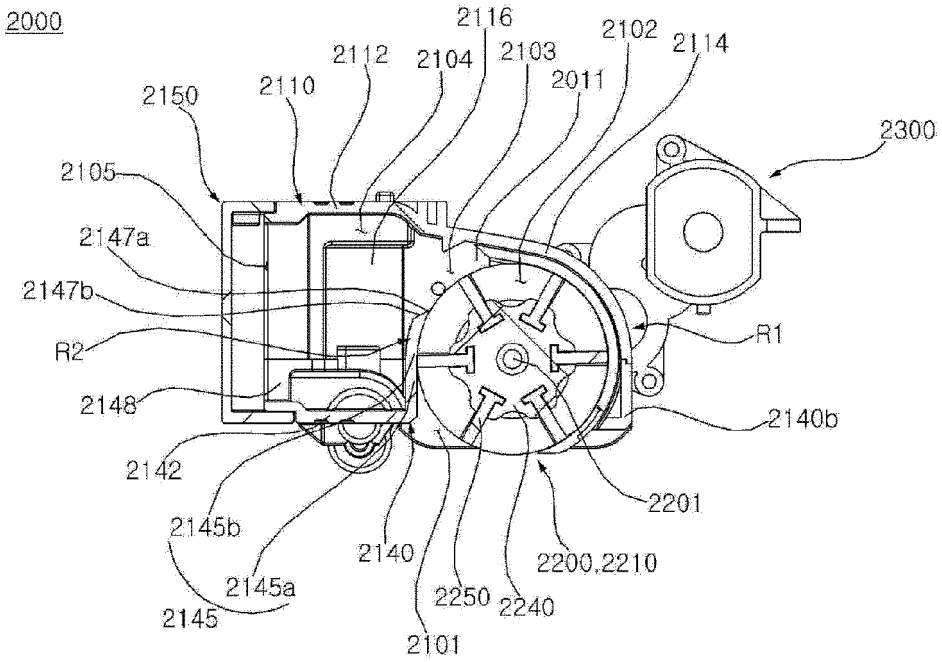
【Figure 5】



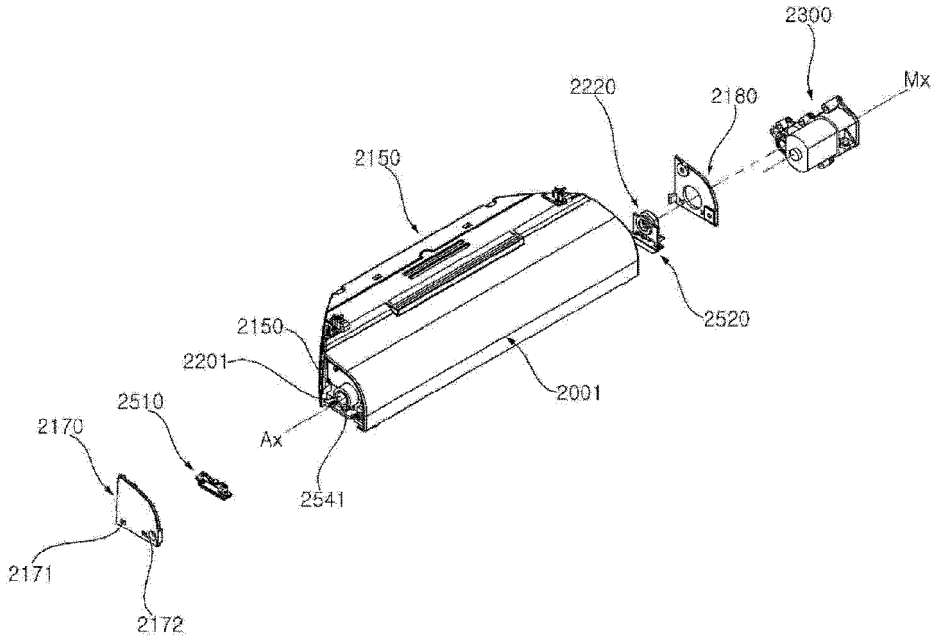
【Figure 6】



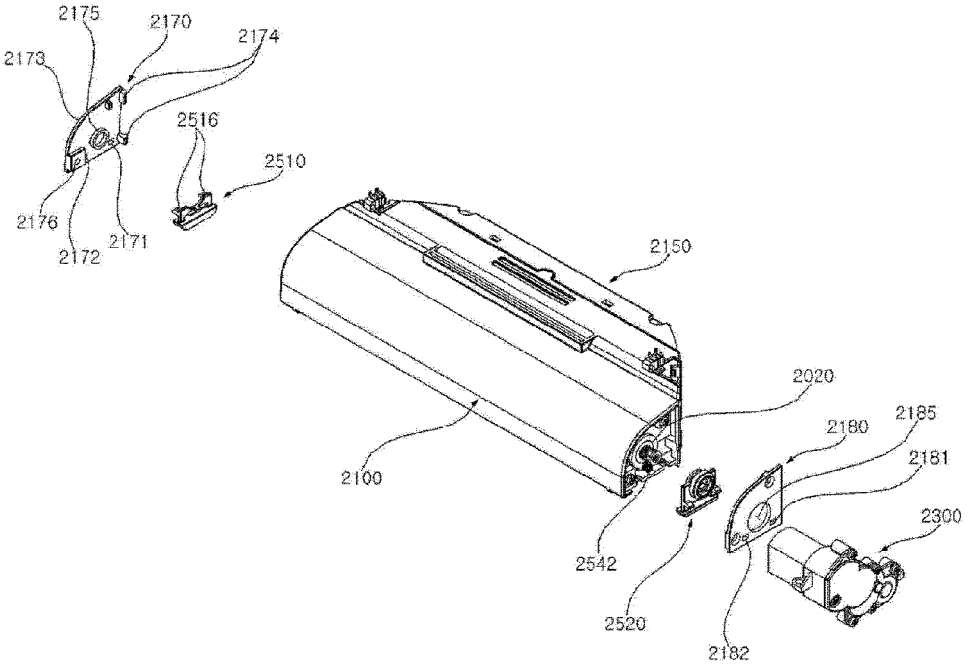
【Figure 7】



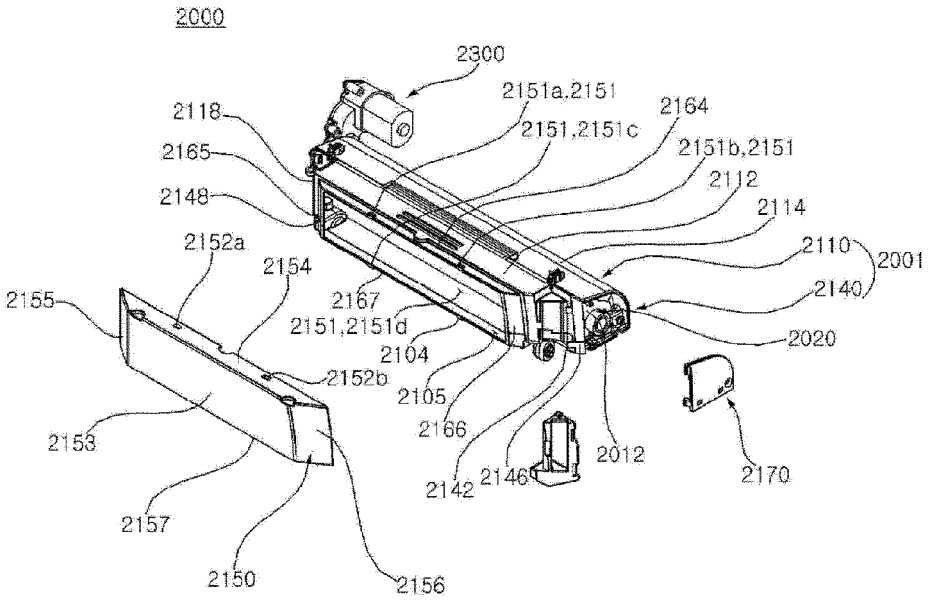
【Figure 8】



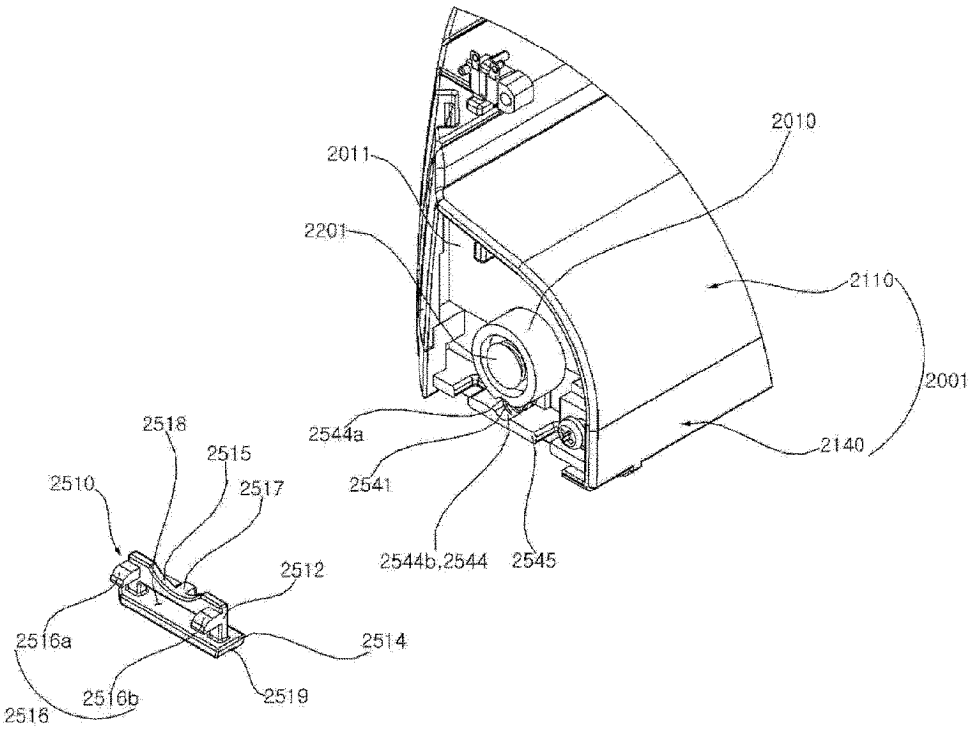
【Figure 9】



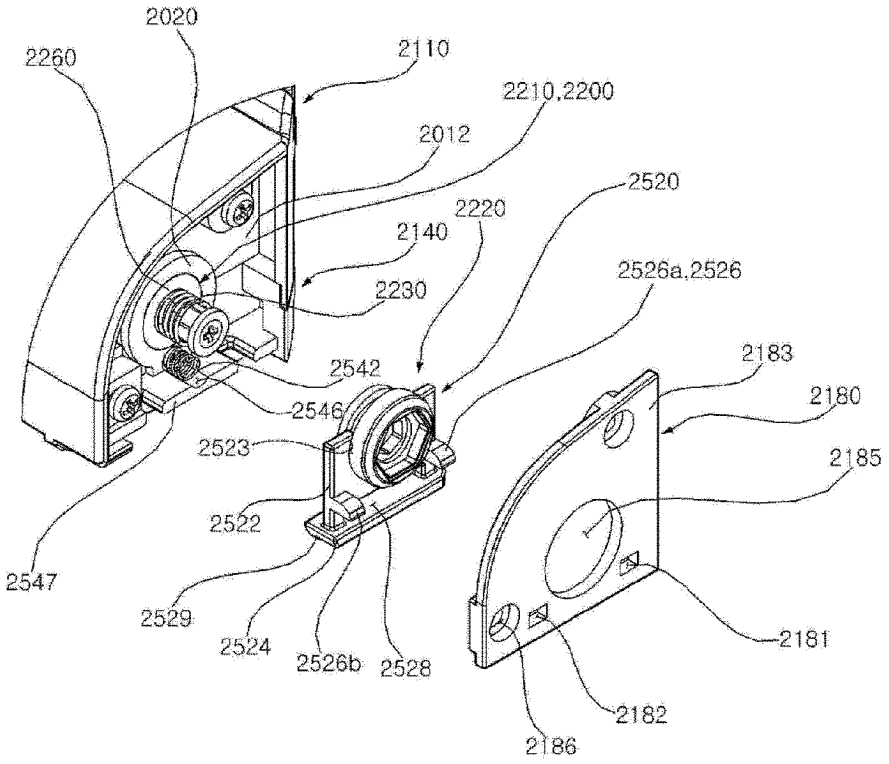
【Figure 10】



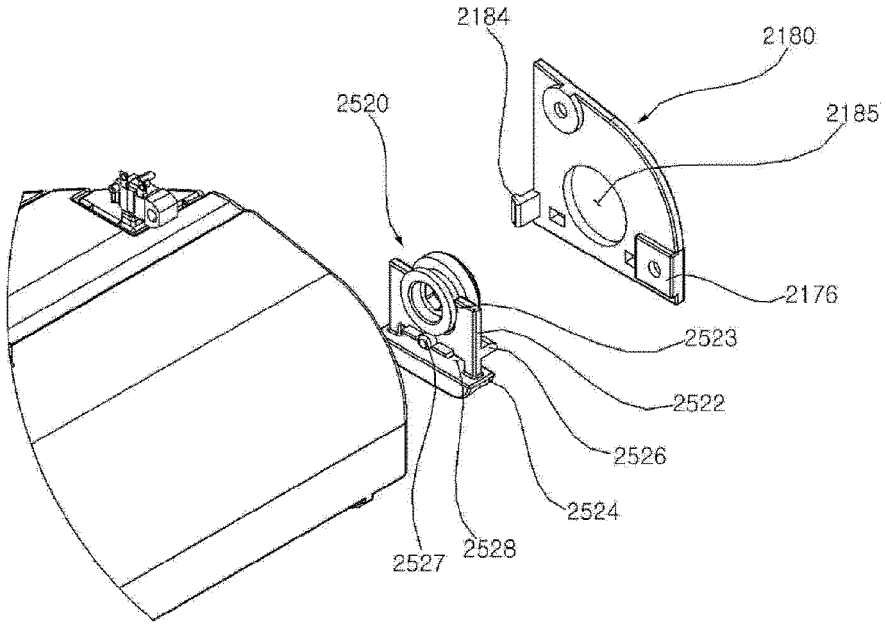
【Figure 11】



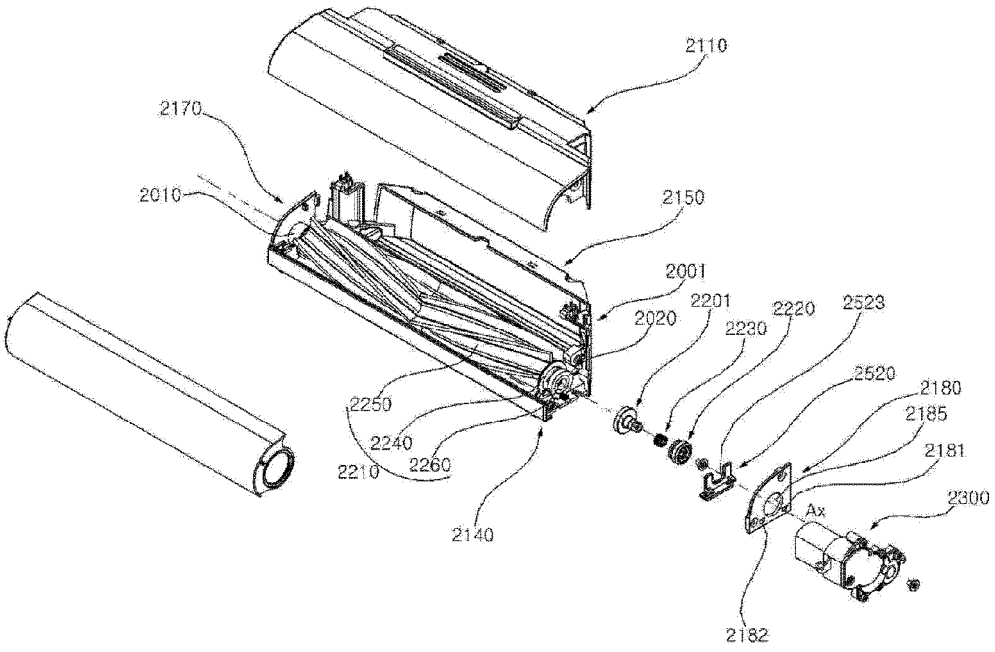
【Figure 12】



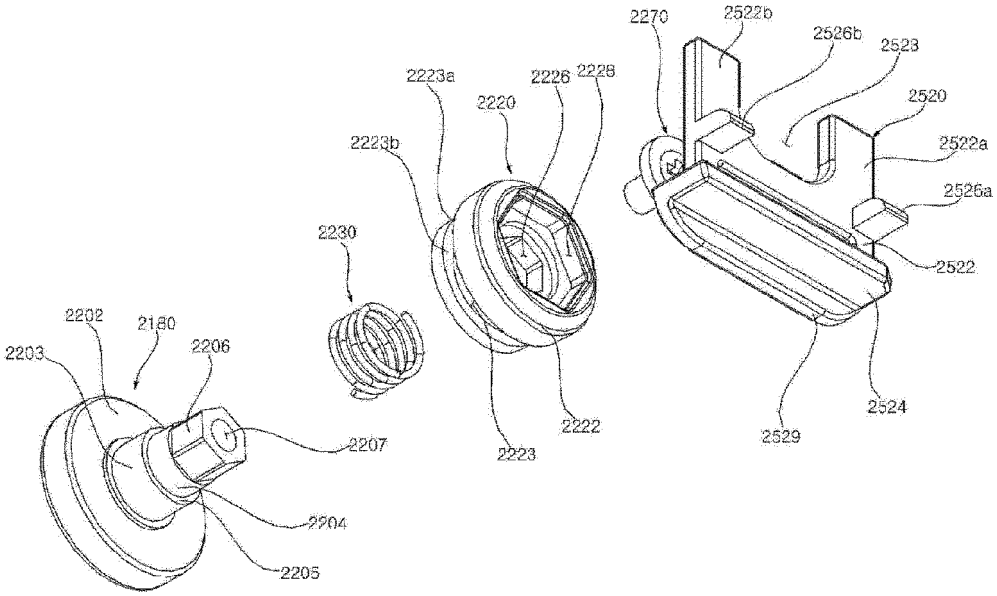
【Figure 13】



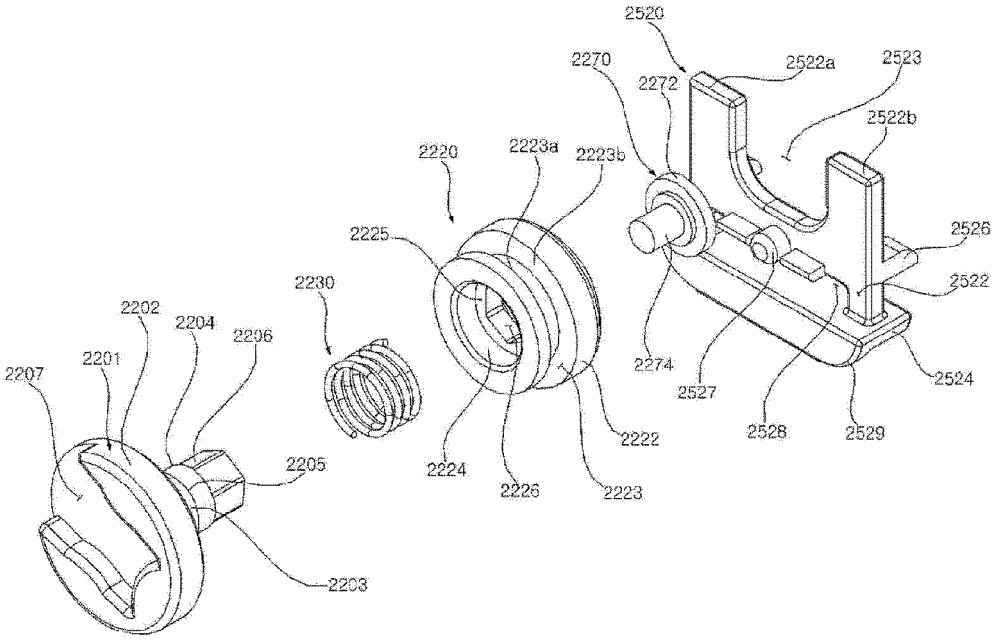
【Figure 14】



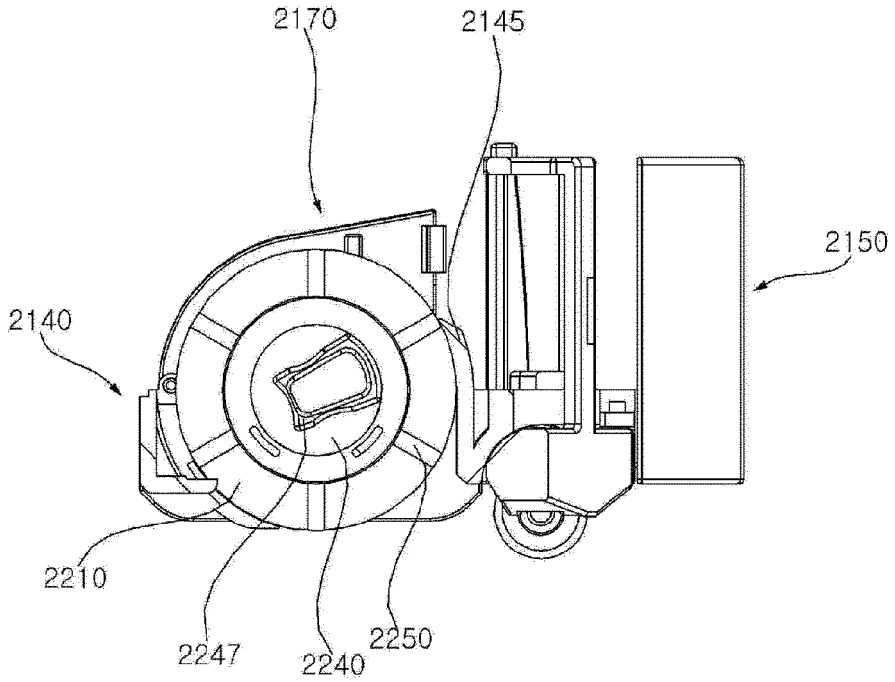
【Figure 15】



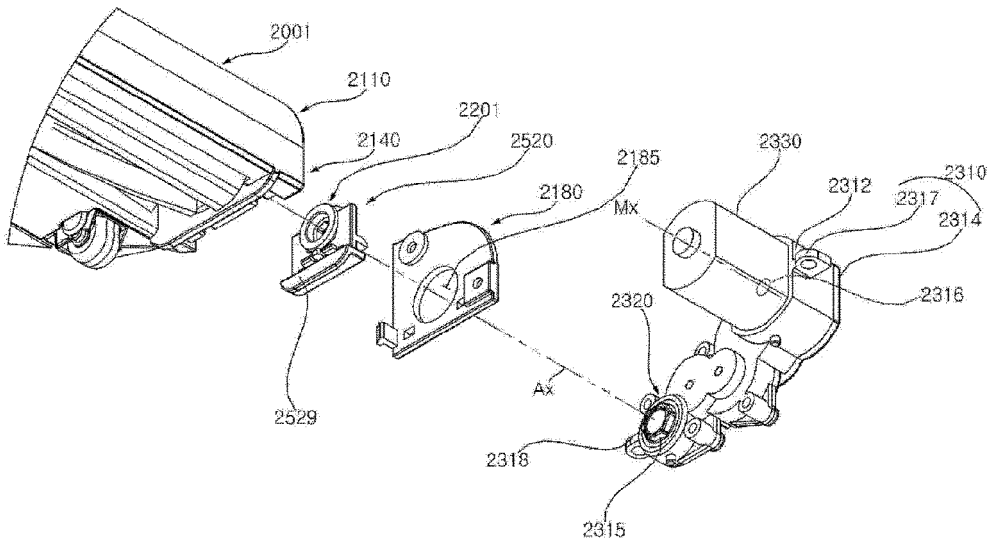
【Figure 16】



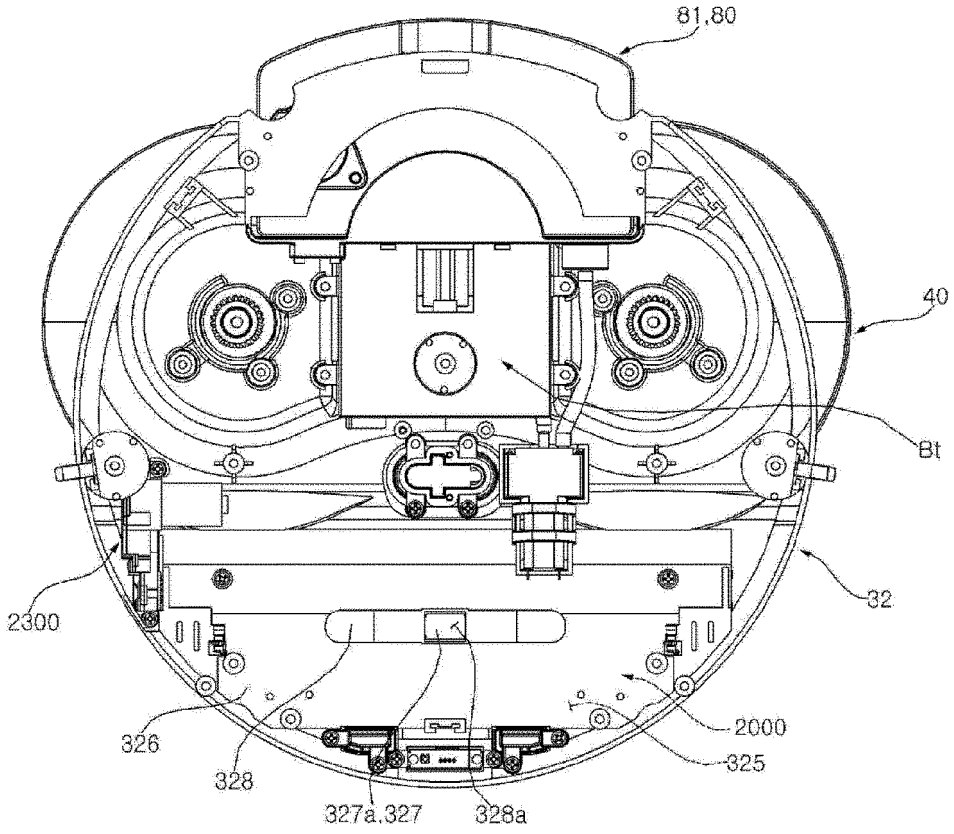
【Figure 17】



【Figure 18】



【Figure 19】



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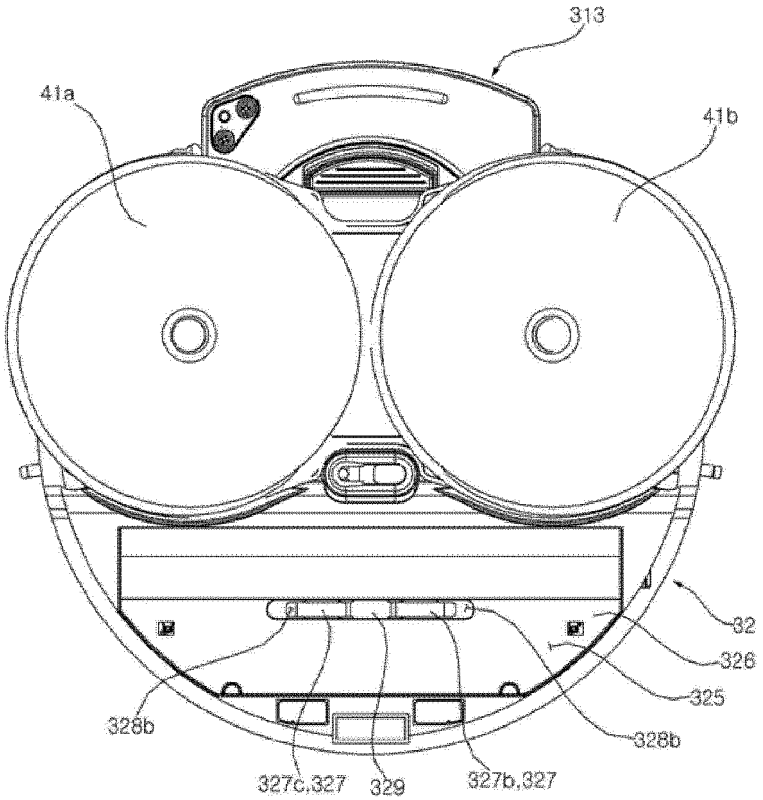
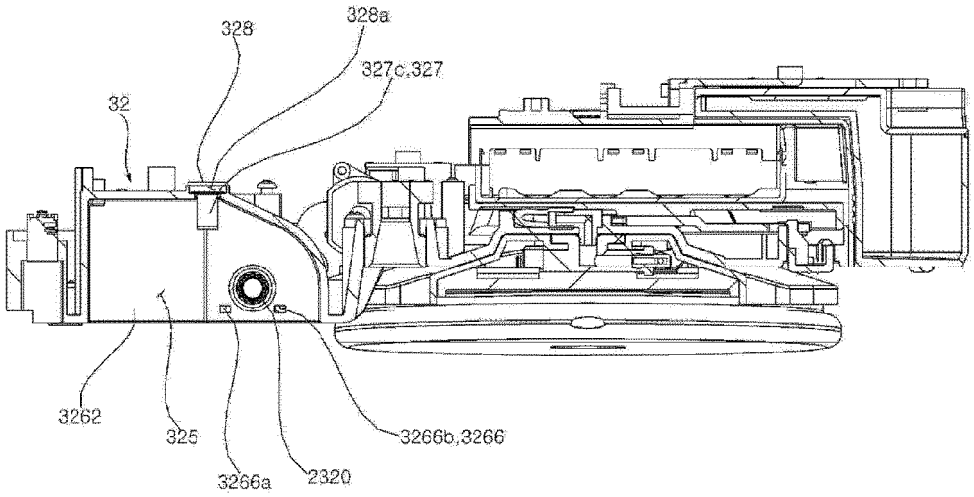
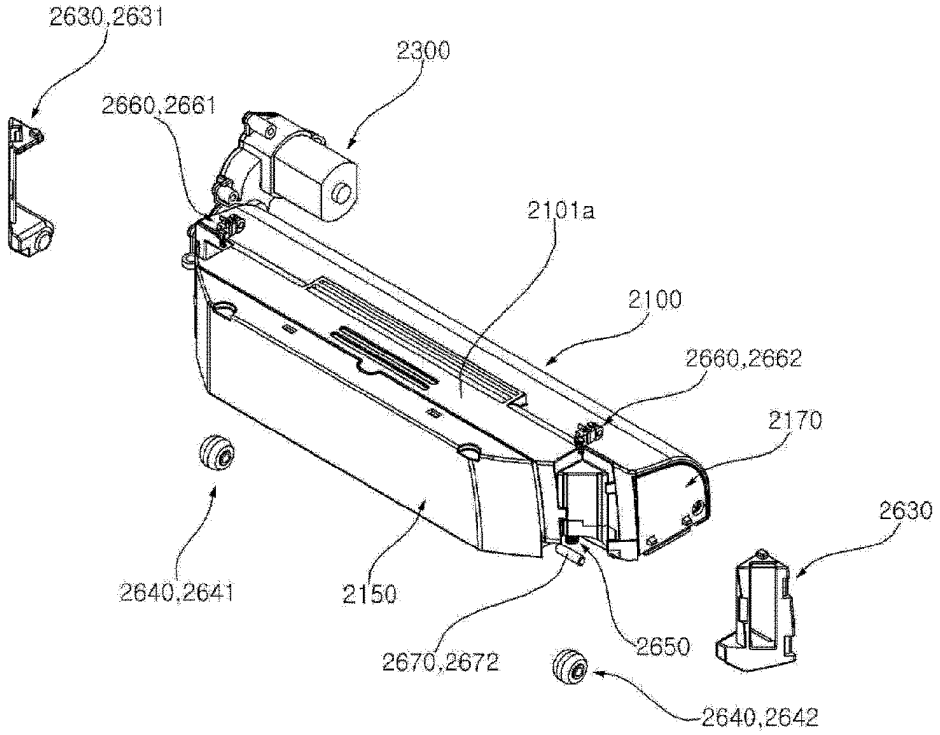


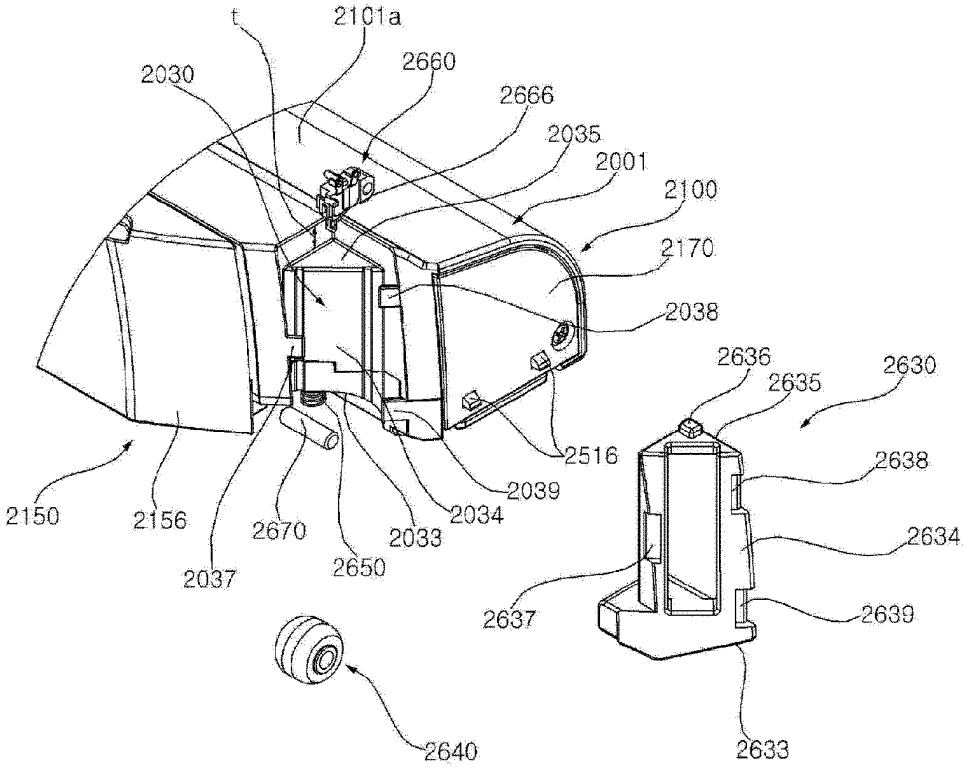
【Figure 21】



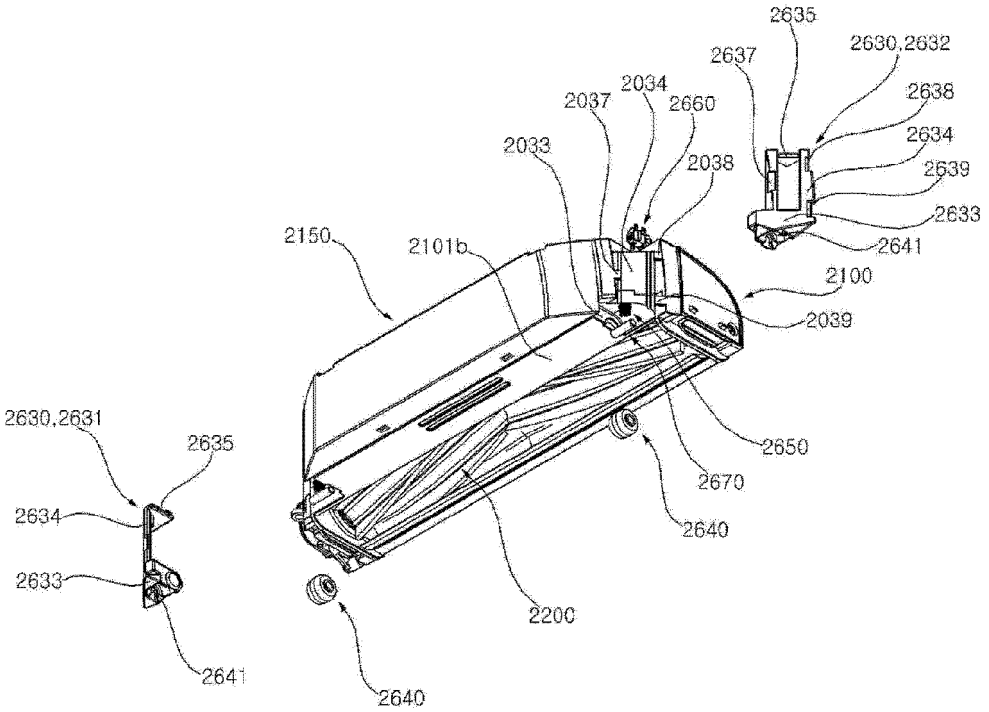
【Figure 22】



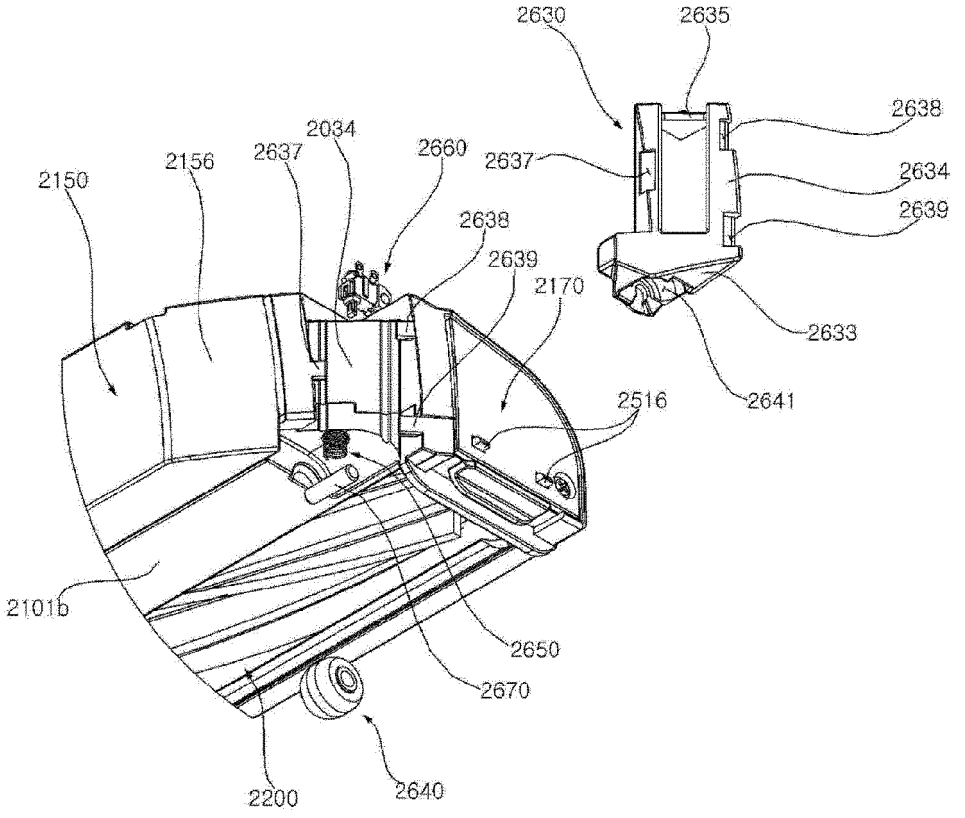
【Figure 23】



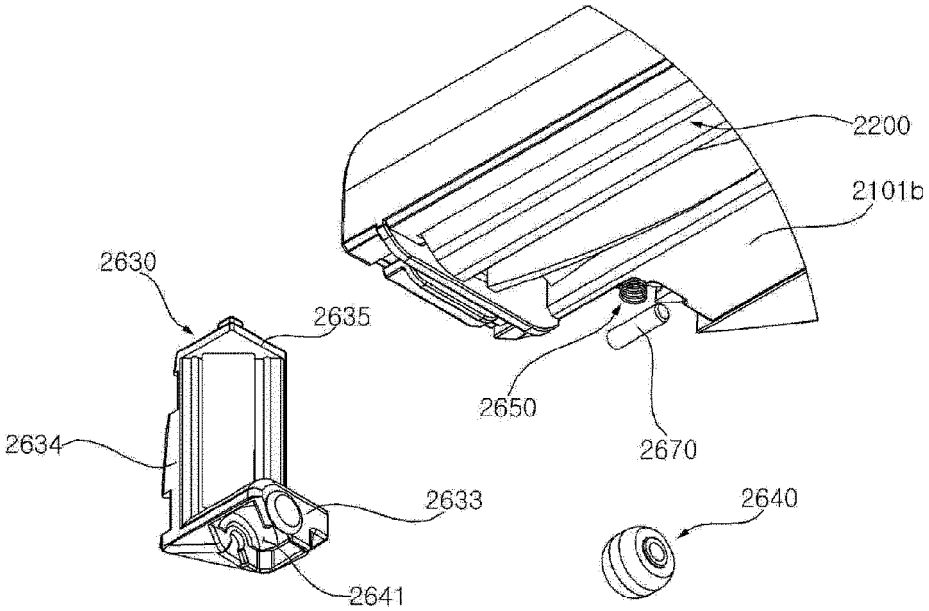
【Figure 24】



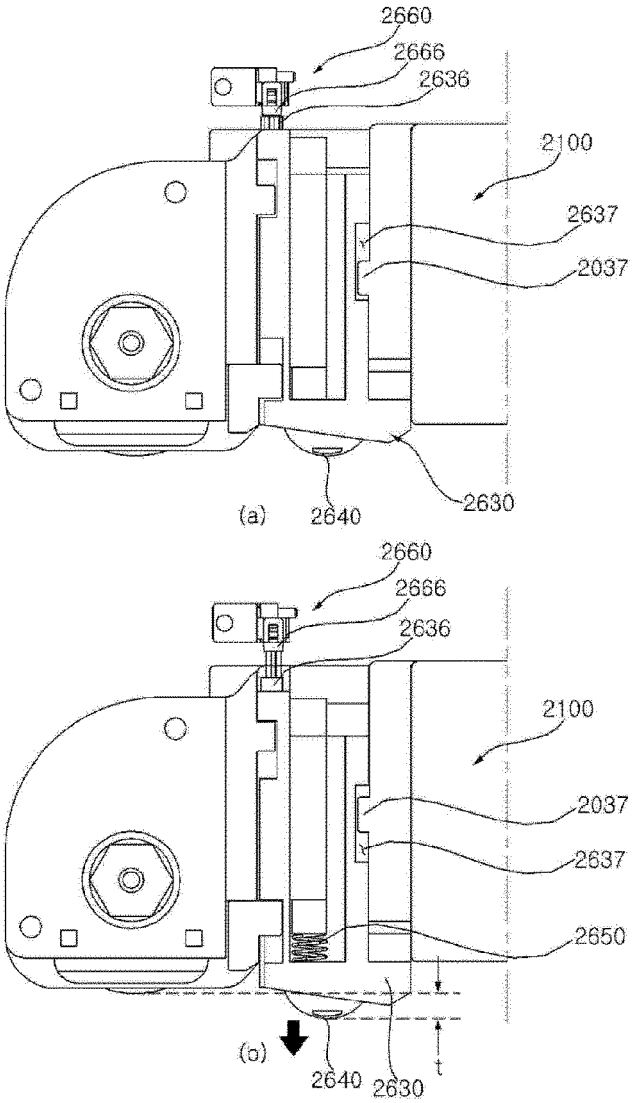
【Figure 25】



【Figure 26】



【Figure 27】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2037
2630
(a)
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2100
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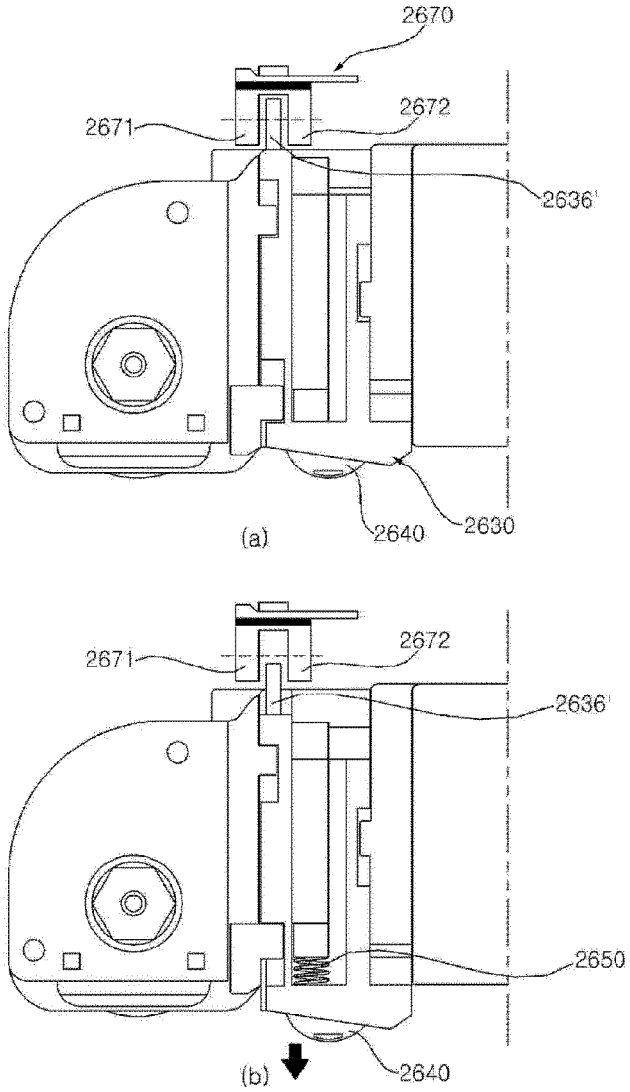
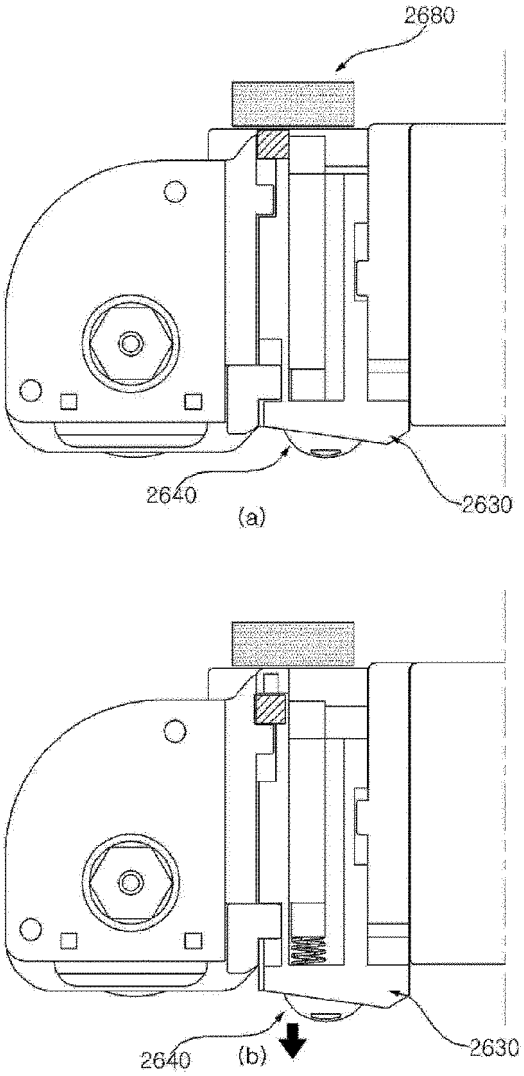
2637
2650
(b)
2640
2630
t

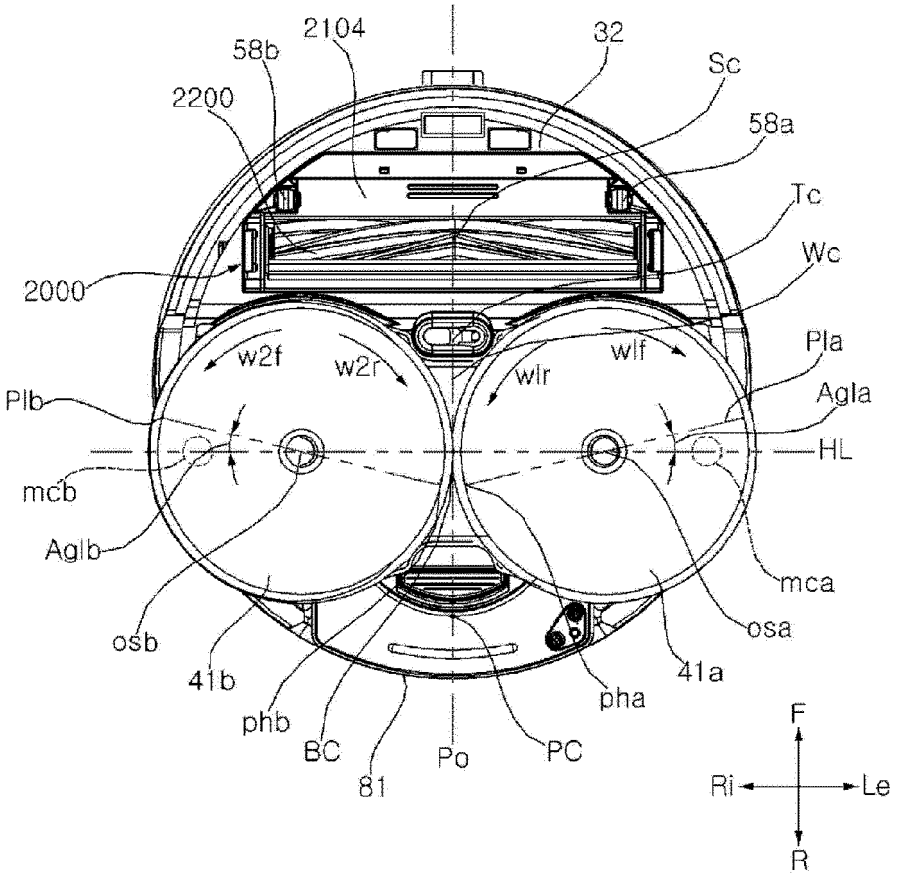
【Figure 28】



【Figure 29】



【Figure 30】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Aglb
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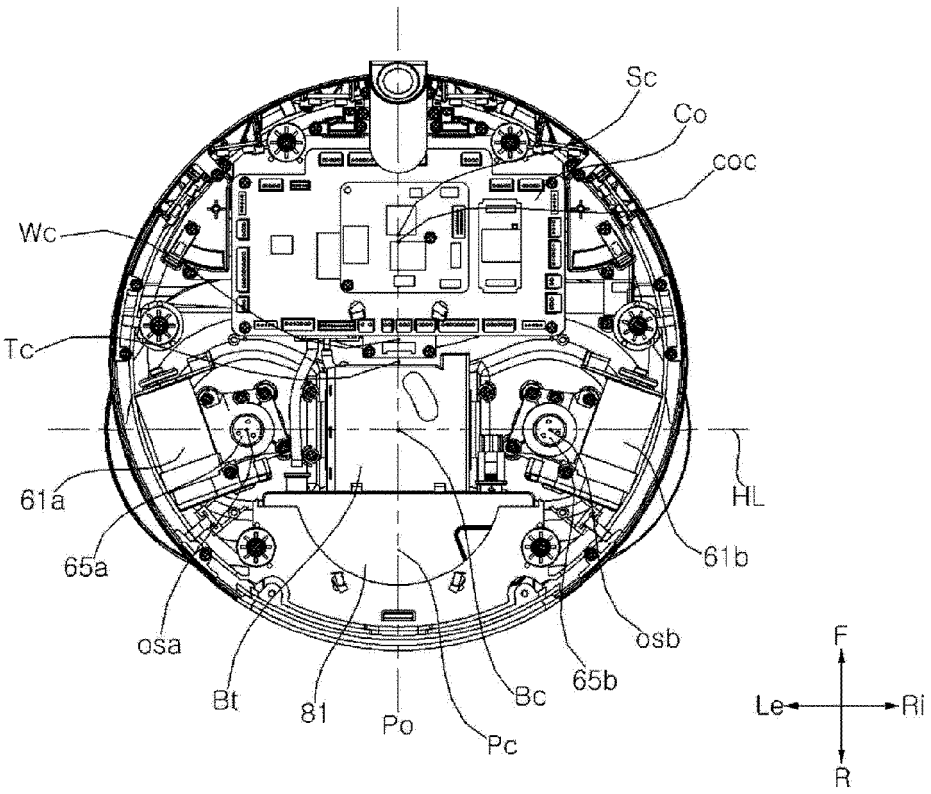
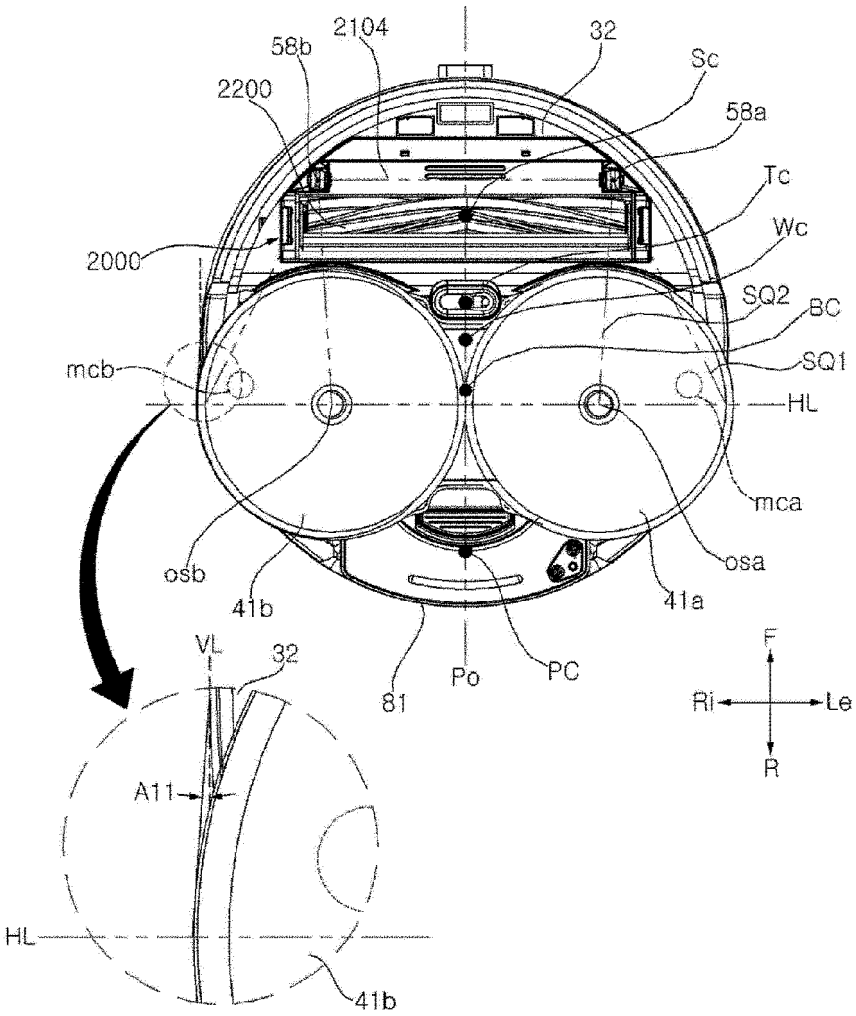
R

【Figure 31】



【Figure 32】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SQ1
mcb
HL
mca
osb
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osa
41a
81
Po
PC
F
Ri
Le
R
VL
32
A11
HL
41b

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2020/001366

A. CLASSIFICATION OF SUBJECT MATTER

A47L 11/40(2006.01)i, A47L 11/24(2006.01)i, B25J 9/16(2006.01)i, B25J 19/02(2006.01)i, B25J 9/00(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 11/40; A47L 11/00; A47L 11/16; A47L 9/28; G05D 1/02; A47L 11/24; B25J 9/16; B25J 19/02; B25J 9/00

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: cleaner, mop, agitator, wheel, cliff sensor, reed switch, micro switch, magnet, hall sensor, photo sensor, dust housing

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	KR 10-2019-0015933 A (LG ELECTRONICS INC.) 15 February 2019 See paragraphs [0030]-[0043] and [0047]-[0049] and figures 1-7.	1-19
A		20-21
Y	KR 10-2010-0132147 A (WOONGJIN COWAY CO., LTD.) 17 December 2010 See paragraphs [0041]-[0050] and [0063]-[0065] and figures 1-7.	1-19
Y	KR 10-0595571 B1 (LG ELECTRONICS INC.) 03 July 2006 See claim 1 and figures 4-6.	5,15
Y	US 2013-0310978 A1 (OZICK et al.) 21 November 2013 See paragraph [0056] and figures 12A-13A.	7,17
Y	KR 10-2019-0015931 A (LG ELECTRONICS INC.) 15 February 2019 See paragraphs [0049]-[0050] and figure 8.	8-9,11,18-19

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

* Special categories of cited documents:
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"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
18 JUNE 2020 (18.06.2020)	**18 JUNE 2020 (18.06.2020)**
Name and mailing address of the ISA/KR Korean Intellectual Property Office Government Complex Daejeon Building 4, 189, Cheongsa-ro, Seo-gu, Daejeon, 35208, Republic of Korea Facsimile No. +82-42-481-8578	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR2020/001366

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REFERENCES CITED IN THE DESCRIPTION

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- KR 100671897 **[0005]**