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(54) **AUTONOMOUS CLEANING DEVICE**

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(57) **ABSTRACT**

An autonomous cleaning device that may reduce noise caused by friction with a floor includes: a main body having an opening; a brush unit that is rotatably disposed in the opening of the main body; and a blade assembly that guides introduction of dust swept up by the brush unit, the blade assembly including: a blade that guides dust toward an inner side of the main body; a support member that is coupled to the blade so as to support the blade and that has one side in which a coupling groove is formed; and an insertion member that is inserted into the coupling groove of the support member. The autonomous cleaning device can prevent noise from occurring due to abnormal contact between the blade and the floor while the autonomous cleaning device travels.

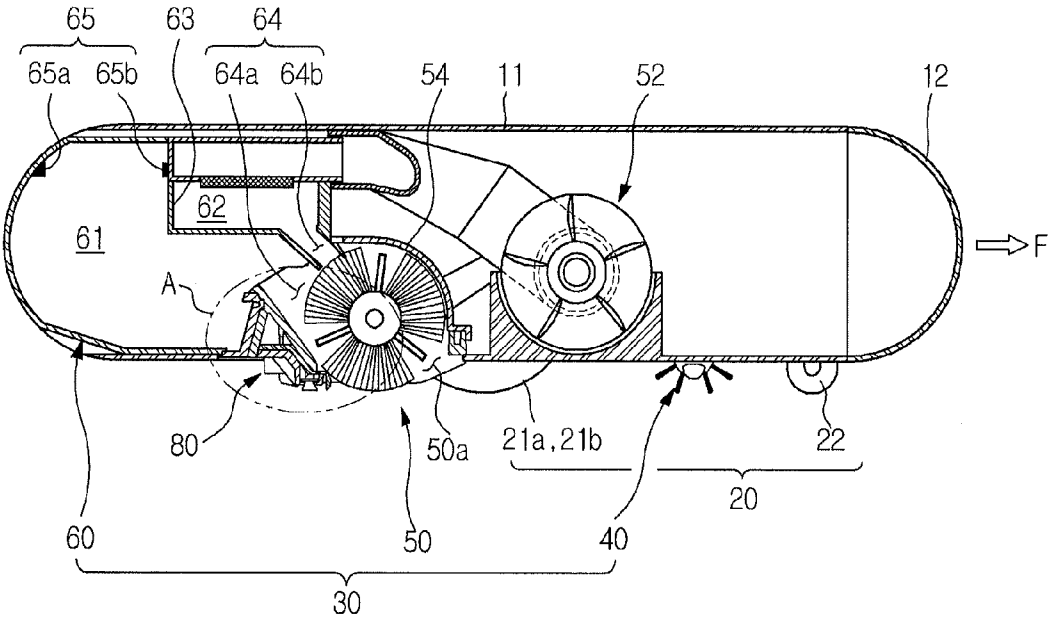

FIG. 1

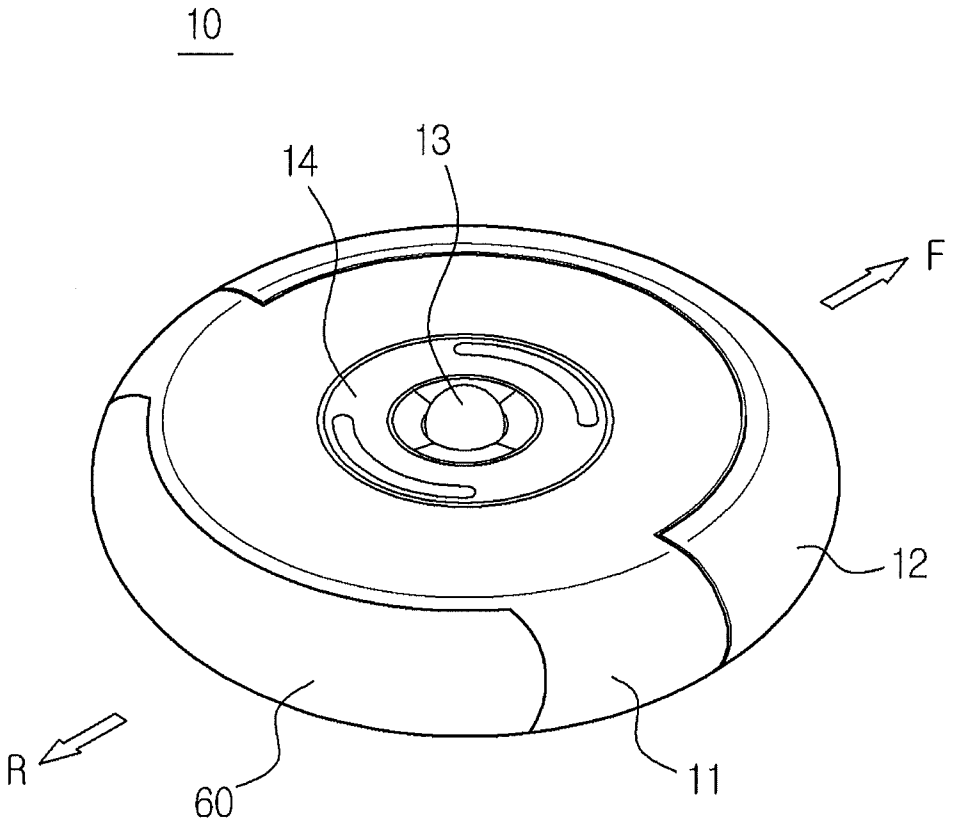

FIG.2

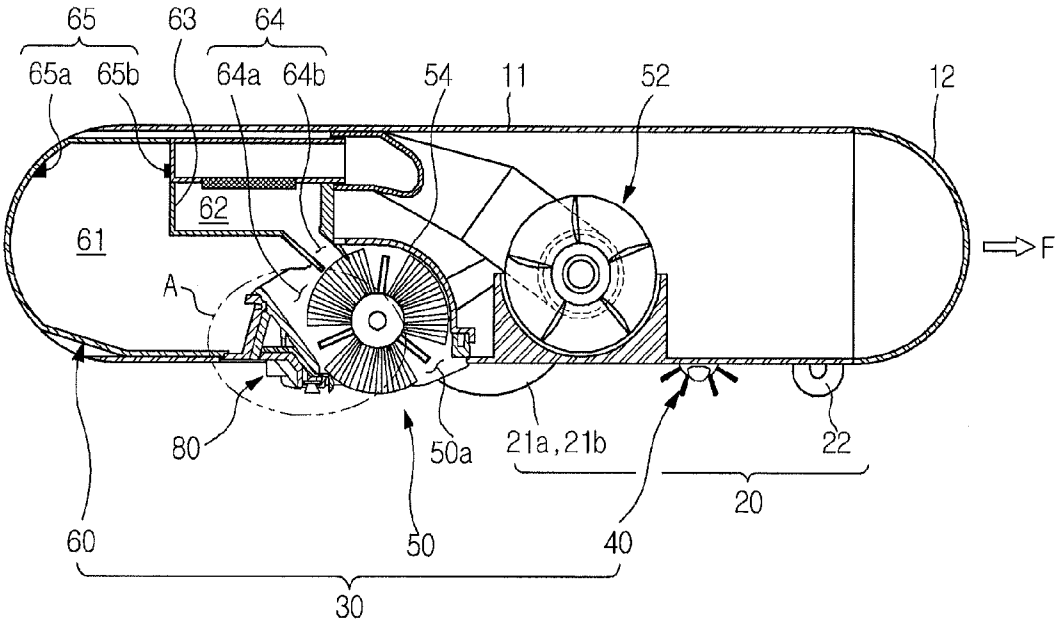
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FIG.3

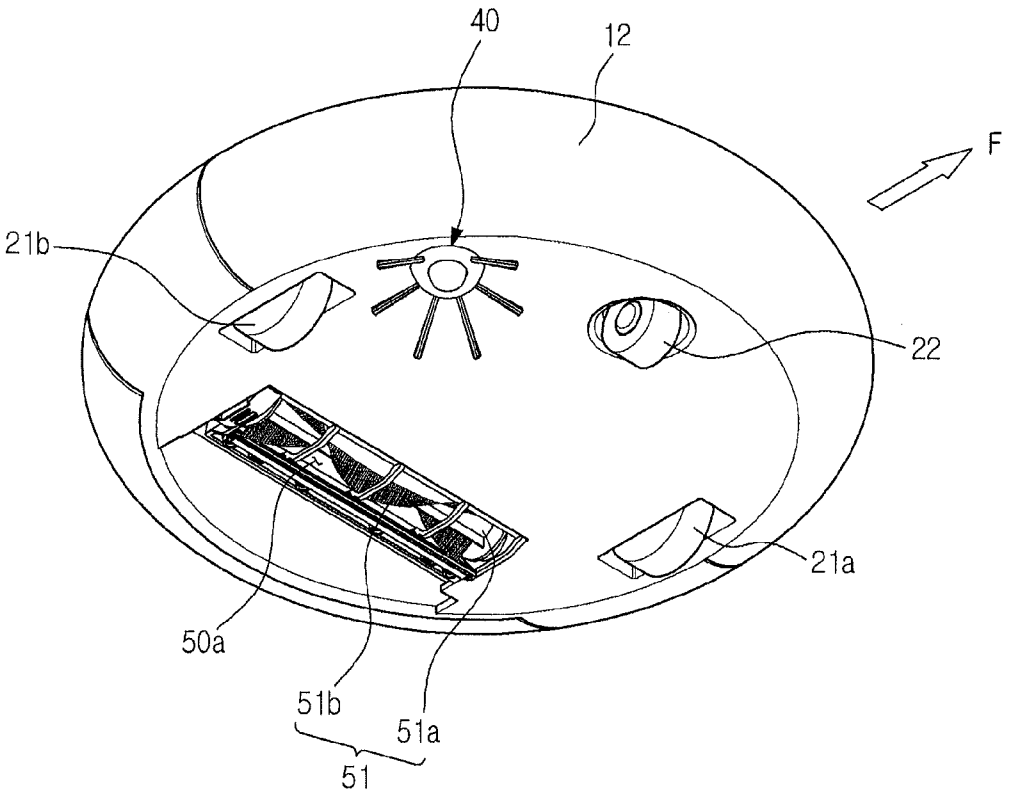
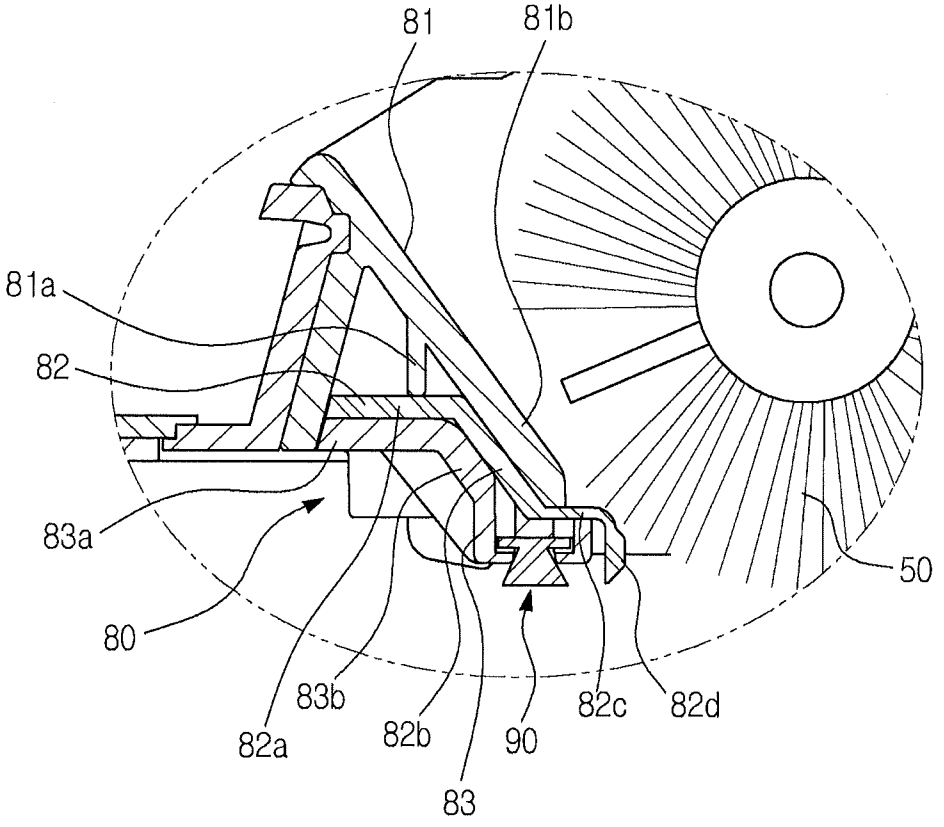


FIG.4



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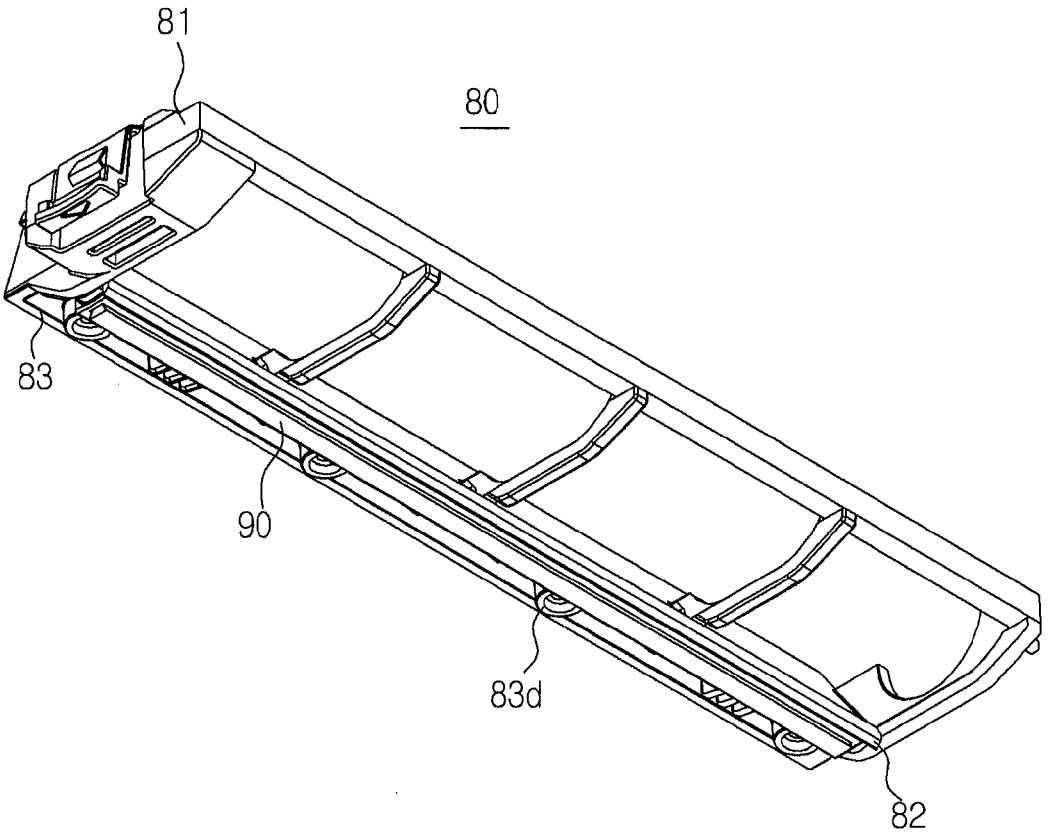

FIG.6

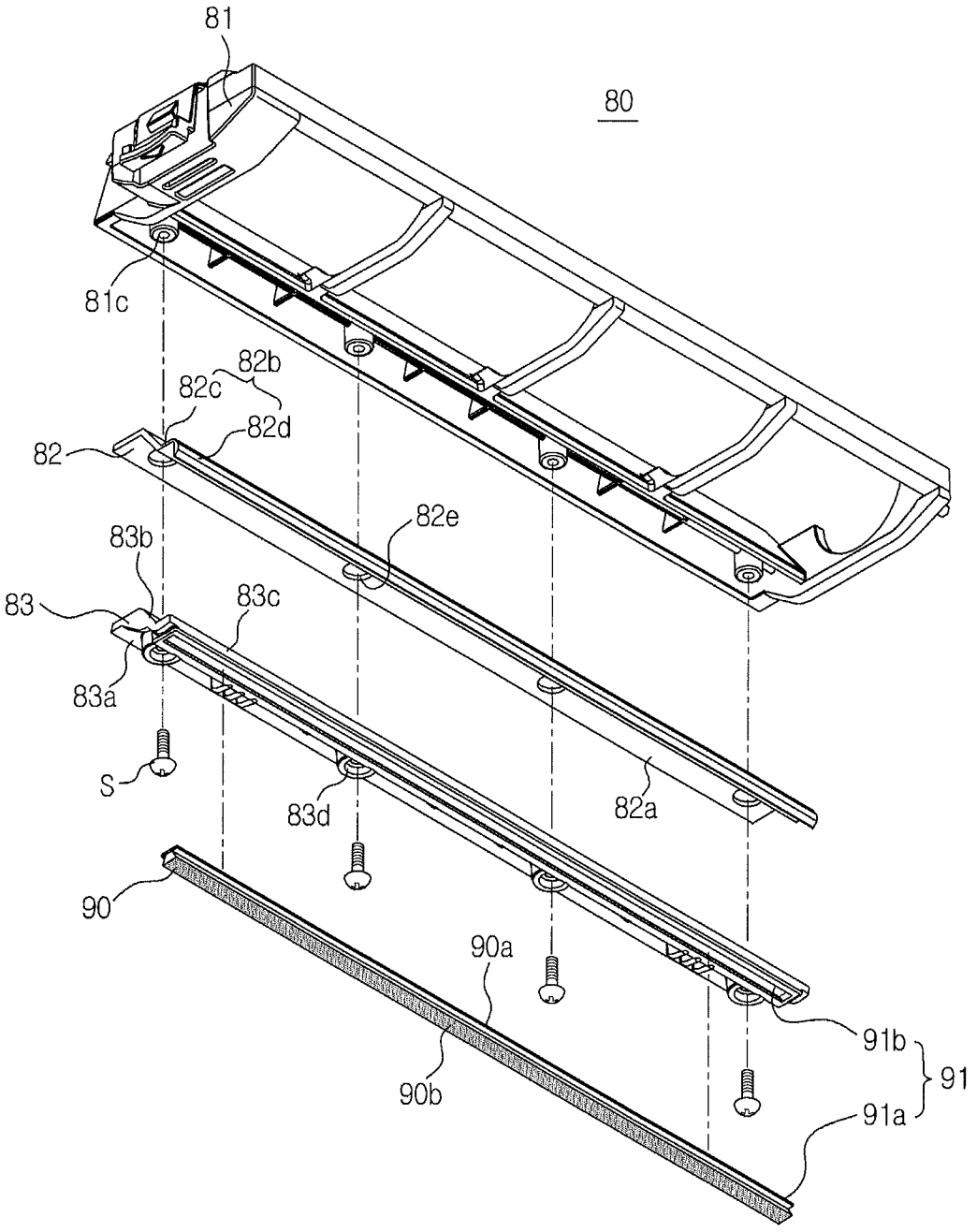
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FIG.7

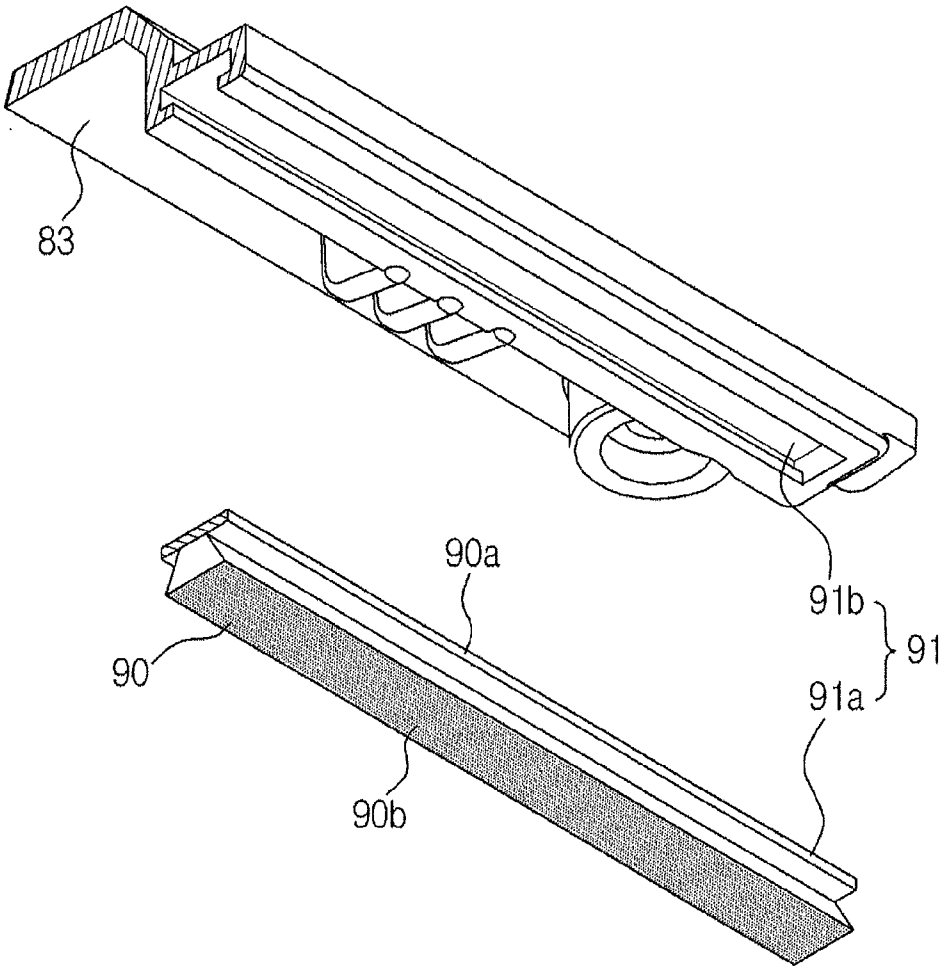

FIG.8

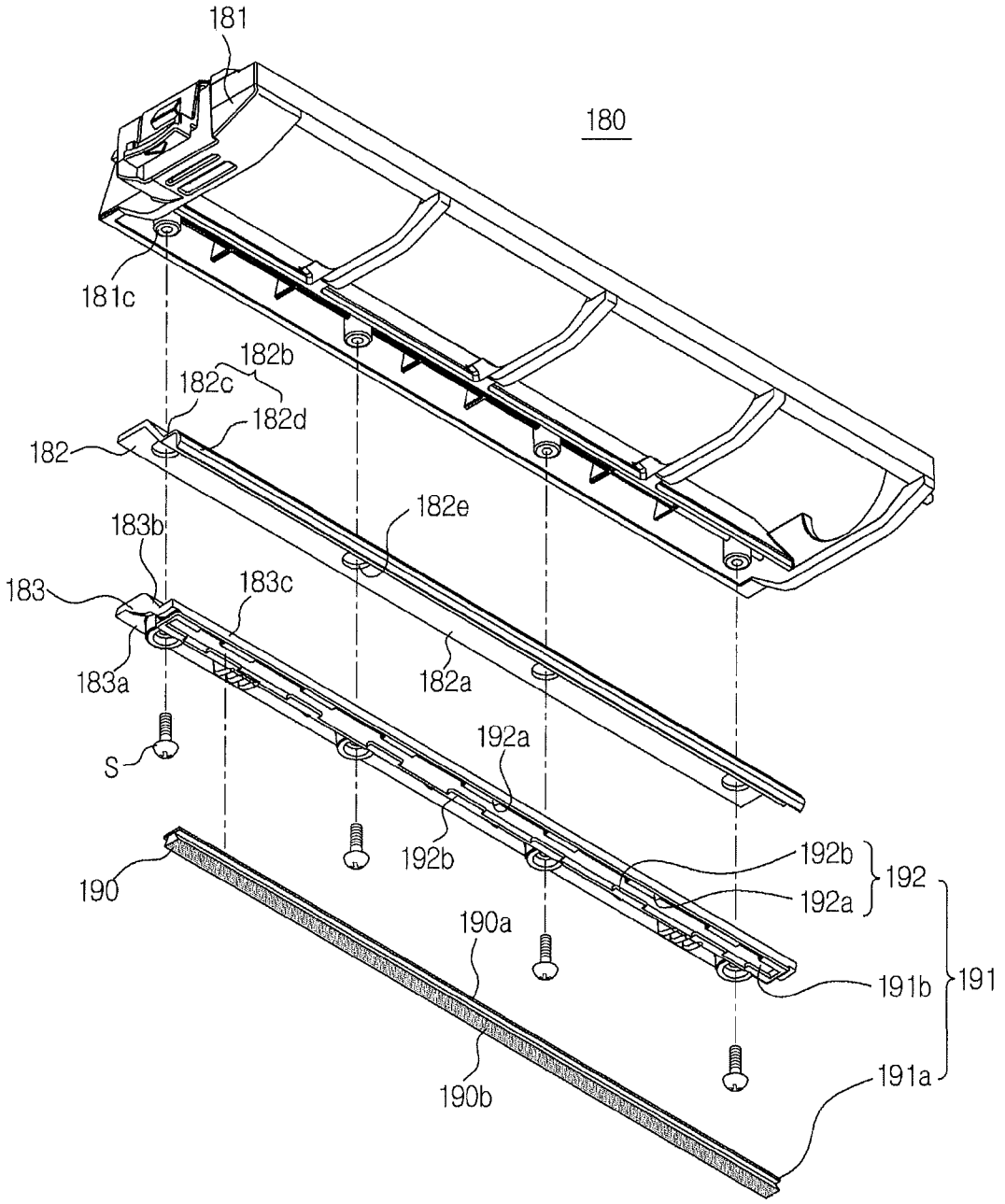
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FIG.9

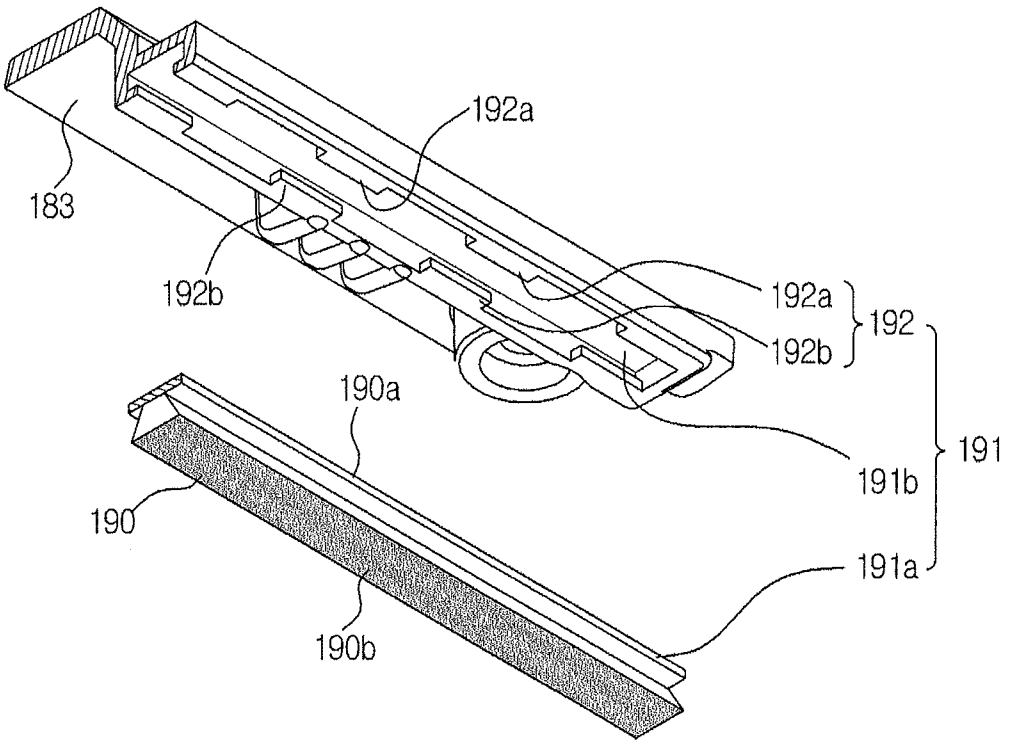

FIG.10

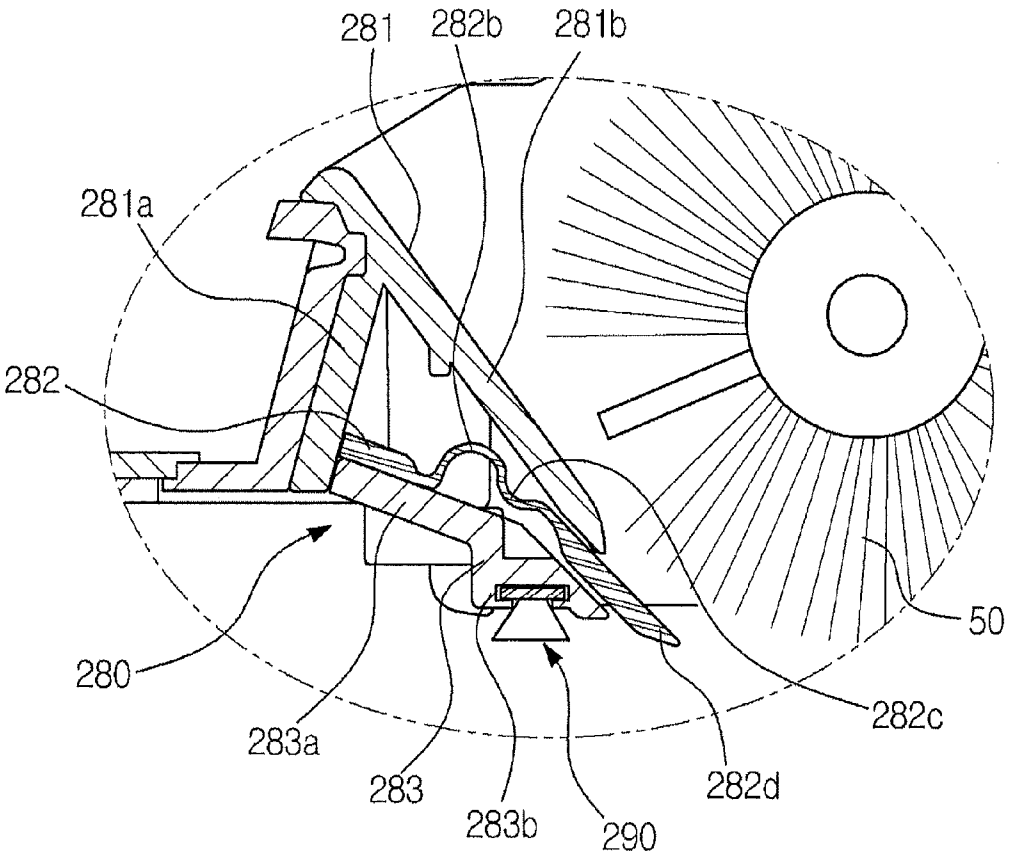

FIG.11

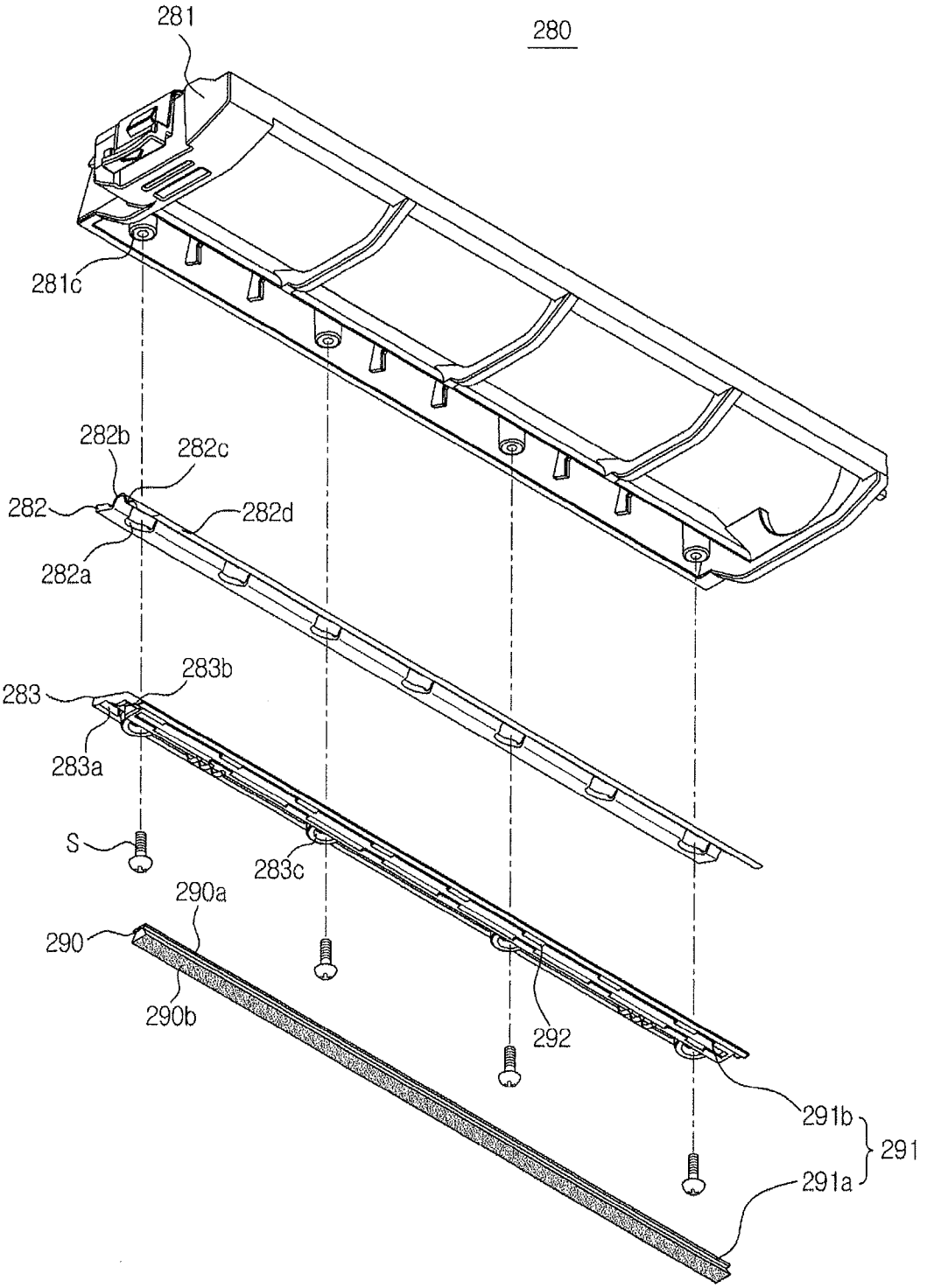
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FIG.12

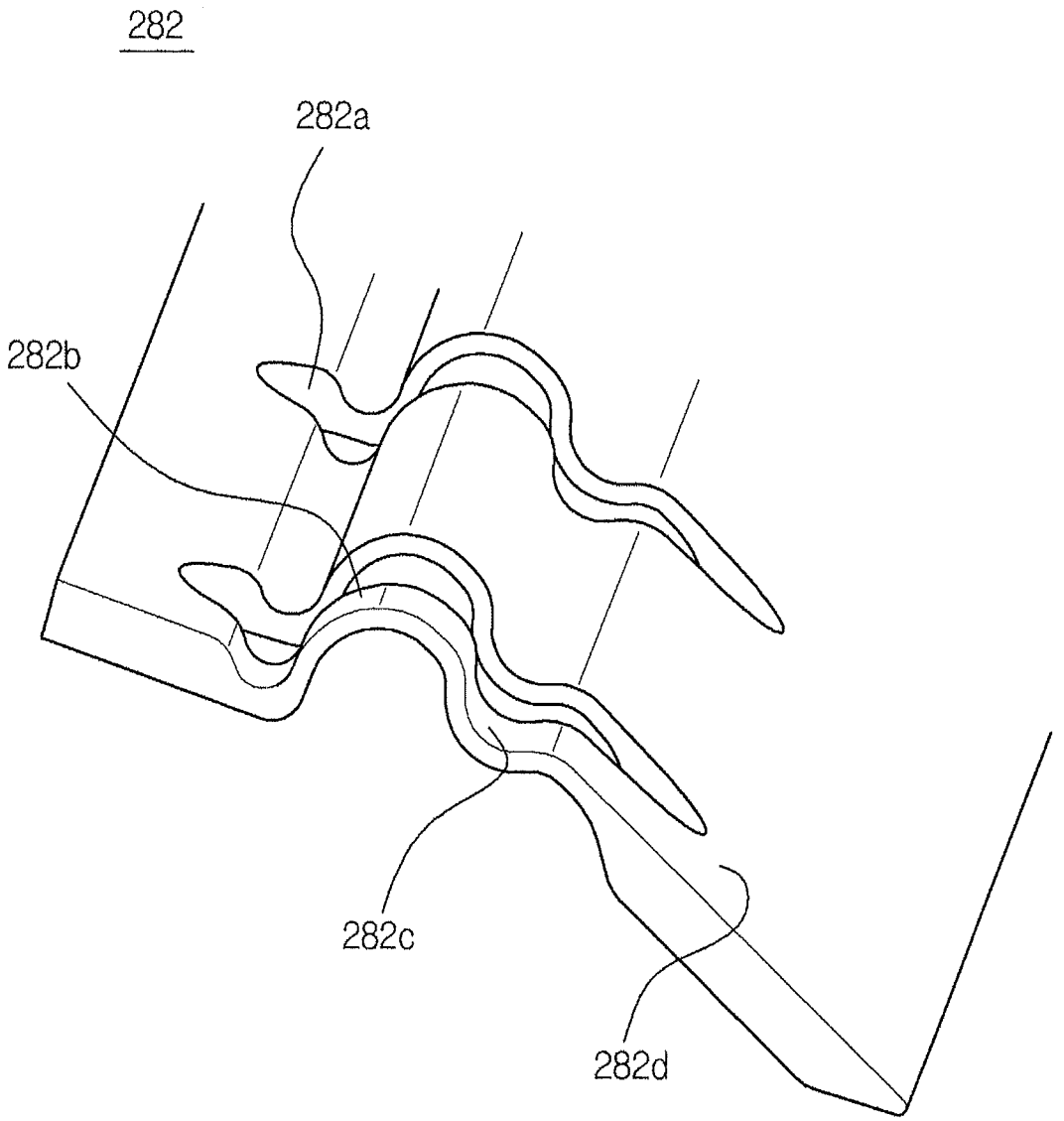

FIG.13

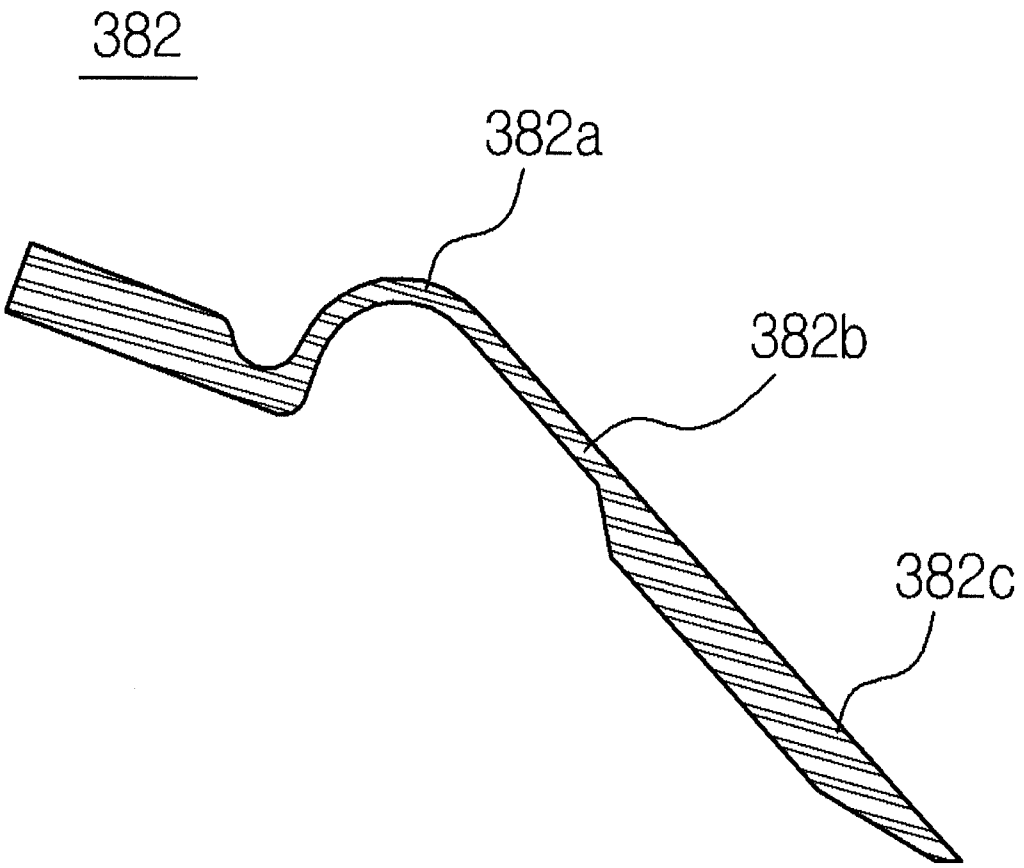

FIG.14

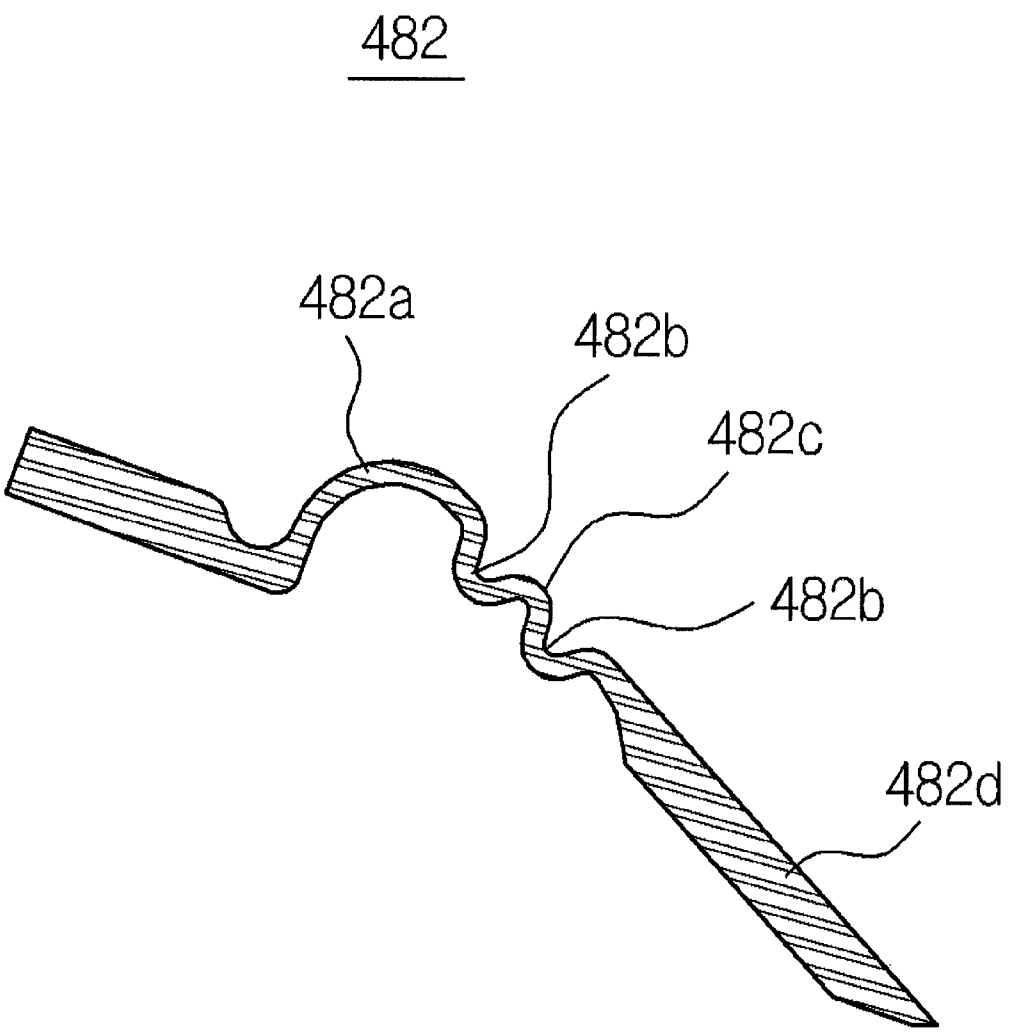

FIG.15

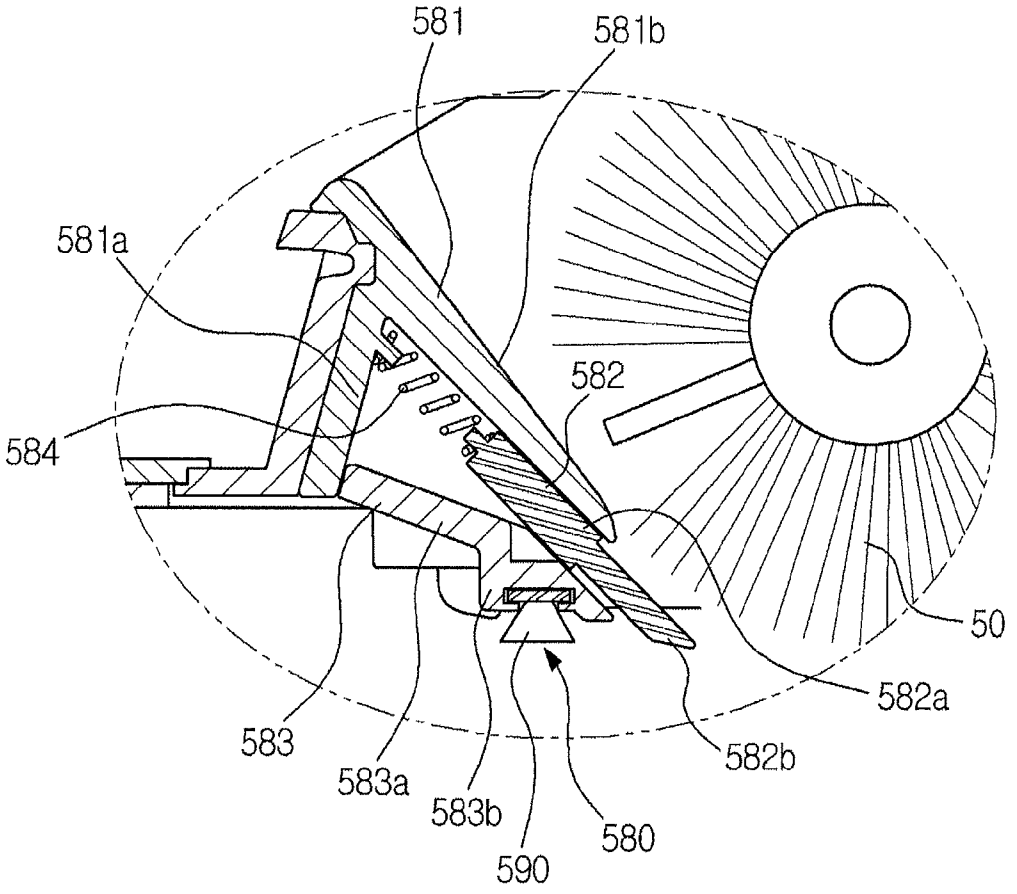

FIG.16

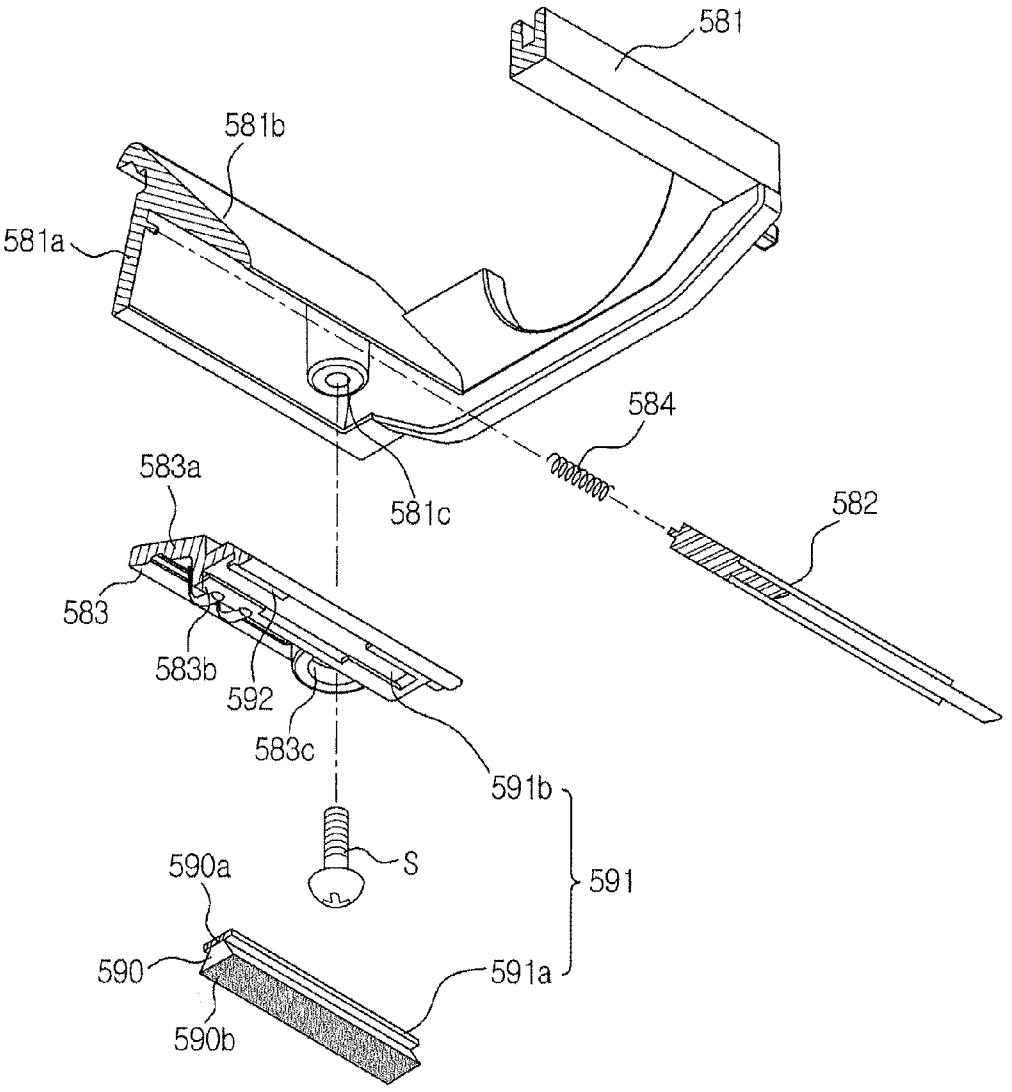
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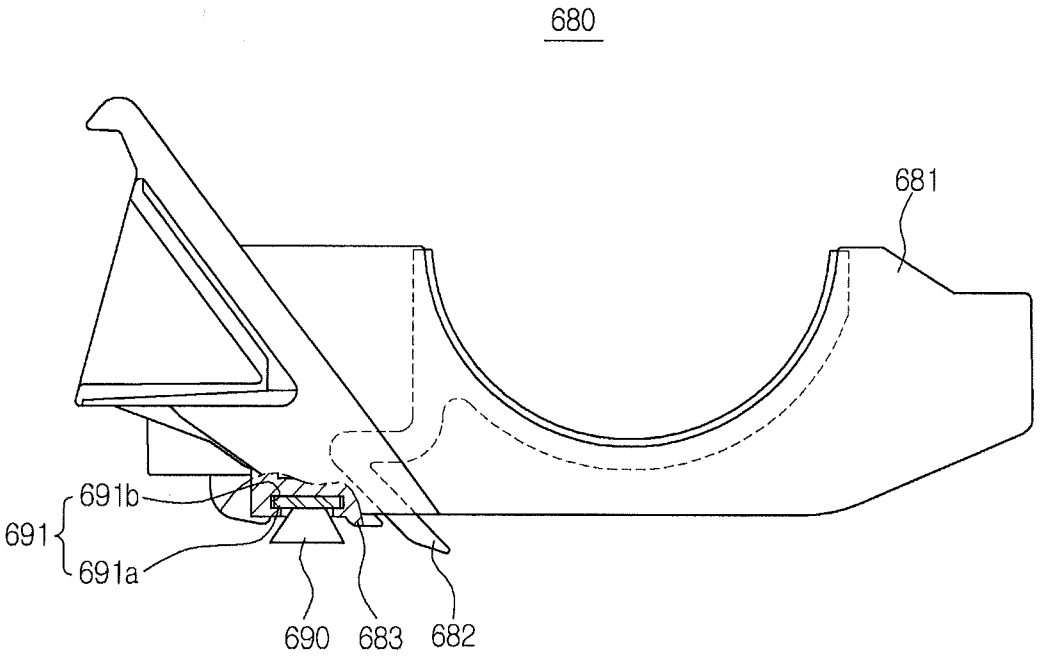
FIG.17



AUTONOMOUS CLEANING DEVICE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of Korean Patent Application No. 10-2012-0081487, filed on Jul. 25, 2012 and No. 10-2012-0085321, filed on Aug. 3, 2012 in the Korean Intellectual Property Office, the disclosure of which is incorporated herein by reference

BACKGROUND

[0002] 1. Field

[0003] One or more embodiments relate to an autonomous cleaning device, and more particularly, an autonomous cleaning device in which the structure of a blade assembly is improved, thereby reducing noise that occurs during cleaning.

[0004] 2. Description of the Related Art

[0005] An autonomous mobile robot is a device that travels about an arbitrary area to perform a predetermined task without user manipulation. The robot may travel autonomously to a considerable extent, and autonomous travel may be embodied in various manners. For example, the robot may travel along a predetermined route using a map or may travel using a sensor to sense surroundings thereof without following a predetermined route.

[0006] An autonomous cleaning device travels about an area to be cleaned so as to clean a floor without user manipulation. Specifically, the autonomous cleaning device may function to remove dust or clean a floor at home. Here, dust may include, for example, dirt, motes, powder, fragments and other dust particles that may be collected by a vacuum cleaning device, an automatic or semiautomatic cleaning device.

[0007] The autonomous cleaning device includes a brush unit to sweep up dust and a blade to guide the dust to a dust box. In the related art, when an unevenness floor area is cleaned, noise occurs due to friction between the blade and the floor.

SUMMARY

[0008] Therefore, it is an aspect of one or more embodiments to provide an autonomous cleaning device that may reduce noise caused by friction with a floor.

[0009] Additional aspects and/or advantages of one or more embodiments will be set forth in part in the description which follows and, in part, will be apparent from the description, or may be learned by practice of one or more embodiments of disclosure. One or more embodiments are inclusive of such additional aspects.

[0010] In accordance with one or more embodiments, there is provided an autonomous cleaning device that may include: a main body having an opening; a brush unit that is rotatably disposed in the opening of the main body; and a blade assembly that may guide introduction of dust swept up by the brush unit, wherein the blade assembly may include: a blade that may guide dust toward an inner side of the main body; a support member that may be coupled to the blade so as to support the blade and that may have one side in which a coupling groove is formed; and an insertion member that may be inserted into the coupling groove of the support member.

[0011] A coupling jaw may be disposed at one side of the insertion member and may be coupled to the coupling groove.

[0012] The support member may include at least one deviation prevention jaw so as to possibly prevent deviation of the insertion member.

[0013] The at least one deviation prevention jaw may be disposed at both sides of the coupling groove so as to face each other based on the coupling groove.

[0014] The insertion member may include a plate coupled to the support member and a contact part coupled to the plate.

[0015] The contact part may be formed of a flexible material.

[0016] The blade assembly may further include a fixing member that is disposed adjacent to the blade so that at least a portion of the blade may closely contact a floor.

[0017] The blade assembly may further include at least one elastic member that is coupled to an end of the blade so that the blade may move in a forward/backward direction of a direction in which the autonomous cleaning device travels.

[0018] One side of the at least one elastic member may be coupled to an end of the blade, and the other side of the at least one elastic member may be coupled to the fixing member.

[0019] The blade may be formed of an elastic material so that the blade may move in a forward/backward direction of a direction in which the autonomous cleaning device travels.

[0020] The blade may include at least one movement part that moves in a forward/backward direction of a direction in which the autonomous cleaning device travels.

[0021] The fixing member and the support member may be integrally injection molded.

[0022] The fixing member and the support member may be integrally injection molded, and the blade may be injection molded between the fixing member and the support member.

[0023] The blade may include a first part fixed to the main body and a second part that extends from the first part to the floor, and the support member may include a first support part that contacts the first part of the blade and a second support part that is disposed adjacent to the second part of the blade.

[0024] The fixing member may include a first fixing part that contacts the first part of the blade and a second fixing part that is disposed adjacent to the second part of the blade.

[0025] In accordance with one or more embodiments, there is provided an autonomous cleaning device that may include: a main body having an opening; a brush unit that is rotatably disposed in the opening of the main body; and a blade assembly that may guide introduction of dust swept up by the brush unit, wherein the blade assembly may include: a blade that may guide dust toward an inner side of the main body; a support member that may be coupled to the blade so as to support the blade; and an insertion member that may be coupled to one side of the support member so as to possibly prevent noise caused by friction between the support member and a floor.

[0026] The insertion member may be disposed at a rear of the support member so as to be positioned in a space between the support member and the floor.

[0027] The insertion member may include a plate coupled to the support member and a contact part coupled to the plate and formed of a flexible material, and the insertion member may be inserted into and coupled to one side of the support member.

[0028] A coupling groove may be disposed in one side of the support member so that the insertion member may be inserted into the support member through the coupling groove, and a coupling jaw may be disposed at one side of the

insertion member so that the insertion member may be coupled to the support member through the coupling jaw.

[0029] A deviation prevention jaw may be disposed at both sides of the coupling groove so as to possibly prevent deviation of the insertion member.

[0030] In accordance with one or more embodiments, there is provided an autonomous cleaning device that may include: a main body having an opening; a brush unit that is rotatably disposed in the opening of the main body; and a blade assembly that may guide introduction of dust swept up by the brush unit, wherein the blade assembly may include: a blade that may guide dust toward an inner side of the main body and may include at least one wrinkle part so as to be movable in a forward/backward direction of a direction in which the autonomous cleaning device travels; and a support member that may be coupled to the blade so as to support the blade.

[0031] The at least one wrinkle part may include at least one of a mount-shaped part that protrudes from an upper side of the blade and a valley-shaped part that protrudes from a lower side of the blade.

[0032] The autonomous cleaning device may further include an insertion member having a coupling jaw through which the insertion member is inserted into a coupling groove, and the support member may include the coupling groove.

[0033] The support member may include at least one deviation prevention jaw that may be disposed facing each other based on the coupling groove so as to possibly prevent deviation of the insertion member.

[0034] The insertion member may include a plate coupled to the support member and a contact part coupled to the plate, and the contact part may be formed of a flexible material.

[0035] The blade may be formed of an elastic material so as to be movable in a forward/backward direction of a direction in which the autonomous cleaning device travels.

[0036] The blade may be formed of hydrogenated nitrile butadiene rubber (HNBR).

[0037] The blade assembly may further include a fixing member that may be disposed adjacent to the blade so that at least a portion of the blade can closely contact a floor.

BRIEF DESCRIPTION OF THE DRAWINGS

[0038] These and/or other aspects will become apparent and more readily appreciated from the following description of embodiments, taken in conjunction with the accompanying drawings of which:

[0039] FIG. **1** is a perspective view illustrating an autonomous cleaning device according to one or more embodiments;

[0040] FIG. **2** is a cross-sectional view illustrating autonomous cleaning device one or more embodiments;

[0041] FIG. **3** is a bottom perspective view illustrating an autonomous cleaning device one or more embodiments;

[0042] FIG. **4** is an enlarged cross-sectional view illustrating a blade assembly according to one or more embodiments;

[0043] FIG. **5** is a perspective view illustrating a rear side of a blade assembly according to one or more embodiments, such as the blade assembly illustrated in FIG. **4**;

[0044] FIG. **6** is a view illustrating a state in which an insertion member is separated from a support member, according to one or more embodiments;

[0045] FIG. **7** is a view illustrating portions of an insertion member and a support member according to one or more embodiments, such as the insertion member and the support member illustrated in FIG. **6**;

[0046] FIG. **8** is a view illustrating a state in which an insertion member is separated from a support member, according to one or more embodiments;

[0047] FIG. **9** is a view illustrating portions of an insertion member and a support member according to one or more embodiments, such as the insertion member and the support member illustrated in FIG. **8**;

[0048] FIG. **10** is an enlarged cross-sectional view illustrating a blade assembly according to one or more embodiments;

[0049] FIG. **11** is an exploded view illustrating a blade assembly according to one or more embodiments, such as the blade assembly illustrated in FIG. **10**;

[0050] FIG. **12** is an enlarged view illustrating a blade according to one or more embodiments;

[0051] FIG. **13** is a cross-sectional view illustrating a blade in a latitudinal direction according to one or more embodiments;

[0052] FIG. **14** is a cross-sectional view illustrating a blade in a latitudinal direction according to one or more embodiments;

[0053] FIG. **15** is an enlarged cross-sectional view illustrating a blade assembly according to one or more embodiments;

[0054] FIG. **16** is an exploded view illustrating a blade assembly according to one or more embodiments, such as the blade assembly illustrated in FIG. **15**; and

[0055] FIG. **17** is an enlarged cross-sectional view of a blade assembly according to one or more embodiments.

DETAILED DESCRIPTION

[0056] Reference will now be made in detail to one or more embodiments, illustrated in the accompanying drawings, wherein like reference numerals refer to like elements throughout. In this regard, embodiments of the present invention may be embodied in many different forms and should not be construed as being limited to embodiments set forth herein, as various changes, modifications, and equivalents of the systems, apparatuses and/or methods described herein will be understood to be included in the invention by those of ordinary skill in the art after embodiments discussed herein are understood. Accordingly, embodiments are merely described below, by referring to the figures, to explain aspects of the present invention.

[0057] FIG. **1** is a perspective view illustrating an autonomous cleaning device **10** according to one or more embodiments, FIG. **2** is a cross-sectional view illustrating an autonomous cleaning device according to one or more embodiments, such as the autonomous cleaning device **10** illustrated in FIG. **1**, and FIG. **3** is a bottom perspective view illustrating an autonomous cleaning device according to one or more embodiments, such as the autonomous cleaning device **10** of FIG. **1**.

[0058] As illustrated in FIGS. **1** through **3**, the autonomous cleaning device **10** may include a main body **11**, a driving unit **20**, a cleaning unit **30**, and a controller (not shown).

[0059] The main body **11** may be configured in various forms. For example, the main body **11** may be configured in a circular form. The circular main body **11** may have a uniform radius of rotation, and therefore, the main body **11** may avoid contact with surrounding obstacles and may change

course. Also, during travel, the main body **11** may be prevented from being caught by surrounding obstacles.

[0060] Various components, such as the driving unit **20**, the cleaning unit **30**, various sensors **12** and **13**, a display unit **14**, and the controller (not show), to perform cleaning may be disposed at the main body **11**.

[0061] The driving unit **20** may enable the main body **11** to travel about an area to be cleaned. The driving unit **20** may include left and right drive wheels **21***a* and **21***b* and a caster **22**. Power from a motor (not shown) may be supplied to the left and right drive wheels **21***a* and **21***b*. Also, the left and right drive wheels **21***a* and **21***b* may be mounted at the middle region of the bottom of the main body **11**, and the caster **22** may be mounted at the front region of the bottom of the main body **11** so that the main body **11** may maintain a stable posture.

[0062] The left and right drive wheels **21***a* and **21***b* and the caster **22** may constitute a single assembly, which may be detachably mounted to the main body **11**.

[0063] The cleaning unit **30** may remove dust from a floor on which the main body **11** is positioned and surroundings thereof. The cleaning unit **30** may include a side brush **40**, a brush drum unit **50**, and a dust box **60**.

[0064] The side brush **40** may be rotatably mounted at one side of the edge of the bottom of the main body **11**. The side brush **40** may deviate from the middle region of the main body **11** with an inclination to the front F of the main body **11**.

[0065] The side brush **40** may move dust collected around the main body **11** to an area of a floor where the main body **11** is positioned. The side brush **40** may extend a cleaning range to an area around the floor where the main body **11** is positioned. In particular, the side brush **40** may remove dust collected from a corner, which is a boundary between the floor and walls.

[0066] The brush drum unit **50** may be mounted at a position deviating from the middle region of the bottom of the main body **11**. The brush drum unit **50** may deviate from the left and right drive wheels **21***a* and **21***b* mounted at the middle region of the bottom of the main body **11** toward the rear R of the main body **11**.

[0067] The brush drum unit **50** may remove dust collected on the floor where the main body **11** is positioned. The brush drum unit **50** may include a dust introduction channel **50***a* forming a dust introduction route. Also, the brush drum unit **50** may include a brush unit **51** disposed in the dust introduction channel **50***a* to sweep dust off of the floor.

[0068] The brush unit **51** may include a roller **51***a* and a brush **51***b* formed at an outer circumferential surface of the roller **51***a*. Power from a motor (not shown) may be supplied to the roller **51***a*. As the roller **51***a* rotates, the brush **51***b* may sweep up dust collected on the floor. The roller **51***a* may be formed of a rigid body. However, aspects of embodiments are not limited thereto. The brush **51***b* may be formed of various materials exhibiting high elasticity.

[0069] The brush unit **51** may be driven at uniform speed to maintain uniform cleaning performance. When a floor surface that is not smooth, for example, such as a carpet, is cleaned, the rotational speed of the brush unit **51** may be lower than the rotational speed of the brush unit **51** when a smooth floor surface is cleaned. At this time, additional current may be supplied to possibly allow the rotational speed of the brush unit **51** to be uniformly maintained.

[0070] The dust box **60** may be mounted at the rear R of the main body **11**. An introduction port **64** of the dust box **60** may communicate with the dust introduction channel **50***a* of the brush drum unit **50**. Thus, dust swept by the brush unit **51** may be stored in the dust box **60** via the dust introduction channel **50***a*.

[0071] The dust box **60** may be divided into a large dust box **61** and a small dust box **62** by a partition wall **63**. Correspondingly, the introduction port **64** may be divided into a first introduction port **64***a* disposed at an inlet of the large dust box **61** and a second introduction port **64***b* disposed at an inlet of the small dust box **62**.

[0072] The brush unit **51** may sweep relatively large dust particles into the large dust box **61**. A blowing unit **52** may suction relatively small airborne dust, such as hair, into the small dust box **62**. In particular, a brush cleaning member (not shown) may be disposed at a position adjacent to the second introduction port **64***b* to separate hair from the brush unit **51**. The hair separated from the brush unit **51** by the brush cleaning member (not shown) may be stored in the small dust box **62** by suction force of the blowing unit **52**.

[0073] Also, a dust amount detection unit **65** may be disposed in the dust box **60** to detect whether the dust box **60** is filled with dust. The dust amount detection unit **65** may include a light emitting part **65***a* to emit a beam and a light receiving part **65***b* to receive the beam. When the amount of light received by the light receiving part **65***b* is equal to or less than a predetermined value, it may be determined that the dust box **60** is filled with dust.

[0074] The brush drum unit **50**, the brush unit **51**, and the dust box **60** may constitute a single assembly, which may be detachably mounted to the main body **11**.

[0075] The sensors **12** and **13** may include, for example, a proximity sensor **12** and/or an optical sensor **13**. For example, when the autonomous cleaning device **10** travels in an arbitrary direction without a predetermined route, i.e. in a cleaning system having no map, the autonomous cleaning device **10** may travel about an area to be cleaned using the proximity sensor **12**. On the other hand, when the autonomous cleaning device **10** travels along a predetermined route, i.e. in a cleaning system having a map, the optical sensor **13** may be disposed to receive position information of the autonomous cleaning device **10** and create a map. The optical sensor **13** may correspond to an embodiment of a location recognition system. Other various methods may be provided.

[0076] The display unit **14** may display various states of the autonomous cleaning device **10**. For example, the display unit **14** may display a battery charge state, whether the dust box **60** is filled with dust, and a cleaning mode or a resting mode of the autonomous cleaning device **10**, etc.

[0077] The controller (not shown) may control the driving unit **20** and the cleaning unit **30** to efficiently perform a cleaning task. The controller (not shown) may receive signals from the sensors **12** and **13** to avoid an obstacle or change travel modes.

[0078] Also, the controller (not shown) may receive a signal from the dust amount detection unit **65**. If it is determined that the dust box **60** is filled with dust, the controller (not shown) may dock with a maintenance station (not shown) to automatically remove dust from the dust box **60** or may sound an alarm to notify a user.

[0079] Also, the controller (not shown) may receive a signal from a dust introduction detection unit (not shown) to distinguish between an area from which dust is introduced and an area from which dust is not introduced. For example, an area may be traveled over repeatedly, a travel speed may be

reduced or rotational force of the brush unit **51** or the suction force of the blowing unit **52** may be increased to improve cleaning efficiency at an area from which dust is introduced. On the other hand, a cleaning sequence may be delayed or the number of times of travel may be reduced at an area from which dust is not introduced.

[0080] FIG. **4** is an enlarged cross-sectional view illustrating a blade assembly **80** according to one or more embodiments.

[0081] As illustrated in FIG. **4**, the blade assembly **80** may be disposed in the main body **11** so as to guide introduction of dust. The blade assembly **80** may be mounted at the rear of the brush unit **51** to serve as a kind of dustpan when the brush unit **51** sweeps dust.

[0082] The blade assembly **80** may include a blade **82**, a fixing member **81**, and a support member **83**.

[0083] The blade **82** may be fixed to the main body **11** and may guide dust toward an inner side of the main body **11**. The blade **82** may include a first part **82***a* that constitutes an upper part thereof and a second part **82***b* that may extend from the first part **82***a* toward a floor side. The second part **82***b* of the blade **82** may be inclined downward. The second part **82***b* of the blade **82** may extend from the floor to a guide **82***d* for guiding introduction of dust. Dust may be introduced into the main body **11** along the guide **82***d*. A bent part **82***c* may be formed between the guide **82***d* and the second guide **82***b* so as to adjust an angle between the guide **82***d* and the floor. Thus, introduction of dust may be guided. Although not shown, a plurality of guides may be disposed spaced apart from each other by a predetermined gap.

[0084] The blade **82** may be formed of a flexible material, such as rubber, and may be inclined downward toward the floor. In this case, an end of the blade **82** may closely contact the floor.

[0085] The support member **83** may restrict movement of the blade **82** to within a predetermined range and may be coupled to the blade **82**. The support member **83** may be coupled to a lower part of the blade **82**. The fixing member **81** may be disposed adjacent to the blade **82** so that at least a portion of the blade closely contacts the floor. The fixing member **81** may be coupled to the upper part of the blade **82**. The fixing member **81** and the support member **83** may be installed so that the blade **82** exhibits rigidity and flexibility. As a result, the performance of the blade **82** may be increased to improve cleaning efficiency.

[0086] The first part **82***a* of the blade **82** may be tightly fixed by a first fixing part **81***a* of the fixing member **81** and a first support part **83***a* of the support member **83**. That is, the first part **82***a* of the blade **82** may be inserted and supported between the first fixing part **81***a* of the fixing member **81** and the first support part **83***a* of the support member **83**. Thus, the first part **82***a* of the blade **82** may not be moved.

[0087] A second fixing part **81***b* of the fixing member **81** may be disposed adjacent to an upper part of the second part **82***b* of the blade **82**. A second support part **83***b* of the support member **83** may be disposed adjacent to the lower part of the second part **82***b* of the blade **82**. As a result, the second part **82***b* of the blade **82** may be moved between the second fixing part **81***b* of the fixing member **81** and the second support part **83***b* of the support member **83**, of which movement may be restricted to within a predetermined range. In particular, the second support part **83***b* of the support member **83** may prevent the second part **82***b* of the blade **82** from being bent in an opposite direction to a direction of travel of the main body **11**, thereby possibly securing operational reliability of the blade **82**.

[0088] An insertion member **90** may be disposed at one side of the support member **83** so as to possibly prevent noise from occurring due to friction between the support member **83** and the floor. The insertion member **90** may be disposed at a rear side of the support member **83** so as to be positioned in a space between the support member **83** and the floor. The blade **82** may contact the floor while the autonomous cleaning device **10** travels. Thus, when a rugged tatami floor is cleaned, an end of the second part **82***b* of the blade **82** may fall into valleys of the tatami floor and may collide with ridges of the tatami floor, and the blade **82** may be damaged. This may cause damage of the tatami floor and the occurrence of noise while cleaning is performed using the autonomous cleaning device **10**. The insertion member **90** may be disposed to prevent such damage and noise. Since the insertion member **90** may be disposed at the rear side of the support member **83**, noise may be reduced while the autonomous cleaning device **10** travels.

[0089] Although the insertion member **90** is disposed on the support member **83**, aspects of one or more embodiments are not limited thereto. For example, the insertion member **90** may be disposed on an end of the blade **82**.

[0090] FIG. **5** is a perspective view illustrating a rear side of a blade assembly according to one or more embodiments, such as the blade assembly **80** illustrated in FIG. **4**. FIG. **6** is a view illustrating a state in which an insertion member **90** is separated from a support member **83**, according to one or more embodiments. FIG. **7** is a view illustrating portions of an insertion member and a support member, such as the insertion member **90** and the support member **83** illustrated in FIG. **6**.

[0091] As illustrated in FIGS. **5** through **7**, the fixing member **81** may be disposed with a protrusion **81***c* having a screw groove. The blade **82** and the support member **83** may have holes **82***e* and **83***d* through which the protrusion **81***a* of the fixing member **81** may be inserted. The protrusion **81***c* of the fixing member **81** may be sequentially inserted through the hole **82***e* of the blade **82** and the hole **83***d* of the support member **83**, and then a screw S may be coupled to the protrusion **81***c* of the fixing member **81**, thereby completing the blade assembly **80**.

[0092] The insertion member **90** may be inserted into and coupled to one side of the support member **83**; however, aspects of one or more embodiments are not limited thereto. The insertion member **90** may, for example, be disposed at the second support part **83***b* of the support member **83** and may face the floor.

[0093] According to one or more embodiments, the insertion member **90** may include a plate **90***a* coupled to the support member **83** and a contact part **90***b* coupled to the plate **90***a*. The contact part **90***b* may be formed of a flexible material, such as a brush, rubber, sponge or fiber, so as to possibly reduce damage to the floor.

[0094] A coupling part **91** may be disposed at a contact surface between the insertion member **90** and the support member **83** so as to couple the insertion member **90** to the support member **83**. The coupling part **91** may include a coupling jaw **91***a* disposed at one side of the insertion member **90** and a coupling groove **91***b* formed in one side of the support member **83**. As shown in FIG. **7**, the coupling groove **91***b* may be disposed in the rear side of the support member **83** and may have one side that is open. The coupling jaw **91***a* of the insertion member **90** may be coupled to the open side of

the coupling groove **91***b*. The coupling jaw **91***a* of the insertion member **90** may be disposed on the plate **90***a* to have a shape corresponding to the coupling groove **91***b*. As shown in FIG. **7**, the coupling groove **91***b* and the coupling jaw **91***a* may be rectangular; however, aspects of one or more embodiments are not limited thereto.

[0095] FIG. **8** is a view illustrating a state in which an insertion member **190** is separated from a support member **183**, according to one or more embodiments, and FIG. **9** is a view illustrating portions of an insertion member and a support member according to one or more embodiments, such as the insertion member **190** and the support member **183** illustrated in FIG. **8**.

[0096] As illustrated in FIGS. **8** and **9**, a coupling part **191** may include a deviation prevention jaw **192**. At least one deviation prevention jaw **192** may be disposed on the support member **183** so as to possibly prevent deviation of the insertion member **190**. The deviation prevention jaw **192** may be disposed at an outer side of a coupling groove **191***b*, i.e., may be disposed at both sides of the coupling groove **191***b* in a state in which the coupling groove **191***b* is interposed between the deviation prevention jaws **192**. The deviation prevention jaw **192** disposed at one side of both sides of the coupling groove **191** b is referred to as a first deviation prevention jaw **192***a*, and the deviation prevention jaw **192** disposed at the other side thereof is referred to as a second deviation prevention jaw **192***b*.

[0097] The first deviation prevention jaw **192***a* and the second deviation prevention jaw **192***b* may be disposed facing each other based on the coupling groove **191***b*. However, aspects of one or more embodiments are not limited thereto, and the first deviation prevention jaw **192***a* and the second deviation prevention jaw **192***b* may be disposed crossing each other. A plurality of deviation prevention jaws **192** may be provided as a plurality of pairs of deviation prevention jaws. The plurality of first deviation prevention jaws **192***a* and the plurality of second deviation prevention jaws **192***b* may be positioned at the same intervals. Due to the deviation prevention jaw **192**, the insertion member **90** may possibly be prevented from being deviated from time when an autonomous cleaning device travels.

[0098] FIG. **10** is an enlarged cross-sectional view illustrating a blade assembly **280** according to one or more embodiments. FIG. **11** is an exploded view illustrating a blade assembly according to one or more embodiments, such as the blade assembly **280** illustrated in FIG. **10**. FIG. **12** is an enlarged view illustrating a blade **282** according to one or more embodiments.

[0099] As illustrated in FIGS. **10** through **12**, the blade assembly **280** may be configured such that the blade **282** may be moved in a forward/backward direction of a direction in which an autonomous cleaning device travels. As illustrated in FIGS. **10** through **12**, the blade **282** may include at least one wrinkle part **282***b* and **282***c*. The wrinkle parts **282***b* and **282***c* may include a mount-shaped part **282***b* that protrudes from the upper part of the blade **282**, and a valley-shaped part **282***c* that protrudes from the lower part of the blade **282**. Thus, as the autonomous cleaning device **10** travels, the wrinkle parts **282***b* and **282***c* may have predetermined mobility. Also, the blade **282** may be formed of an elastic material. According to one or more embodiments, the blade **282** may be formed of hydrogenated nitrile butadiene rubber (HNBR). Since HNBR has flexibility and simultaneously has mechanical characteristics and strength, an autonomous cleaning device may not be damaged due to friction with the floor. Also, when an autonomous cleaning device travels over a cracked or rough floor, the blade **282** may be moved to some extent due to mobility of the wrinkles **282***b* and **282***c* and HNBR so that cleaning may be efficiently performed using the autonomous cleaning device. Thus, the autonomous cleaning device may be used in various floor conditions.

[0100] In addition, a blade contact surface **282***d* that contacts the floor may be somewhat inclined and may serve as a guide that guides introduction of dust on the floor toward an inner side of the main body. A support member **283** may restrict movement of the blade **282** to within a predetermined range. To this end, a protrusion **281***c* of a fixing member **281** may be inserted through a hole **282***a* formed in the blade **282**. Also, after the blade **282** is inserted, the protrusion **281** c of the fixing member **281** may be inserted through a hole **283***c* of the support member **283**. The hole **282***a* of the blade **282** may be formed in such a way that the blade **282** may be moved relative to the fixing member **281**.

[0101] FIG. **13** is a cross-sectional view illustrating a blade **382** in a latitudinal direction according to one or more embodiments, and FIG. **14** is a cross-sectional view illustrating a blade **482** in a latitudinal direction according to one or more embodiments.

[0102] As illustrated in FIGS. **13** and **14**, the blades **382** and **482** may be configured in various forms.

[0103] According to one or more embodiments, such as illustrated in FIG. **13**, the blade **382** may include a wrinkle part **382***a* including only an upwardly-protruding mount-shaped part **382***a*. The blade **382** may extend from the mount-shaped part **382***a* to a blade contact surface **382***c* via an inclination **382***b*. In this case, the blade **382** may be more easily processed as compared to other embodiments.

[0104] According to one or more embodiments, such as illustrated in FIG. **14**, the blade **482** may include a plurality of wrinkle parts **482***a*, **482***b*, and **482***c*. Thus, mount-shaped parts **482***a* and **482***b* and valley-shaped parts **482***b* may be alternately arranged. A first mount-shaped part **482***a* may be positioned, and a second mount-shaped part **482***c* may be positioned between the valley-shaped parts **482***b*. Thus, mobility of the blade **482** may be relatively large.

[0105] FIG. **15** is an enlarged cross-sectional view illustrating a blade assembly **580** according to one or more embodiments, and FIG. **16** is an exploded view illustrating a blade assembly according to one or more embodiments, such as the blade assembly **580** illustrated in FIG. **15**.

[0106] As illustrated in FIGS. **15** and **16**, the blade assembly **580** may include at least one elastic member **584** that may be coupled to an end of a blade **582** so as to move in the forward/backward direction of the direction in which the autonomous cleaning device travels. The elastic member **584** may be a spring.

[0107] One side of the elastic member **584** may be coupled to the end of the blade **582**, and the other side of the elastic member **584** may be coupled to a fixing member **581**. Since the elastic member **584** may be inserted into a protrusion **581***c* of the fixing member **581** and the blade **582** may be coupled to the protrusion **581***c* of the fixing member **581**, the blade **582** may be moved relative to the fixing member **581**. At least one elastic member **584** may be provided. According to one or more embodiments, the elastic member **584** may be coupled to both sides of the blade **582**.

[0108] An insertion member **590** may be inserted in the lower side of a support member **583** so as to alleviate frictional force with the floor, like in other embodiments.

[0109] FIG. **17** is an enlarged cross-sectional view of a blade assembly according to another embodiment of the present invention.

[0110] As illustrated in FIG. **17**, a support member and a fixing member **681** may be integrally injection molded. A blade **682** may be injection molded between the support member **683** and the fixing member **681**. A mold (not shown) may be disposed between the support member **683** and the fixing member **681** to have a shape corresponding to that of the blade **682**. Thus, a resin that is a material for the blade **682** may be forcibly inserted into the mold (not shown).

[0111] A coupling groove **691***b* may be integrally injection molded in one side of the support member **683** that contacts the floor so that an insertion member **690** may be inserted into the support member **683** through the coupling groove **691***b*. A coupling jaw **691***a* may be disposed on the insertion member **690**, as in other embodiments, and the insertion member **690** may be inserted into the support member **683** so that the coupling jaw **691***a* may contact the coupling groove **691***b*.

[0112] As described above, in an autonomous cleaning device according to an embodiment of the present invention, noise may be prevented from occurring due to abnormal contact between a blade and a floor while the autonomous cleaning device travels.

[0113] While aspects of the present invention has been particularly shown and described with reference to differing embodiments thereof, it should be understood that these embodiments should be considered in a descriptive sense only and not for purposes of limitation. Descriptions of features or aspects within each embodiment should typically be considered as available for other similar features or aspects in the remaining embodiments. Suitable results may equally be achieved if the described techniques are performed in a different order and/or if components in a described system, architecture, device, or circuit are combined in a different manner and/or replaced or supplemented by other components or their equivalents.

[0114] Thus, although a few embodiments have been shown and described, with additional embodiments being equally available, it would be appreciated by those skilled in the art that changes may be made in these embodiments without departing from the principles and spirit of the invention, the scope of which is defined in the claims and their equivalents.

What is claimed is:

1. An autonomous cleaning device comprising:

a main body having an opening;

a brush unit rotatably disposed in the opening of the main body; and

a blade assembly to guide introduction of dust swept up by the brush unit,

wherein the blade assembly comprises:

a blade to guide dust toward an inner side of the main body;

a support member coupled to the blade so as to support the blade and having one side in which a coupling groove is formed; and

an insertion member inserted into the coupling groove of the support member.

2. The autonomous cleaning device according to claim **1**, wherein a coupling jaw is disposed at one side of the insertion member and is coupled to the coupling groove.

3. The autonomous cleaning device according to claim **2**, wherein the support member comprises at least one deviation prevention jaw to prevent deviation of the insertion member.

4. The autonomous cleaning device according to claim **3**, wherein the at least one deviation prevention jaw is disposed at both sides of the coupling groove so as to face each other based on the coupling groove.

5. The autonomous cleaning device according to claim **1**, wherein the insertion member comprises a plate coupled to the support member and a contact part coupled to the plate.

6. The autonomous cleaning device according to claim **5**, wherein the contact part is formed of a flexible material.

7. The autonomous cleaning device according to claim **1**, wherein the blade assembly further comprises a fixing member disposed adjacent to the blade so that at least a portion of the blade contacts a floor.

8. The autonomous cleaning device according to claim **1**, wherein the blade assembly further comprises at least one elastic member coupled to an end of the blade so that the blade is movable in a forward/backward direction of a direction in which the autonomous cleaning device travels.

9. The autonomous cleaning device according to claim **8**, wherein one side of the at least one elastic member is coupled to an end of the blade and the other side of the at least one elastic member is coupled to the fixing member.

10. The autonomous cleaning device according to claim **1**, wherein the blade is formed of an elastic material so that the blade is movable in a forward/backward direction of a direction in which the autonomous cleaning device travels.

11. The autonomous cleaning device according to claim **10**, wherein the blade comprises at least one movement part that moves in a forward/backward direction of a direction in which the autonomous cleaning device travels.

12. The autonomous cleaning device according to claim **7**, wherein the fixing member and the support member are integrally injection molded.

13. The autonomous cleaning device according to claim **12**, wherein the fixing member and the support member are integrally injection molded and the blade is injection molded between the fixing member and the support member.

14. The autonomous cleaning device according to claim **1**, wherein the blade comprises a first part fixed to the main body and a second part that extends from the first part to the floor and the support member comprises a first support part that contacts the first part of the blade and a second support part disposed adjacent to the second part of the blade.

15. The autonomous cleaning device according to claim **14**, wherein the fixing member comprises a first fixing part that contacts the first part of the blade and a second fixing part disposed adjacent to the second part of the blade.

16. An autonomous cleaning device comprising:

a main body having an opening;

a brush unit rotatably disposed in the opening of the main body; and

a blade assembly to guide introduction of dust swept up by the brush unit,

wherein the blade assembly comprises:

a blade to guide dust toward an inner side of the main body;

a support member coupled to the blade so as to support the blade; and

an insertion member coupled to one side of the support member so as to prevent noise caused by friction between the support member and a floor.

17. The autonomous cleaning device according to claim **16**, wherein the insertion member is disposed at rear of the support member so as to be positioned in a space between the support member and the floor.

18. The autonomous cleaning device according to claim **16**, wherein the insertion member comprises a plate coupled to the support member and a contact part coupled to the plate and formed of a flexible material and the insertion member is inserted into and coupled to one side of the support member.

19. The autonomous cleaning device according to claim **18**, wherein a coupling groove is disposed in one side of the support member so that the insertion member is inserted into the support member through the coupling groove and a coupling jaw is disposed at one side of the insertion member so that the insertion member is coupled to the support member through the coupling jaw.

20. The autonomous cleaning device according to claim **19**, wherein a deviation prevention jaw is disposed at both sides of the coupling groove so as to prevention deviation of the insertion member.

21. An autonomous cleaning device comprising:

a main body having an opening;

a brush unit rotatably disposed in the opening of the main body; and

a blade assembly to guide introduction of dust swept up by the brush unit,

wherein the blade assembly comprises:

a blade to guide dust toward an inner side of the main body and comprising at least one wrinkle part so as to be movable in a forward/backward direction of a direction in which the autonomous cleaning device travels; and

a support member coupled to the blade so as to support the blade.

22. The autonomous cleaning device according to claim **21**, wherein the at least one wrinkle part comprises at least one of a mount-shaped part that protrudes from an upper side of the blade and a valley-shaped part that protrudes from a lower side of the blade.

23. The autonomous cleaning device according to claim **21**, further comprising an insertion member having a coupling jaw through which the insertion member is inserted into a coupling groove, wherein the support member comprises the coupling groove.

24. The autonomous cleaning device according to claim **23**, wherein the support member comprises at least one deviation prevention jaw disposed facing each other based on the coupling groove so as to prevent deviation of the insertion member.

25. The autonomous cleaning device according to claim **23**, wherein the insertion member comprises a plate coupled to the support member and a contact part coupled to the plate and the contact part is formed of a flexible material.

26. The autonomous cleaning device according to claim **21**, wherein the blade is formed of an elastic material so as to be movable in a forward/backward direction of a direction in which the autonomous cleaning device travels.

27. The autonomous cleaning device according to claim **26**, wherein the blade is formed of hydrogenated nitrile butadiene rubber (HNBR).

28. The autonomous cleaning device according to claim **21**, wherein the blade assembly further comprises a fixing member disposed adjacent to the blade so that at least a portion of the blade closely contacts a floor.

29. A blade assembly for an autonomous cleaning device, the blade assembly comprising:

a blade to guide dust toward an inner side of a main body of the autonomous cleaning device;

a support member coupled to the blade so as to support the blade; and

an insertion member coupled to one side of the support member so as to prevent noise caused by friction between the support member and a floor.

30. The blade assembly of claim **28**, further comprising at least one wrinkle part so as to be movable in a forward/backward direction of a direction in which the autonomous cleaning device travels.

31. The blade assembly of claim **30**, wherein the at least one wrinkle part comprises at least one of a mount-shaped part that protrudes from an upper side of the blade and a valley-shaped part that protrudes from a lower side of the blade.

32. The autonomous cleaning device according to claim **29**, wherein the blade assembly further comprises at least one elastic member coupled to an end of the blade so that the blade is movable in a forward/backward direction of a direction in which the autonomous cleaning device travels.

33. The autonomous cleaning device according to claim **29**, wherein the blade is formed of an elastic material so that the blade is movable in a forward/backward direction of a direction in which the autonomous cleaning device travels.

34. The autonomous cleaning device according to claim **33**, wherein the blade comprises at least one movement part that moves in a forward/backward direction of a direction in which the autonomous cleaning device travels.

35. The autonomous cleaning device according to claim **29**, wherein the insertion member comprises a plate coupled to the support member and a contact part coupled to the plate and the contact part is formed of a flexible material.

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