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ELECTRIC CLEANER****Publication Classification**(75) Inventor: **Kazuya Sudo**, Osaka (JP)(51) **Int. Cl.****A47L 5/00**

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ABSTRACT

An electric cleaner or an autonomous electric cleaner that prevents scattering of garbage and dust towards the back and both sides thereby enhancing cleaning rate (absorbing rate) is provided. In the autonomous electric cleaner 1 having an absorbing port 2b for absorbing garbage and dust arranged at the bottom surface of the main body 2 facing the floor or the cleaning surface, the back blade 11 and the side blades 12 that contact the floor and receive the garbage and dust without allowing them to pass are arranged at the back part and both the left and right sides, respectively, of the absorbing port 2b.

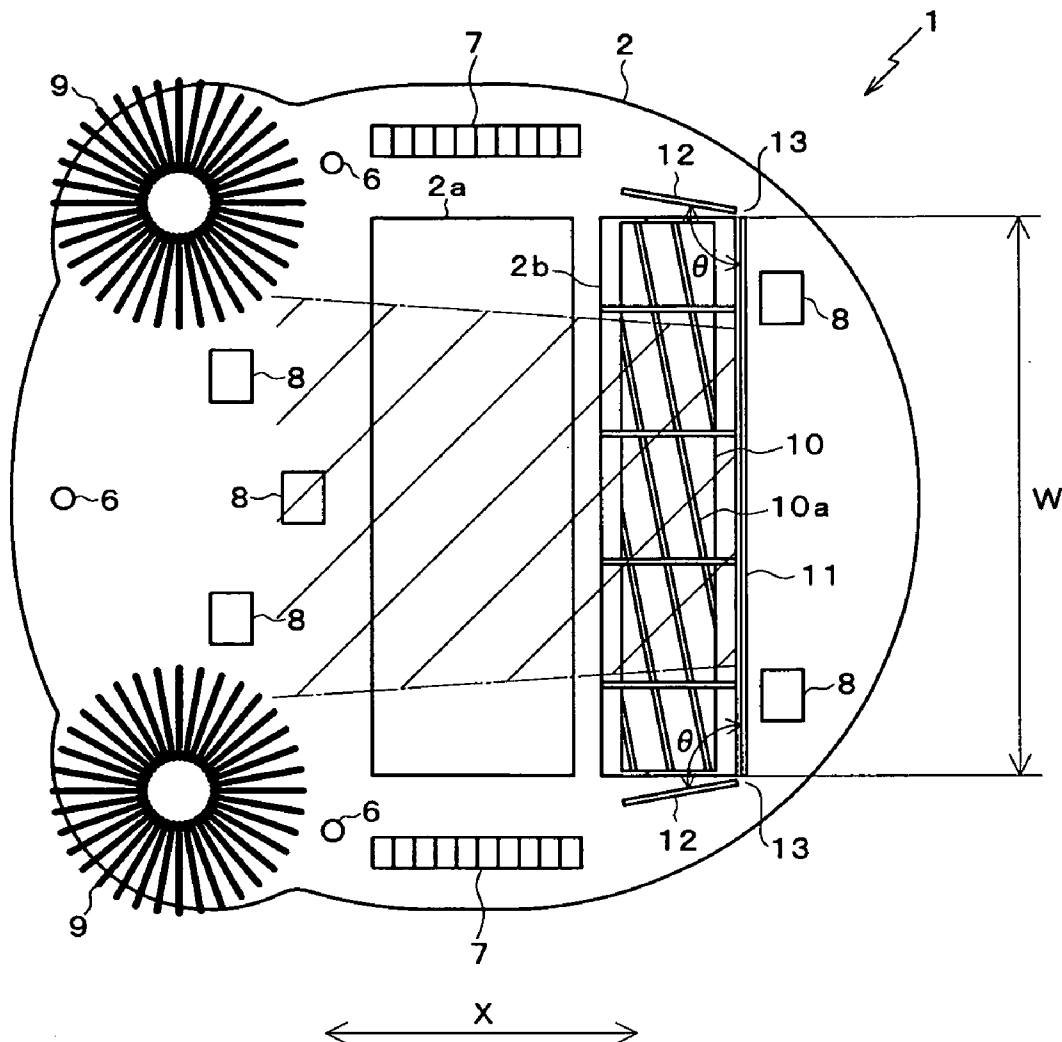


FIG. 1

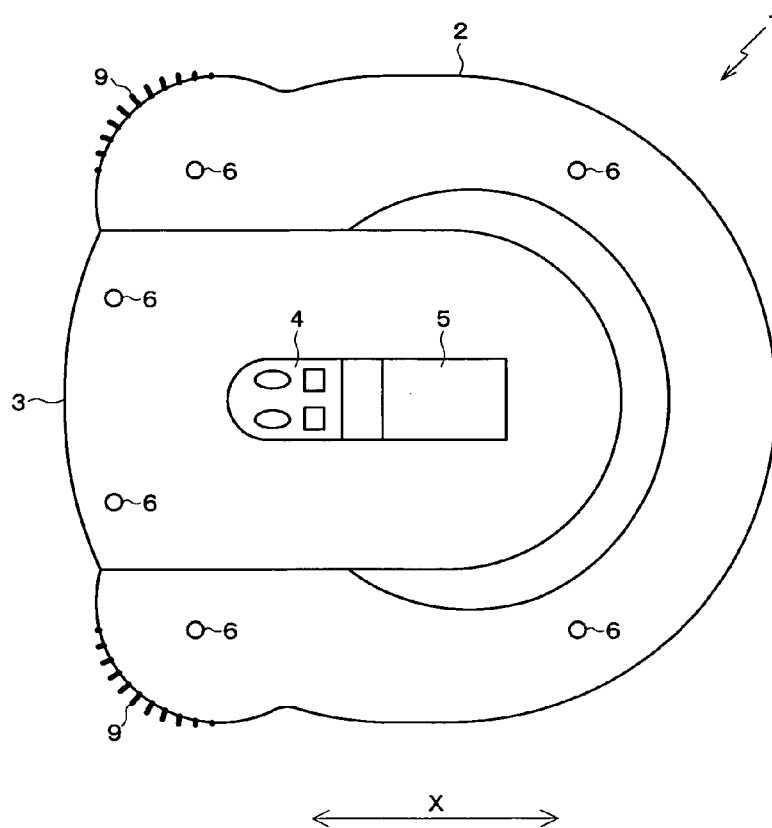


FIG. 2

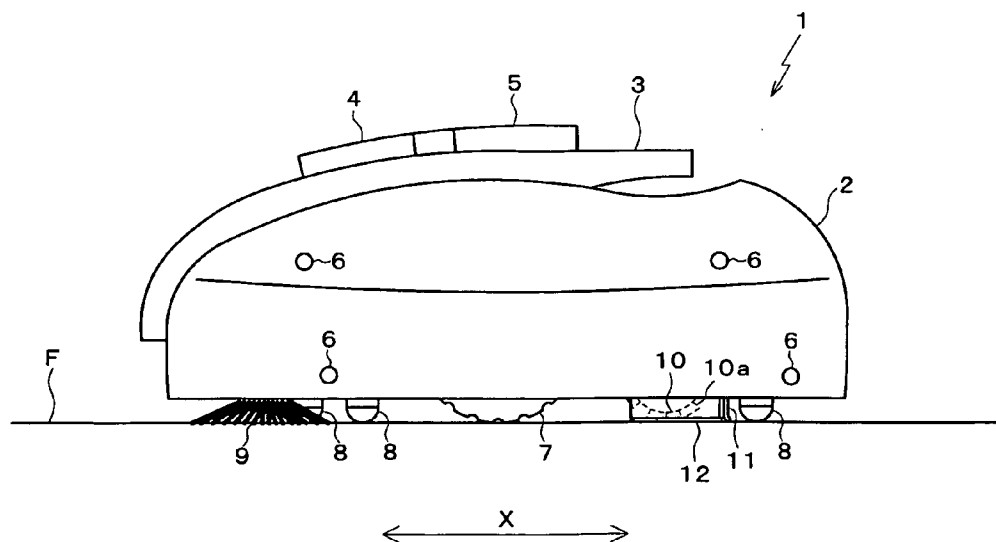


FIG. 3

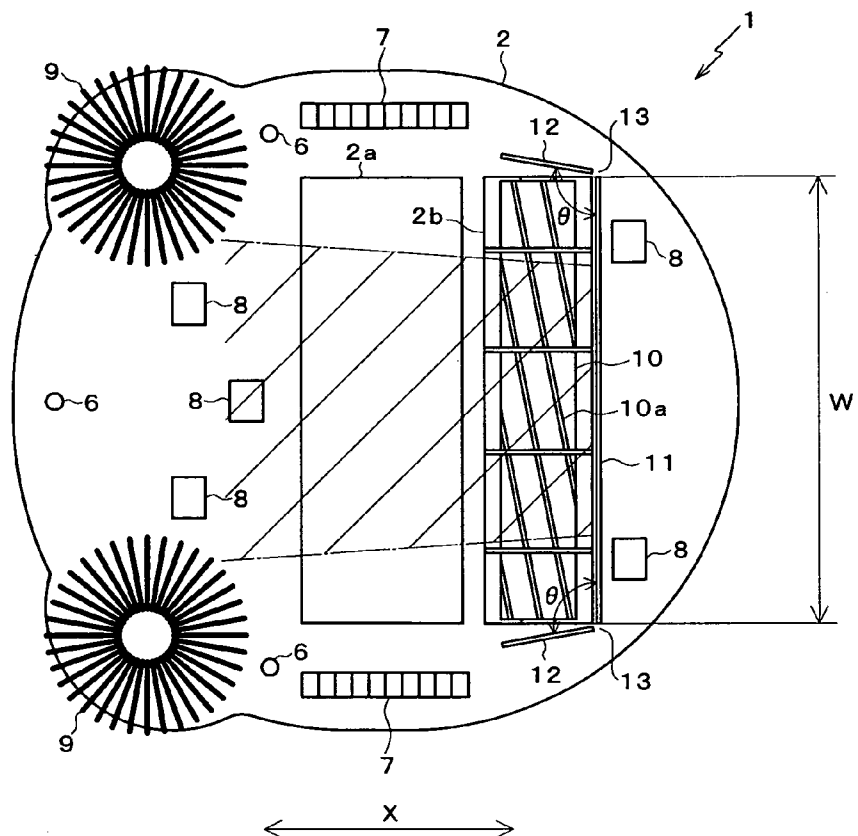


FIG. 4

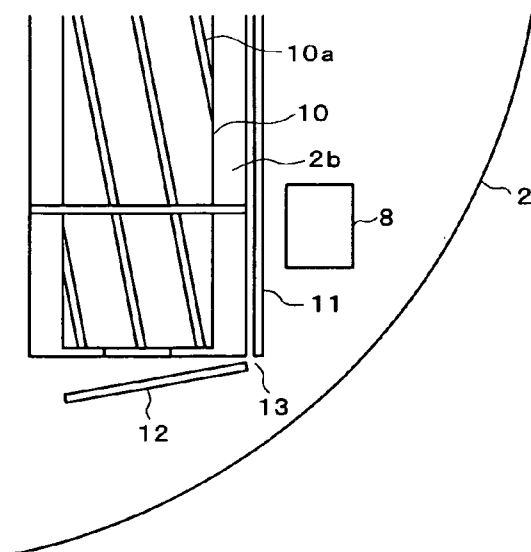
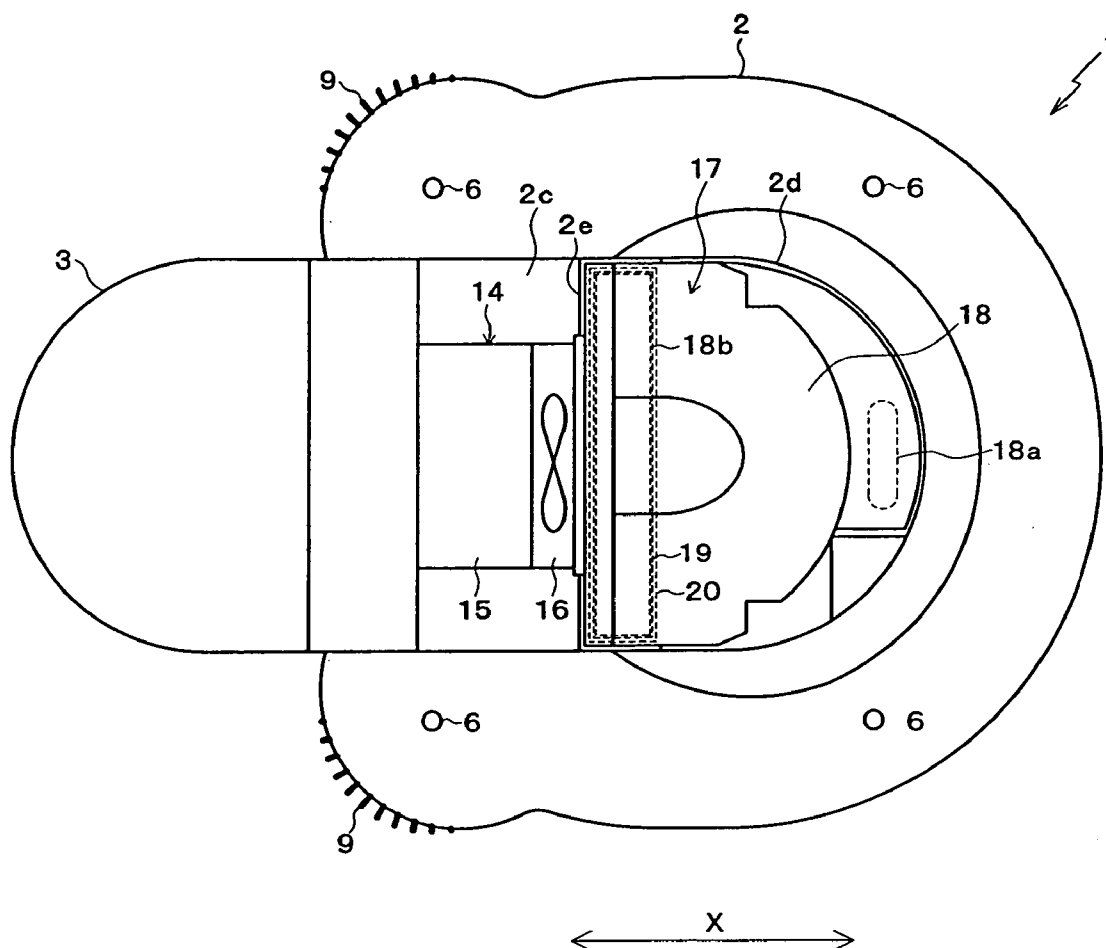


FIG. 5



AUTONOMOUS ELECTRIC CLEANER AND ELECTRIC CLEANER

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to an autonomous electric cleaner and an electric cleaner that absorbs garbage and dust on a cleaning surface to clean the cleaning surface.

[0003] 2. Description of the Related Art

[0004] The electric cleaner that absorbs garbage and dust on the cleaning surface such as floor to clean the cleaning surface includes an autonomous type in which the cleaner autonomously travels by the drive of the motor, and a non-autonomous type in which the cleaner is pulled by a person and the like. In either electric cleaner, garbage and dust on the cleaning surface are absorbed along with external air from the absorbing port facing the cleaning surface by the suction force generated by an electric air blower made up of a motor and a fan, where the garbage and dust are then separated from the external air and captured and collected by a dust collecting body made up of a filter and the like, and the cleaned air is exhausted to the outside.

[0005] The above described electric cleaner includes that in which a rotating cleaning body that collects the garbage and dust by rotating is arranged at the absorbing port, and a blade, a brush and the like is arranged at the front and the back of the absorbing port so as to contact the cleaning surface (refer to e.g., patent article 1, 2 below). Further, an electric cleaner has been provided in which two rotating cleaning bodies are arranged in the front and back direction at the absorbing port, a sweep-out device is arranged at the center of the absorbing port and between the rotating cleaning bodies, and a soft fiber contacting the cleaning surface is arranged at the distal end of the sweep-out device (refer to e.g., patent article 3 below). Further, an electric cleaner has been provided in which a dust attracting member formed by a material having a wiping cloth covered and attached on a soft core material such as brush, sponge and the like and formed with a plurality of cuts at the lower part, or an elastic member formed by a sponge-like porous material having high percentage of void are arranged around the absorbing port so as to face the cleaning surface (refer to e.g., patent article 4, 5 below).

[0006] Reference is made to patent article 1, Japanese Laid-Open Utility Model Publication No. H02-90762; patent article 2, Japanese Laid-Open Patent Publication No. 2001-149282; patent article 3, Japanese Laid-Open Patent Publication No. H09-10143; patent article 4, Japanese Laid-Open Patent Publication No. H11-253369; and patent article 5, Japanese Laid-Open Patent Publication No. 2000-5108.

SUMMARY OF THE INVENTION

[0007] As disclosed in patent articles 1 to 3, the garbage and dust are prevented from scattering backwards when the wall body that can receive the garbage and dust such as the blade and the sweep-out device is arranged at the back or at the center of the absorbing port, but scattering of hard garbage such as a small rock towards both sides by rolling etc. cannot be prevented, and thus the garbage and the like are sometimes not absorbed from the absorbing port. In particular, in case of the autonomous electric cleaner that is

mostly used in a situation of not monitored by a person, even if the garbage and dust are left unabsorbed while the cleaner is traveling on the cleaning surface, the operation of immediate returning back to where garbage and dust have been left unabsorbed is generally not performed, and thus the garbage and dust tend to remain on the cleaning surface. As disclosed in patent articles 4, 5, when the wall body through which the garbage and dust of a predetermined size can be passed through such as brush or dust attaching member or elastic member formed with a gap, a cut, or a void is arranged around the absorbing port, the garbage and dust of greater than the predetermined size cannot pass through the wall body from the front and approach the absorbing port, and may scatter to both sides and remain unabsorbed. Even if the garbage and dust of less than or equal to a predetermined size pass through the wall body from the front and approach the absorbing port, they may pass through the wall body and scatter backwards or to both sides before being absorbed from the absorbing port and remain unabsorbed.

[0008] The present invention provides, in an aim to solve the above problems, an electric cleaner and an autonomous electric cleaner that prevents garbage and dust from scattering backwards and towards both sides thereby enhancing the cleaning rate (absorption rate).

[0009] In the present invention, an electric cleaner absorbing garbage and dust from an absorbing port facing a cleaning surface is provided with receiving wall bodies respectively positioned at a back part and both sides of the absorbing port so as to contact the cleaning surface and receive the garbage and dust.

[0010] In this arrangement, the garbage and dust on the cleaning surface approach the absorbing port from the front that is opened, that is, not arranged with a receiving wall body, and scattering backwards and to both sides before being absorbed into the absorbing port is prevented by being received by the receiving wall bodies, and thus the remains of the garbage and dust that are not absorbed into the absorbing port is reduced and the cleaning rate (absorbing rate) is enhanced.

[0011] In one embodiment of the present invention, the absorbing port having the receiving wall bodies at the back part and the both sides thereof is provided with a rotating cleaning body that rotates and sweeps the garbage and dust into the absorbing port.

[0012] Thus, the garbage and dust near the absorbing port is easily swept and absorbed into the absorbing port, thereby further enhancing the cleaning rate of the garbage and dust. Further, even if the garbage and dust are not swept but bounced off by the rotating cleaning body, they are prevented from scattering backwards and to both sides by the receiving wall bodies and remain in the vicinity of the absorbing port, and thus, the garbage and dust are swept again and easily absorbed into the absorbing port by the rotating cleaning body.

[0013] In one embodiment of the present invention, the receiving wall body at the back part of the absorbing port is disposed in a direction perpendicular to a traveling direction and parallel to the absorbing port, and the receiving wall bodies on both sides of the absorbing port is disposed in a slanted manner so that a distance with respect to each other increases towards a front part.

[0014] Thus, the garbage and dust are collected towards the center of the absorbing port by means of receiving wall bodies arranged in a slanted manner at both sides of the absorbing port and easily absorbed into the absorbing port. Further, when the garbage and dust are received by the receiving wall body arranged at the back part of the absorbing port, the garbage and dust are less likely to move towards the sides along the receiving wall body, and variation in absorption of the garbage and dust depending on the position is suppressed since the distance to the absorbing port is constant irrespective of the position of the garbage and dust at the receiving wall body. Further, when hard garbage and the like such as a small rock hits the receiving wall body arranged at the back part of the absorbing port and bounces off toward the sides, the garbage and the like hits the receiving wall bodies at the sides thereby being bounced back towards the front at the center of the absorbing port, and thus the garbage and the like are easily absorbed from the absorbing port.

[0015] In one embodiment of the present invention, the receiving wall body at the back part of the absorbing port and the receiving wall bodies at both sides of the absorbing port are positioned distant from each other with a microscopic gap therebetween that allows air to pass through.

[0016] Thus, distinct large garbage and dust do not pass from the microscopic gap between the receiving wall body arranged at the back part and the receiving wall body arranged at both sides of the absorbing port, but air passes and escapes therefrom, whereby scattering of the garbage and dust towards the back and both sides is prevented, air pressure at the inner side of the receiving wall body, that is, the space on the absorbing port side is adjusted, and influence on the movement performance of the electric cleaner is eliminated.

[0017] In a typical embodiment of the present invention, an autonomous electric cleaner that autonomously travels and cleans a cleaning surface includes an absorbing port facing the cleaning surface to absorb garbage and dust; and a rotating brush arranged at the absorbing port and rotated to sweep the garbage and dust into the absorbing port, wherein a blade that contacts the cleaning surface and receives the garbage and dust is arranged in the vicinity of a back part of the absorbing port parallel to the absorbing port and the rotating brush across the entire width of the absorbing port perpendicular to a traveling direction, and blades are arranged in the vicinity of both sides of the absorbing port so that a distance with respect to each other increases towards a front part, and arranged slightly slanted from a perpendicular direction and spaced apart by a microscopic gap that allows air to pass through with respect to the blade arranged at the back part.

[0018] Thus, the garbage and dust on the cleaning surface approach the absorbing port from the front not arranged with a blade, and scattering of the garbage and dust towards the back and both sides before being absorbed into the absorbing port is prevented by being received by the blades. Further, the garbage and dust remain in the vicinity of the absorbing port by the blades, so as to be swept and easily absorbed into the absorbing port by the rotating brush. The garbage and dust are collected towards the center of the absorbing port by the blades arranged on both sides of the absorbing port so as to be easily absorbed from the absorb-

ing port. When the garbage and dust are received by the blade arranged at the back part of the absorbing port, the garbage and dust are less likely to move towards the sides along the blade, and variation in absorption of the garbage and dust depending on the position is suppressed since the distance to the absorbing port and the rotating brush is constant irrespective of the position of the garbage and dust on the receiving wall body. Further, when hard garbage such as a small rock hits the blade arranged at the back part of the absorbing port and bounces off, the garbage and the like hits the blades at the sides thereby being bounced towards the front at the center of the absorbing port, and thus the garbage and the like are easily absorbed from the absorbing port. Therefore, in the autonomous electric cleaner mostly used in a situation of not being monitored by a person, the remains of the garbage and dust unabsorbed from the absorbing port is reduced and thus the cleaning rate (absorbing rate) is enhanced. In addition, since the blades arranged at both sides of the absorbing port is slightly slanted from the perpendicular direction with respect to the blade arranged at the back of the absorbing port, it barely acts as the traveling resistance of the autonomous electric cleaner, and the air passes and escapes from a microscopic gap between the blades arranged at the back and both sides, and thus the air pressure on the inner side of the blade, that is, the space on the absorbing port side is adjusted, and the influence on the traveling performance of the autonomous electric cleaner is eliminated.

[0019] According to the present invention, the garbage and dust on the cleaning surface approach the absorbing port from the front that is open, and scattering towards the back and both sides before being absorbed into the absorbing port is prevented by being received at the receiving wall body, and thus the remains of the garbage and dust unabsorbed by the absorbing port is reduced and the cleaning rate (absorbing rate) is enhanced.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] FIG. 1 is a plan view of an autonomous electric cleaner according to an embodiment of the present invention;

[0021] FIG. 2 is a side view of the autonomous electric cleaner;

[0022] FIG. 3 is a bottom view of the autonomous electric cleaner;

[0023] FIG. 4 is an enlarged view of the main part of FIG. 3 of the autonomous electric cleaner; and

[0024] FIG. 5 is a plan view showing the autonomous electric cleaner with a cover in an opened state.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0025] FIG. 1 is a plan view of an autonomous electric cleaner 1 according to an embodiment of the present invention. FIG. 2 is a side view of the autonomous electric cleaner 1. FIG. 3 is a bottom view of the autonomous electric cleaner 1. FIG. 4 is an enlarged view of the main part in FIG. 3. The autonomous electric cleaner (hereinafter referred to as simply "electric cleaner") 1 autonomously travels while absorbing garbage and dust on the floor F which is a cleaning surface and cleaning the surface F.

[0026] An openable/closable cover 3 is attached to the upper part of the main body 2 of the electric cleaner 1 as shown in FIG. 1 and FIG. 2. An operating part 4 including various keys for instructing start or stop and the like of cleaning to the electric cleaner 1, and a camera 5 for photographing the surrounding are arranged at the upper part of the cover 3. The camera 5 is incorporated in the cover 3 in FIG. 1 and FIG. 2 but projects upward during photographing. A plurality of sensors 6 are arranged on each outer peripheral surface of the main body 2, as shown in FIG. 1 to FIG. 3. The sensor 6 is configured by an optical sensor, an ultrasonic sensor, a temperature sensor and the like, and detects the distance to the obstacles such as wall, step, floor, installed objects in the surrounding, or detects person. The electric cleaner 1 travels while avoiding contact with the surrounding obstacles and the like based on the output from the sensor 6.

[0027] As shown in FIG. 2 and FIG. 3, a traveling wheel 7 is arranged on each side of a center portion of the bottom of the main body 2. Three driven wheels 8 are arranged on the front side (left side in each figure) between the traveling wheels 7, and two driven wheels 8 are arranged on the back side (right side in each figure). Each traveling wheel 7 is independently rotated by the drive of a separate motor (not shown). When each traveling wheel 7 is independently rotated, each driven wheel 8 rolls on the floor F with the traveling wheel 7, and the electric cleaner 1 travels while changing the direction of the main body 2. An attachment 2a of a battery (not shown) which is a driving source of the electric cleaner 1 is attached to the center of the bottom of the main body 2.

[0028] One sub-rotating brush 9 is arranged on both sides towards the front of the bottom of the main body 2. Each sub-rotating brush 9 rotates towards the center of the main body 2 in a plane parallel to the floor F through the drive of a separate motor (not shown). That is, the sub-rotating brush 9 on the upper side in FIG. 3 rotates in the counterclockwise direction, whereas the sub-rotating brush 9 on the lower side in FIG. 3 rotates in the clockwise direction. Thus, when each sub-rotating brush 9 rotates, the garbage and dust on the floor F are collected into a range at the lower part of the center of the main body 2 shown with diagonal lines.

[0029] An absorbing port 2b for absorbing garbage and dust along with external air is arranged facing the floor F towards the back of the bottom of the main body 2. A main rotating brush 10 is arranged on the absorbing port 2b perpendicular to a traveling (movement) direction X of the main body 2 and parallel to the absorbing port 2b. The main rotating brush 10 has a plurality of rubber blades 10a arranged in a spiral form on the outer peripheral surface, and rotates from the front towards the back of the main body 2 in a plane parallel to the traveling direction X and perpendicular to the floor F by the drive of the motor (not shown). That is, in FIG. 2, the main rotating brush 10 rotates in a counterclockwise direction. When the main rotating brush 10 rotates in such manner, the garbage and dust collected to the center by the sub-rotating brush 9 are swept into the adsorbing port 2b. The main rotating brush 10 configures one embodiment of the rotating cleaning body and the rotating brush in the present invention.

[0030] As shown in FIG. 2 to FIG. 4, a rubber blade 11 is arranged in the vicinity of the back part of the absorbing

port 2b parallel to the absorbing port 2b and the main rotating blade 10 across the entire width W of the absorbing port 2b that is perpendicular to the traveling direction X. Rubber blades 12 are arranged in the vicinity of both left and right sides of the absorbing port 2b in a manner slightly slanted with respect to the blade 11 and spaced apart from the blade 11 by a microscopic gap 13 so that the distance with respect to each other increases towards the front. In the present example, the angle θ formed by each of the blades 12 on both sides (hereinafter referred to as "side blades") and the blade 11 at the back (hereinafter referred to as "back blade") is set to about 100 degrees. The size of the gap 13 is set to about 2 to 3 mm, so as to pass air but not distinct garbage and dust of greater than or equal to a predetermined size. Each blade 11, 12 contacts the floor F and receives garbage and dust, as shown in FIG. 2. The blades 11, 12 configure one embodiment of receiving wall bodies and the blades according to the present invention.

[0031] FIG. 5 is a plan view showing the electric cleaner 1 with the cover 3 in an opened state. An accommodating part 2c for accommodating the electric air blower 14, and an attachment part 2d for removably attaching the dust collecting body 17 are arranged at the portion covered by the cover 3 of the main body 2. The accommodating part 2c and the attachment part 2d are partitioned by a barrier 2e, and communicated through a void or a communication hole (not shown) formed in the barrier 2e. The electric air blower 14 is configured by a motor 15 and a fan 16, where suction force is generated by rotating the fan 16 through the drive of the motor 15.

[0032] The dust collecting body 17 is configured by a dust box 18 formed with an air suction hole 18a at the bottom surface and formed with an air exhaust hole 18b at the side surface facing the accommodating part 2c side; a filter 19 for passing air but not passing garbage and dust of greater than or equal to a predetermined size; and a filter holder 20 for holding the filter 19 and removably attached to the dust box 18 so as to cover the air exhaust hole 18b. The air suction hole 18a of the dust box 18 communicates with the absorbing port 2b of the main body 2 (FIG. 3), and the air exhaust hole 18b communicates with the accommodating part 2c by way of the void and the communication hole of the barrier 2e and the electric air blower 14.

[0033] A control circuit for controlling each part, a power supply circuit for supplying power to each part, a battery and the like are arranged on the electric cleaner 1 other than the above components, but the illustration and explanation thereof are omitted herein.

[0034] In the electric cleaner 1, when the cover 3 is closed and the above mentioned operating part 4 is operated for the electric cleaner 1 to start cleaning, the electric cleaner 1 autonomously travels while avoiding obstacles as mentioned above and rotates each sub-rotating brush 9 and the main rotating brush 10 and further generates the suction force with the electric air blower 14. The garbage and dust on the floor F are then collected to the lower part at the center of the main body 2 by means of each sub-rotating brush 9, and swept into the absorbing port 2b by the main rotating brush 10 and absorbed from the absorbing port 2b along with external air by the suction force generated by the electric air blower 14. The external air and the garbage and dust that have been absorbed then flow into the dust box 18 through

the air suction hole **18a** of the dust box **18**. The garbage and dust of greater than or equal to a predetermined size are separated from the external air by the filter **19** arranged in the vicinity of the air exhaust hole **18b** of the dust box **18**. The separated garbage and dust are then captured and collected in the dust box **18** and the filter **19** and the cleaned air is exhausted to the outside through the air exhaust hole **18b**, the barrier **2e**, the electric air blower **14**, the accommodating part **2c**, and the space between the main body **2** and the cover **3**.

[0035] In the cleaning operation, since the blades **11**, **12** are arranged at the back part and both sides of the absorbing port **2b**, garbage and dust on the floor **F** approach the absorbing port **2b** from the front that is open, that is, not arranged with the blades **11**, **12**, and the garbage and dust are prevented from scattering backwards and to both sides before being absorbed from the absorbing port **2b** by being received by the blades **11**, **12**. Further, since the blades **11**, **12** are arranged in the vicinity of the absorbing port **2b** and the back blade **11** is arranged across the entire width **W** of the absorbing port **2b**, the garbage and dust may be left remaining in the vicinity of the absorbing port **2b** by the blades **11**, **12** so as to be swept and easily absorbed into the absorbing port **2b** by the main rotating brush **10**. Further, even if the garbage and dust are bounced off without being swept into the absorbing port **2b** by the main rotating brush **10**, the garbage and dust are left remaining in the vicinity of the absorbing port **2b** by the blades **11**, **12**, and thus, the garbage and dust are swept again and easily absorbed into the absorbing port **2b** by the main rotating brush **10**.

[0036] Since the side blades **12** are arranged slanted so that the distance with respect to each other increases towards the front, even if dust and the like of light mass flies in the space between the main body **2** and the floor **F** and move outside the range indicated by a diagonal line of **FIG. 3**, the dust and the like can be collected towards the center of the absorbing port **2b** by each side blade **12** so as to be easily absorbed from the absorbing port **2b**. Further, since the back blade **11** is arranged perpendicular to the traveling direction **X** and parallel to the absorbing port **2b** and the main rotating brush **10**, the garbage and dust are less likely to move towards the side along the back blade **11** when garbage and dust are received at the back blade **11**. Further, variation of absorption of the garbage and dust depending on the position is suppressed since the distance to the absorbing port **2b** and the main rotating brush **10** is constant irrespective of the position of the garbage and dust at the back blade **11**. Moreover, when hard garbage and the like such as a small rock hits the back blade **11** and bounces off towards the sides, the garbage and the like hits the side blades **12** and bounces back towards the front at the center of the absorbing port **2b**, so that the garbage and the like are easily absorbed from the absorbing port **2b**.

[0037] As a result of the above, the garbage and dust left remaining without being absorbed from the absorbing port **2b** are reduced and the cleaning rate (absorbing rate) is enhanced in a situation where the autonomous electric cleaner **1** is used without being monitored by a person and the operation of immediately reabsorbing the garbage and dust when they are left unabsorbed is not performed.

[0038] In addition, since each of the side blades **12** is simply slightly slanted from the perpendicular direction with

respect to the back blade **11**, it barely acts as a traveling resistance of the autonomous electric cleaner **1**. Further, since a microscopic gap **13** is formed between the back blade **11** and each side blade **12**, distinct large garbage and dust do not pass the gap **13**, and substantially only air passes and escapes the gap. The scattering of garbage and dust backwards and to both sides is thereby prevented and the air pressure at the inner side of the blades **11**, **12**, that is, the space on the absorbing port **2b** side is adjusted. Therefore, the influence on the traveling performance of the autonomous electric cleaner **1** such as movement or pivot of the main body **2** becoming difficult due to the blades **11**, **12** can be eliminated.

[0039] The present invention may adopt various forms other than the above described embodiment. For instance, a case of using rubber blades **11**, **12** as the receiving wall bodies is given by way of example in the above embodiment, but the present invention is not limited thereto. For instance, synthetic resin blades, or brushes and the like in which capillary bodies having rigidity are spacelessly bonded may be used. That is, any form may be used as the receiving wall bodies as long as it is possible to receive the garbage and dust on the absorbing port side without passing them.

[0040] Further, in the above embodiment, a case of arranging blades **11**, **12** at the back and both sides of the main rotating brush **10** that rotates in a counterclockwise direction so as not to become a resistance in the forward movement of the electric cleaner **1** by the drive of the motor is given by way of example, but the present invention is not limited thereto. For instance, the receiving wall bodies such as the blades may be arranged at the back part and both sides of the rotating cleaning body that rotates in the clockwise direction that becomes a resistance and that rotates in the counterclockwise direction that does not become a resistance in the forward movement of the electric cleaner by the drive of the motor or the suction force of the electric air blower.

[0041] Further, in the above embodiment, the present invention is applied to the autonomous electric cleaner **1** by way of example, but the present invention may be applied to a general electric cleaner such as, for instance, a non-autonomous electric cleaner in which the cleaner travels by being pulled by a person, an electric cleaner having a absorbing port body separate from the canister type main body and the like.

What is claimed is:

1. An autonomous electric cleaner that autonomously travels and cleans a cleaning surface, the cleaner comprising:

an absorbing port facing the cleaning surface to absorb garbage and dust; and

a rotating brush arranged at the absorbing port and rotated to sweep the garbage and dust into the absorbing port, wherein

a blade that contacts the cleaning surface and receives the garbage and dust is arranged in the vicinity of a back part of the absorbing port parallel to the absorbing port and the rotating brush across the entire width of the absorbing port perpendicular to a traveling direction, and blades are arranged in the vicinity of both sides of the absorbing port so that a distance with respect to

each other increases towards a front part, and arranged slightly slanted from a perpendicular direction and spaced apart by a microscopic gap that allows air to pass through with respect to the blade arranged at the back part.

2. An electric cleaner that absorbs garbage and dust from an absorbing port facing a cleaning surface, wherein

the cleaner is provided with receiving wall bodies respectively positioned at a back part and both sides of the absorbing port so as to contact the cleaning surface and receive the garbage and dust.

3. The electric cleaner according to claim 2, wherein

the absorbing port is provided with a rotating cleaning body that rotates and sweeps the garbage and dust into the absorbing port.

4. The electric cleaner according to claim 2, wherein the receiving wall body at the back part of the absorbing port is disposed in a direction perpendicular to a traveling direction and parallel to the absorbing port, and

the receiving wall bodies on both sides of the absorbing port is disposed in a slanted manner so that a distance with respect to each other increases towards a front part.

5. The electric cleaner according to claim 2, wherein

the receiving wall body at the back part of the absorbing port and the receiving wall bodies at both sides of the absorbing port are positioned distant from each other with a microscopic gap therebetween that allows air to pass through.

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