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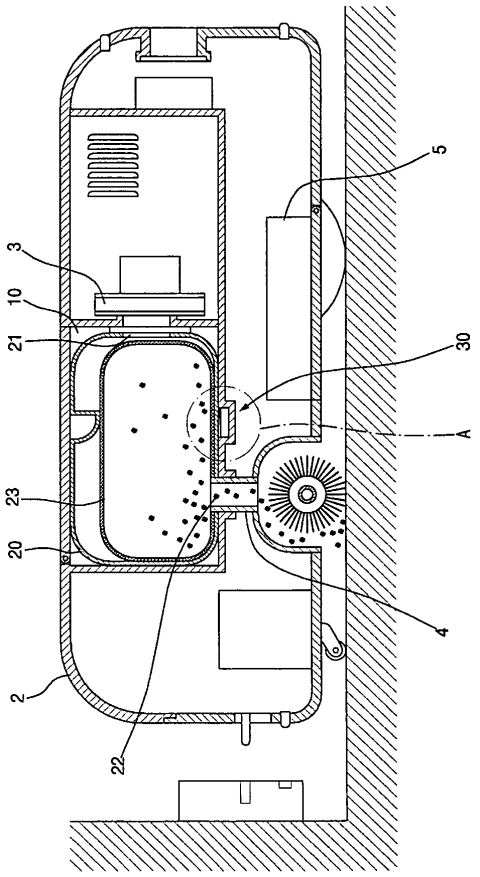
(54) Automatic cleaning device

(57) Disclosed herein is an automatic cleaning device having a dirt receptacle sensor unit (30) to sense the presence of a dirt receptacle (20). The dirt receptacle (20) is detachably mounted in an installation chamber (10) defined in a body (2) of the automatic cleaning device.

Fig.2



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Description

[0001] The present invention relates to an automatic cleaning device, and, more particularly, to an automatic cleaning device having a dirt receptacle sensor unit to sense the presence of a dirt receptacle.

[0002] Generally, an automatic cleaning device is a self-running vacuum cleaner. The automatic cleaning device automatically finds its way back to its charging station to recharge when needed. If the cleaning hasn' t been completed when the automatic cleaning device needs to be charged, the automatic cleaning device continues cleaning when charging is finished.

[0003] FIG. 1 is a schematic longitudinal sectional view illustrating the general configuration of a conventional automatic cleaning device.

[0004] As shown in FIG. 1, the conventional automatic cleaning device comprises: a body 100; a fan motor 200 mounted in the body 100 to generate a suction force; and a dirt receptacle 300 containing a filter 301 therein. The dirt receptacle 300 is detachably mounted in an installation chamber 101 defined in the body 100. The installation chamber 101 is connected with the fan motor 200, and thus, the dirt receptacle 300 is connected with the fan motor 200.

[0005] The conventional automatic cleaning device further comprises: a suction pipe 400; a suction head 500; and a brush 600. The suction pipe 400 is penetrated through the bottom of the dirt receptacle 300 to be connected with the filter 301. The suction head 500 is coupled to a lower end of the suction pipe 400 to suction dust and dirt from the floor. The brush 600 is located in the bottom of the suction head 500 so that it is exposed to the outside to come into contact with the floor.

[0006] The body 100 is provided at the bottom thereof with a plurality of wheels exposed to the outside. The wheels include a drive wheel 700 for the self-running of the body 100 and a plurality of auxiliary wheels 701 to assist the operation of the drive wheel 700.

[0007] Also, a controller 102 is mounted in the body 100 to control the traveling direction of the automatic cleaning device. With the above-described configuration, the automatic cleaning device travels in a predetermined direction in accordance with operation of the controller 102, so that it suctions dust and dirt from the floor via the suction head 500 into the suction pipe 400 during the driving of the fan motor 200. Subsequently, the suctioned dust and dirt are caught while passing through the filter 301. Thereby, the conventional automatic cleaning device is adapted to clean a room while discharging filtered air.

[0008] However, the above-described prior art has a problem in that it has no function of sensing the presence of the dirt receptacle. When a user forgets to put the dirt receptacle into the installation chamber of the body after emptying the dirt receptacle, or the dirt receptacle is unintentionally separated from the installation chamber due to external factors, such as shock, the conventional automatic cleaning device may continue cleaning without knowing the absence of the dirt receptacle. This causes the suctioned dust and dirt to be directly discharged into the room without passing through the filter of the dirt receptacle, resulting in room contamination. Furthermore, the dust and dirt may be suctioned into other elements of the device, causing the automatic cleaning device to breakdown.

[0009] It is an object of the present invention to provide an automatic cleaning device having a dirt receptacle sensor unit to sense the presence of a dirt receptacle.

[0010] It is another object of the present invention to provide an automatic cleaning device having a dirt receptacle sensor unit which can sense the presence of a dirt receptacle with a simplified structure, allow the dirt receptacle to be coupled to a body of the device with an increased coupling strength by the use of a magnetic force, and achieve an increase in the air-tightness of the connecting region between the dirt receptacle and the dirt receptacle sensor unit.

[0011] It is yet another object of the present invention to provide an automatic cleaning device having a dirt receptacle sensor unit, which is capable of allowing a user to easily recognize the presence of a dirt receptacle.

[0012] In accordance with the present invention, the above and other objects can be accomplished by the provision of an automatic cleaning device comprising: a body; a fan motor to generate a suction force; an installation chamber defied in the body to be connected with the fan motor; a dirt receptacle detachably mounted in the installation chamber, the dirt receptacle having a through-hole connected with the fan motor, an insertion through-hole for the insertion of a dirt suction pipe, and a filter received in the dirt receptacle to be connected with a distal end of the suction pipe; and a dirt receptacle sensor unit to sense the presence of the dirt receptacle inside the installation chamber, whereby if the dirt receptacle sensor unit senses the absence of the dirt receptacle inside the installation chamber, the dirt receptacle sensor unit inputs the sensed result to a controller, so that the controller stops the operation of the automatic cleaning device.

[0013] Preferably, the dirt receptacle sensor unit may include: a mounting recess defined in an inner lower surface of the installation chamber; and a micro switch received in the mounting recess to be switched on/off in accordance with installation/removal of the dirt receptacle.

[0014] Preferably, the dirt receptacle sensor unit may include: a magnet attached around a circumference of the through-hole; and a magnetic sensor mounted to a suction side of the fan motor to be magnetically attracted by the magnet, the magnetic sensor sensing the presence of the dirt receptacle based on a magnetic field produced by the magnet.

[0015] Preferably, the dirt receptacle sensor unit may further include a sealing member made of a synthetic rubber material, and attached to an outer surface of the

magnetic sensor that will be attached to the magnet.

[0016] Preferably, the dirt receptacle sensor unit may include: a magnet attached around a circumference of the insertion through-hole; an insertion recess formed in an inner lower surface of the installation chamber to receive the magnet; and a magnetic sensor mounted in the insertion recess around the suction pipe to be magnetically attracted by the magnet, the magnetic sensor sensing the presence of the dirt receptacle based on a magnetic field produced by the magnet.

[0017] Preferably, the dirt receptacle sensor unit may further include a sealing member made of a synthetic rubber material and attached to an upper surface of the magnetic sensor that will be attached to the magnet.

[0018] Preferably, the dirt receptacle sensor unit may include: a sensor mounting recess formed in an inner lower surface of the installation chamber; and an optical sensor mounted in the sensor mounting recess to sense the presence of the dirt receptacle by the use of emitted and received light.

[0019] Preferably, the optical sensor may include: a light emitting element received in an inner lower surface of the sensor mounting recess to emit light to the dirt receptacle; and a light receiving element located to surround the light emitting element to receive the light if the light, emitted from the light emitting element, is reflected by the bottom of the dirt receptacle to the light receiving element, thereby sensing the presence of the dirt receptacle.

[0020] Preferably, the optical sensor may include: an insertion protrusion formed at the dirt receptacle to be inserted into the sensor mounting recess; a light emitting element mounted in a lateral location of the sensor mounting recess to correspond to a location on the circumference of the insertion protrusion; and a light receiving element mounted in another lateral location of the sensor mounting recess opposite to the light emitting element, and adapted to sense the presence of the dirt receptacle if light is emitted from the light emitting element and is reflected by the insertion protrusion of the dirt receptacle to be introduced into the light receiving element.

[0021] Preferably, the optical sensor may include: an insertion protrusion formed at the bottom of the dirt receptacle to be inserted into the sensor mounting recess; a light emitting element mounted in a lateral location of the sensor mounting recess to correspond to a location on the circumference of the insertion protrusion; and a light receiving element mounted to surround the light emitting element, and adapted to sense the presence of the dirt receptacle if light is emitted from the light emitting element and is reflected by an outer circumference of the insertion protrusion to be introduced into the light receiving element.

[0022] Preferably, the dirt receptacle sensor unit may further include an absence informer electrically connected to a controller in a signal transmission manner, the informer outputting the absence of the dirt receptacle to the outside if the dirt receptacle is taken out of the installation chamber.

[0023] Preferably, the absence informer may have a sound generator electrically connected to the controller in a signal transmission manner, to output a sound to indicate the absence of the dirt receptacle based on signals inputted from the controller.

[0024] Preferably, the absence informer may have an output display electrically connected to the controller in a signal transmission manner, to output an image to indicate the absence of the dirt receptacle based on signals inputted from the controller.

[0025] The above and other objects, features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a schematic longitudinal sectional view illustrating the general configuration of a conventional automatic cleaning device;

FIG. 2 is a schematic longitudinal sectional view illustrating an automatic cleaning device in accordance with a first embodiment of the present invention;

FIG. 3 is an enlarged sectional view of circle A of FIG. 2;

FIG. 4 is an enlarged section view illustrating separation of a dirt receptacle of FIG. 3,;

FIG. 5 is a schematic longitudinal sectional view illustrating an automatic cleaning device in accordance with a second embodiment of the present invention;

FIG. 6 is an enlarged sectional view of circle B of FIG. 5;

FIG. 7 is an enlarged section view illustrating separation of a dirt receptacle of FIG. 6;

FIG. 8 is a schematic longitudinal sectional view illustrating an automatic cleaning device in accordance with a third embodiment of the present invention;

FIG. 9 is an enlarged sectional view of circle C of FIG. 8;

FIG. 10 is an enlarged, section view illustrating separation of a dirt receptacle of FIG. 9;

FIG. 11 is a schematic longitudinal sectional view illustrating an automatic cleaning device in accordance with a fourth embodiment of the present invention;

FIG. 12 is an enlarged sectional view of circle D of FIG. 11;

FIG. 13 is an enlarged section view illustrating separation of a dirt receptacle of FIG. 12;

FIG. 14 is a schematic longitudinal sectional view illustrating an automatic cleaning device in accordance with a fifth embodiment of the present invention;

FIG. 15 is an enlarged sectional view of circle E of FIG. 14;

FIG. 16 is an enlarged section view illustrating separation of a dirt receptacle of FIG. 15;

FIG. 17 is a schematic longitudinal sectional view illustrating an automatic cleaning device in accordance with a sixth embodiment of the present invention;

FIG. 18 is an enlarged sectional view of circle F of FIG. 17;

FIG. 19 is an enlarged section view illustrating separation of a dirt receptacle of FIG. 18;

FIG. 20 is a block diagram illustrating an automatic cleaning device in accordance with a seventh embodiment of the present invention; and

FIG. 21 is a block diagram illustrating an automatic cleaning device in accordance with an eighth embodiment of the present invention.

[0026] Now, preferred embodiments of an automatic cleaning device according to the present invention will be described with reference to the accompanying drawings.

[0027] FIG. 2 is a schematic longitudinal sectional view illustrating an automatic cleaning device in accordance with a first embodiment of the present invention. FIG. 3 is an enlarged sectional view of circle A of FIG. 2. FIG. 4 is an enlarged section view illustrating separation of a dirt receptacle of FIG. 3.

[0028] As shown in FIGS. 2 to 4, the automatic cleaning device according to the first embodiment of the present invention comprises: a body 2; a fan motor 3 to generate a suction force; an installation chamber 10 defined in the body 2; a dirt receptacle 20 detachably mounted in the installation chamber 10; and a dirt receptacle sensor unit 30 to sense the presence of the dirt receptacle 20.

[0029] The installation chamber 10 is defined in the body 2 at a position connected with the fan motor 3. Thus, the dirt receptacle 20, which is mounted in the installation chamber 10, is connected with the fan motor 3.

[0030] The dirt receptacle 20 has a through-hole 21, so that the dirt receptacle 20 is connected with the fan motor 3 via the through-hole 21 when the dirt receptacle 20 is detachably mounted in the installation chamber 10. The dirt receptacle 20 further has an insertion through-hole 22 for the insertion of a dirt suction pipe 4. Also, a filter 23 is mounted in the dirt receptacle 20, so that a distal end of the suction pipe 4 is fitted into the filter 23 to be connected with the interior of the filter 23.

[0031] If air, containing dust and dirt, is introduced via the suction pipe 4 in accordance with a suction force generated from the fan motor 3, the dirt receptacle 20 having the above-described configuration is able to filter the dust and dirt contained in the air by use of the filter 23.

[0032] The through-hole 21 is a passage to deliver the filtered air to the suction side of the fan motor 3, and the insertion through-hole 22 is a passage to guide the insertion of the suction pipe 4 and to connect the distal end of the suction pipe 4 to the filter 23.

[0033] The dirt receptacle sensor unit 30 is mounted in the installation chamber 10 to sense the presence of the dirt receptacle 20. The sensed result is inputted into a controller 5, which is mounted in the body 2.

[0034] If the dirt receptacle sensor unit 30 senses the absence of the dirt receptacle 20 inside the installation chamber 10 and inputs the sensed result into the controller 5, the controller 5 stops the operation of the automatic cleaning device. Thereby, the dirt receptacle sensor unit 30 serves to prevent the automatic cleaning device from continuing cleaning without knowing the absence of the dirt receptacle 20.

[0035] The dirt receptacle sensor unit 30 includes: a mounting recess 31a defined in an inner lower surface of the installation chamber 10; and a micro switch 32a received in the mounting recess 31a to be switched on/off as the bottom of the dirt receptacle 20 comes into contact with the inner lower surface of the installation chamber 10.

[0036] If the dirt receptacle 20 is put into the installation chamber 10 and the bottom of the dirt receptacle 20 presses the micro switch 32a, the micro switch 32a is switched on. Thereby, the dirt receptacle sensor unit 30 is able to sense the presence of the dirt receptacle 20 inside the installation chamber 10.

[0037] Conversely, if the dirt receptacle 20 is taken out of the installation chamber 10 and a push force applied to the micro switch 32a is removed, the micro switch 32a is switched off. Thereby, the dirt receptacle sensor unit 30 is able to sense the absence of the dirt receptacle 20 inside the installation chamber 10.

[0038] FIG. 5 is a schematic longitudinal sectional view illustrating an automatic cleaning device in accordance with a second embodiment of the present invention. FIG. 6 is an enlarged sectional view of circle B of FIG. 5. FIG. 7 is an enlarged section view illustrating separation of a dirt receptacle of FIG. 6.

[0039] As shown in FIGS. 5 to 7, the automatic cleaning device according to the second embodiment of the present invention comprises: the body 2; the fan motor 3; the installation chamber 10 defined in the body 2 to be connected with the fan motor 3; the dirt receptacle 20 detachably mounted in the installation chamber 10; and the dirt receptacle sensor unit 30 to sense the presence of the dirt receptacle 20.

[0040] The dirt receptacle sensor unit 30 is mounted in the installation chamber 10 so that it senses the absence of the dirt receptacle 20 inside the installation chamber 10 and inputs the sensed result into the controller 5. The dirt receptacle sensor unit 30 of the present embodiment includes: a magnet 31b attached around the circumference of the through-hole 21 formed at the dirt receptacle 20; and a magnetic sensor 32b mounted to the suction side of the fan motor 3 to be magnetically attracted by the magnet 31b. If a magnetic field is produced by the magnet 31b, accordingly, the magnetic sensor 32b is able to sense the presence of the dirt receptacle 20.

[0041] Specifically, if the dirt receptacle 20 is put into

the installation chamber 10, the magnetic sensor 32b is attracted by the magnetic field of the magnet 31b attached around the through-hole 21 of the dirt receptacle 20, thereby sensing the presence of the dirt receptacle 20 inside the installation chamber 10.

[0042] Conversely, if the dirt receptacle 20 is taken out of the installation chamber 10, the magnet 31b escapes from the effective range of the magnetic sensor 32b, making it impossible for the magnetic sensor 32b to sense the magnetic field of the magnet 31b. Thereby, the magnetic sensor 32b is able to sense the absence of the dirt receptacle 20 inside the installation chamber 10.

[0043] Preferably, an outer surface of the magnetic sensor 32b is made of a metal material so that the magnetic sensor 32b is magnetically attached to the magnet 31b. Such a magnetic attachment between the magnet 31b and the magnetic sensor 32b has the effect of mounting the dirt receptacle 20 into the installation chamber 10 with an increased coupling strength.

[0044] A seal ing member 33b, made of a synthetic rubber material, is attached to the outer surface of the magnetic sensor 32b prior to attaching the magnet 31b to the magnetic sensor 32b. As the magnet 31b is magnetically attached to the outer surface of the magnetic sensor 32b, the sealing member 33b is pressed, thereby serving to prevent the leakage of air between the magnet 31b and the magnetic sensor 32b.

[0045] FIG. 8 is a schematic longitudinal sectional view illustrating an automatic cleaning device in accordance with a third embodiment of the present invention. FIG. 9 is an enlarged sectional view of circle C of FIG. 8. FIG. 10 is an enlarged section view illustrating separation of a dirt receptacle of FIG. 9.

[0046] As shown in FIGS. 8 to 10, the automatic cleaning device according to the third embodiment of the present invention comprises: the body 2; the fan motor 3; the installation chamber 10 defined in the body 2 to be connected with the fan motor 3; the dirt receptacle 20 detachably mounted in the installation chamber 10; and the dirt receptacle sensor unit 30 to sense the presence of the dirt receptacle 20.

[0047] The dirt receptacle sensor unit 30 is mounted in the installation chamber 10 so that it senses the absence of the dirt receptacle 20 inside the installation chamber 10 and inputs the sensed result into the controller 5. The dirt receptacle sensor unit 30 of the present embodiment includes : a magnet 31c attached around the circumference of the insertion through-hole 22 formed at the bottom of the dirt receptacle 20; an insertion recess 32c formed in the inner lower surface of the installation chamber 10 to receive the magnet 31c; and a magnetic sensor 33c mounted in the insertion recess 32c around the suction pipe 4 to be magnetically attracted by the magnet 31c. Thereby, if a magnetic field is produced by the magnet 31c, the magnetic sensor 33c is able to sense the presence of the dirt receptacle 20.

[0048] Specifically, if the dirt receptacle 20 is put into the installation chamber 10, the magnetic sensor 33c is attracted by the magnetic field of the magnet 31c attached around the insertion through-hole 22 of the dirt receptacle 20, thereby sensing the presence of the dirt receptacle 20 inside the installation chamber 10.

[0049] Conversely, if the dirt receptacle 20 is taken out of the installation chamber 10, the magnet 31c escapes from the effective range of the magnetic sensor 33c, making it impossible for the magnetic sensor 33c to sense the magnetic field of the magnet 31c. Thereby, the magnetic sensor 33c is able to sense the absence of the dirt receptacle 20 inside the installation chamber 10.

[0050] An outer surface of the magnetic sensor 33c is preferably made of a metal material so that the magnetic sensor 33c is magnetically attached to the magnet 31c. Such a magnetic attachment between the magnet 31c and the magnetic sensor 33c has the effect of mounting the dirt receptacle 20 into the installation chamber 10 with an increased coupling strength.

[0051] A sealing member 34c is attached to the outer surface of the magnetic sensor 33c prior to attaching the magnet 31c to the magnetic sensor 33c. The sealing member 34c is made of a synthetic rubber material, and is located beneath the magnet 31c. As the magnet 31c is magnetically attached to the outer surface of the magnetic sensor 33c, the lower sealing member 34c is pressed, thereby serving to prevent the leakage of air between the magnet 31c and the magnetic sensor 33c.

[0052] FIG. 11 is a schematic longitudinal sectional view illustrating an automatic cleaning device in accordance with a fourth embodiment of the present invention. FIG. 12 is an enlarged sectional view of circle D of FIG. 11. FIG. 13 is an enlarged section view illustrating separation of a dirt receptacle of FIG. 12.

[0053] As shown in FIGS. 11 to 13, the automatic cleaning device according to the fourth embodiment of the present invention comprises: the body 2; the fan motor 3; the installation chamber 10 defined in the body 2 to be connected with the fan motor 3; the dirt receptacle 20 detachably mounted in the installation chamber 10; and the dirt receptacle sensor unit 30 to sense the presence of the dirt receptacle 20.

[0054] The dirt receptacle sensor unit 30 is mounted in the installation chamber 10 so that it senses the absence of the dirt receptacle 20 inside the installation chamber 10 and inputs the sensed result into the controller 5. The dirt receptacle sensor unit 30 of the present embodiment includes: a sensor mounting recess 31d formed in the inner lower surface of the installation chamber 10; and an optical sensor 32d mounted in the sensor mounting recess 31d to sense the presence of the dirt receptacle 20 by the use of emitted and received light.

[0055] The optical sensor 32d has: a light emitting element 321a received in the inner lower surface of the sensor mounting recess 31d to emit light into the dirt receptacle 20, and a light receiving element 322a located to surround the light emitting element 321a to receive the light if the light emitted from the light receiving element 322a is reflected by the bottom of the dirt receptacle 20.

[0056] If the dirt receptacle 20 is put into the installation chamber 10, the light, such as an ultraviolet ray, is emitted from the light emitting element 321a, and is reflected by the bottom of the dirt receptacle 20, thereby being introduced into the light receiving element 322a mounted around the light emitting element 321. Thereby, the presence of the dirt receptacle 20 inside the installation chamber 10 is sensed.

[0057] Conversely, if the dirt receptacle 20 is taken out of the installation chamber 10, the light, emitted from the light emitting element 321a, fails to be introduced into the light receiving element 322a since the dirt receptacle 20 does not reflect the emitted light. Thereby, the dirt receptacle sensor unit 30 is able to sense the absence of the dirt receptacle 20 inside the installation chamber 10.

[0058] FIG. 14 is a schematic longitudinal sectional view illustrating an automatic cleaning device in accordance with a fifth embodiment of the present invention. FIG. 15 is an enlarged sectional view of circle E of FIG. 14. FIG. 16 is an enlarged section view illustrating separation of a dirt receptacle of FIG. 15.

[0059] As shown in FIGS. 14 to 16, the automatic cleaning device according to the fifth embodiment of the present invention comprises: the body 2; the fan motor 3; the installation chamber 10 defined in the body 2 to be connected with the fan motor 3; the dirt receptacle 20 detachably mounted in the installation chamber 10; and the dirt receptacle sensor unit 30 to sense the presence of the dirt receptacle 20.

[0060] The dirt receptacle sensor unit 30 is mounted in the installation chamber 10 so that it senses the absence of the dirt receptacle 20 inside the installation chamber 10 and inputs the sensed result into the controller 5. The dirt receptacle sensor unit 30 of the present embodiment includes: the sensor mounting recess 31d formed in the inner lower surface of the installation chamber 10; and the optical sensor 32d mounted in the sensor mounting recess 31d to sense the presence of the dirt receptacle 20 by the use of emitted and received light.

[0061] The optical sensor 32d of the present embodiment has: an insertion protrusion 321b formed at the bottom of the dirt receptacle 20 to be inserted into the sensor mounting recess 31d; a light emitting element 322b mounted in a lateral location of the sensor mounting recess 31d to correspond to a location on the circumference of the insertion protrusion 321b; and a light receiving element 323b mounted in another lateral location of the sensor mounting recess 31d opposite to the light emitting element 322b. In accordance with whether the insertion protrusion 321b of the dirt receptacle 20 intercepts the light emitted from the light emitting element 322b or not, the light receiving element 323b is able to sense the presence or absence of the dirt receptacle 20.

[0062] If the dirt receptacle 20 is put into the installation chamber 10, and thus, the insertion protrusion 321b is inserted into the sensor mounting recess 31d, the light, such as an ultraviolet ray, is emitted from the light emitting element 322b, but is not introduced into the light receiving element 323b since the insertion protrusion 321 intercepts the emitted light. Thereby, the presence of the dirt receptacle 20 inside the installation chamber 10 is sensed.

[0063] Conversely, if the dirt receptacle 20 is taken out of the installation chamber 10, and thus, the insertion protrusion 321b disappears from the sensor mounting recess 31d, the light, emitted from the light emitting element 322b, is introduced into the light receiving element 323b. Thereby, the dirt receptacle sensor unit 30d is able to sense the absence of the dirt receptacle 20 inside the installation chamber 10.

[0064] FIG. 17 is a schematic longitudinal sectional view illustrating an automatic cleaning device in accordance with a sixth embodiment of the present invention. FIG. 18 is an enlarged sectional view of circle F of FIG. 17. FIG. 19 is an enlarged section view illustrating separation of a dirt receptacle of FIG. 18.

[0065] As shown in FIGS. 17 to 19, the automatic cleaning device according to the fifth embodiment of the present invention comprises: the body 2; the fan motor 3; the installation chamber 10 defined in the body 2 to be connected with the fan motor 3; the dirt receptacle 20 detachably mounted in the installation chamber 10; and the dirt receptacle sensor unit 30 to sense the presence of the dirt receptacle 20.

[0066] The dirt receptacle sensor unit 30 is mounted in the installation chamber 10 so that it senses the absence of the dirt receptacle 20 inside the installation chamber 10 and inputs the sensed result into the controller 5. The dirt receptacle sensor unit 30 of the present embodiment includes: the sensor mounting recess 31d formed in the inner lower surface of the installation chamber 10; and the optical sensor 32d mounted in the sensor mounting recess 31d to sense the presence of the dirt receptacle 20 by the use of emitted and received light.

[0067] The optical sensor 32d of the present embodiment has: an insertion protrusion 321c formed at the bottom of the dirt receptacle 20 to be inserted into the sensor mounting recess 31d; a light emitting element 322c mounted in a lateral location of the sensor mounting recess 31d to correspond to a location on the circumference of the insertion protrusion 321c; and a light receiving element 323c mounted to surround the light emitting element 322c. In accordance with whether the light emitted from the light emitting element 322c is reflected by an outer circumference of the insertion protrusion 321c or not, the light receiving element 323c is able to sense the presence or absence of the dirt receptacle 20.

[0068] If the dirt receptacle 20 is put into the installation chamber 10 and thus, the insertion protrusion 321c is inserted into the sensor mounting recess 31d, the light, such as an ultraviolet ray, is emitted from the light emitting element 322c, and is introduced into the light receiving element 323c after being reflected by the outer circumference of the insertion protrusion 321c. Thereby, the presence of the dirt receptacle 20 inside the installation

chamber 10 is sensed.

[0069] Conversely, if the dirt receptacle 20 is taken out of the installation chamber 10 and thus, the insertion protrusion 321c disappears from the sensor mounting recess 31d, the light, emitted from the light emitting element 322c is not reflected by the insertion protrusion 321c, thereby failing to be introduced into the light receiving element 323c. Thereby, the dirt receptacle sensor unit is able to sense the absence of the dirt receptacle 20 inside the installation chamber 10.

[0070] FIG. 20 is a block diagram illustrating an automatic cleaning device in accordance with a seventh embodiment of the present invention.

[0071] As shown in FIG. 20, in the seventh embodiment of the present invention, the dirt receptacle sensor unit 30 of the automatic cleaning device further includes an absence informer 40 electrically connected to the controller 5 in a signal transmission manner. If the dirt receptacle 20 is taken out of the installation chamber 10, the informer 40 outputs the absence of the dirt receptacle 20 to the outside.

[0072] The absence informer 40 has a sound generator 41 electrically connected to the controller 5 in a signal transmission manner. The sound generator 41 outputs a sound to indicate the absence of the dirt receptacle 20 based on signals inputted from the controller 5.

[0073] In operation of the absence informer 40 having the above-described configuration, if the dirt receptacle sensor unit 30 senses the absence of the dirt receptacle 20 and inputs the sensed result to the controller 5, the controller 5 operates the sound generator 41, for example, a speaker, to output a voice or sound to the outside, thereby allowing a user to easily recognize the absence of the dirt receptacle 20.

[0074] FIG. 21 is a block diagram illustrating an automatic cleaning device in accordance with an eighth embodiment of the present invention.

[0075] As shown in FIG. 21, similar to the seventh embodiment, the dirt receptacle sensor unit of the present embodiment further includes the absence informer 40 electrically connected to the controller 5 in a signal transmission manner, so that it outputs the absence of the dirt receptacle 20 when the dirt receptacle 20 is taken out of the installation chamber 10.

[0076] The absence informer 40 of the present embodiment has an output display 42 electrically connected to the controller 5 in a signal transmission manner. The output display 42 outputs an image to indicate the absence of the dirt receptacle 20 based on signals inputted from the controller 5.

[0077] In operation of the absence informer 40 having the above-described configuration, if the dirt receptacle sensor unit 30 senses the absence of the dirt receptacle 20 and inputs the sensed result to the controller 5, the controller 5 operates the output display 42, for example, a liquid crystal display (LCD) window, mounted at the body 2 of the automatic cleaning device, to output information indicating the absence of the dirt receptacle 20, thereby allowing a user to easily recognize the absence of the dirt receptacle 20 in a visual manner.

[0078] In an operating example of the output display 42, it displays letters, which indicate the absence of the dirt receptacle 20, on the LCD window provided at the outer surface of the body 2. The output display 42 has a function of blinking the LCD window or the displayed letters.

[0079] As apparent from the above description, the present invention provides an automatic cleaning device having the following effects.

[0080] Firstly, according to the present invention, the automatic cleaning device has a function of sensing the presence of a dirt receptacle. This effectively prevents the automatic cleaning device from continuing cleaning without knowing the absence of the dirt receptacle when the dirt receptacle is separated from the automatic cleaning device due to user carelessness or external shock.

[0081] Secondly, the present invention provides a dirt receptacle sensor unit, which can effectively sense the presence of the dirt receptacle with a simplified structure. The dirt receptacle sensor unit of the present invention further can serve to achieve an increased coupling strength of the dirt receptacle by the use of a magnetic force. This has the effect of enabling more stable cleaning by the automatic cleaning device and preventing unintentional separation of the dirt receptacle due to external factors, such as shock.

[0082] Thirdly, according to the present invention, the dirt receptacle sensor unit is configured so that it can be securely coupled to the dirt receptacle by the use of a magnetic force while achieving air-tightness at the connecting region therebetween. As a result, the dirt receptacle sensor unit can completely prevent not only unintentional separation of the dirt receptacle, but also the leakage of air from the connecting region. Preventing the leakage of air, consequently, has the effect of increasing the suction force of a fan motor.

Claims

1. An automatic cleaning device comprising:

a body (2);
a fan motor (3) to generate a suction force;
an installation chamber (10) defied in the body (2) to be connected with the fan motor (3);
a dirt receptacle (20) detachably mounted in the installation chamber (10), the dirt receptacle (20) having a through-hole (21) connected with the fan motor (3), an insertion through-hole (22) for the insertion of a dirt suction pipe (4), and a filter (23) received in the dirt receptacle (20) to-beconnectedwithadistalendof the suction pipe (4); and
a dirt receptacle sensor unit (30) to sense the presence of the dirt receptacle (20) inside the

installation chamber (10).

2. The device as set forth in claim 1, wherein the dirt receptacle sensor unit (30) includes:

amounting recess (31a) defined in an inner lower surface of the installation chamber (10); and
a micro switch (32a) received in the mounting recess (31a) to be switched on/off in accordance with installation/removal of the dirt receptacle (20).

3. The device as set forth in claim 1, wherein the dirt receptacle sensor unit (30) includes:

a magnet (31b) attached around a circumference of the through-hole (21); and
a magnetic sensor (32b) mounted to a suction side of the fan motor (3) to be magnetically attracted by the magnet (31b), the magnetic sensor (32b) sensing the presence of the dirt receptacle (20) based on a magnetic field produced by the magnet (31b).

4. The device as set forth in claim 3, wherein the dirt receptacle sensor unit (30) further includes a sealing member (33b) made of a synthetic rubber material, and attached to an outer surface of the magnetic sensor (32b) that will be attached to the magnet (31b).

5. The device as set forth in claim 1, wherein the dirt receptacle sensor unit (30) includes:

a magnet (31c) attached around a circumference of the insertion through-hole (22);
an insertion recess (32c) formed in an inner lower surface of the installation chamber (10) to receive the magnet (31c); and
a magnetic sensor (33c) mounted in the insertion recess (32c) around the suction pipe (4) to be magnetically attracted by the magnet (31c), the magnetic sensor (33c) sensing the presence of the dirt receptacle (20) based on a magnetic field produced by the magnet (31c).

6. The device as set forth in claim 3, wherein the dirt receptacle sensor unit (30) further includes a sealing member (34c) made of a synthetic rubber material and attached to an upper surface of the magnetic sensor (33c) that will be attached to the magnet (31c).

7. The device as set forth in claim 1, wherein the dirt receptacle sensor unit (30) includes:

a sensor mounting recess (31d) formed in an inner lower surface of the installation chamber (10); and
an optical sensor (32d) mounted in the sensor mounting recess (31d) to sense the presence of the dirt receptacle (20) by the use of emitted and received light.

8. The device as set forth in claim 7, wherein the optical sensor (32d) includes:

a light emitting element (321a) received in the sensor mounting recess (31d) to emit light to the dirt receptacle (20); and
a light receiving element (322a) located to surround the light emitting element (321a) to receive the light if the light, emitted from the light emitting element, is reflected by the bottom of the dirt receptacle (20) to the light receiving element (322a), thereby sensing the presence of the dirt receptacle (20).

9. The device as set forth in claim 7, wherein the optical sensor (32d) includes:

an insertion protrusion (321b) formed at the dirt receptacle (20) to be inserted into the sensor mounting recess (31d) ;
a light emitting element (322b) mounted in a lateral location of the sensor mounting recess (31d) to correspond to a location on the circumference of the insertion protrusion (321b); and
a light receiving element (323b) mounted in another lateral location of the sensor mounting recess (31d) opposite to the light emitting element (322b), and adapted to sense the presence of the dirt receptacle (20) if light is emitted from the light emitting element (322b) and is reflected by the insertion protrusion (321b) of the dirt receptacle (20) to be introduced into the light receiving element (323b).

10. The device as set forth in claim 7, wherein the optical sensor (32d) includes:

an insertion protrusion (321c) formed at the bottom of the dirt receptacle (20) to be inserted into the sensor mounting recess (31d);
a light emitting element (322c) mounted in a lateral location of the sensor mounting recess (31d) to correspond to a location on the circumference of the insertion protrusion (321c); and
a light receiving element (323c) mounted to surround the light emitting element (322c), and adapted to sense the presence of the dirt receptacle (20) if light is emitted from the light emitting element (322c) and is reflected by an outer circumference of the insertion protrusion (321c) to be introduced into the light receiving element (323c).

11. The device as set forth in any of claims 1 to 10, wherein the dirt receptacle sensor unit (30) further includes
an absence informer (40) electrically connected to a controller (5) in a signal transmission manner, the informer (40) outputting the absence of the dirt receptacle (20) to the outside if the dirt receptacle (20) is taken out of the installation chamber (10).

12. The device as set forth in claim 11, wherein the absence informer (40) includes a sound generator (41) electrically connected to the controller (5) in a signal transmission manner, to output a sound to indicate the absence of the dirt receptacle (20) based on signals inputted from the controller (5).

13. The device as set forth in claim 11, wherein the absence informer (40) includes an output display (42) electrically connected to the controller (5) in a signal transmission manner, to output an image to indicate the absence of the dirt receptacle (20) based on signals inputted from the controller (5).

Fig.1

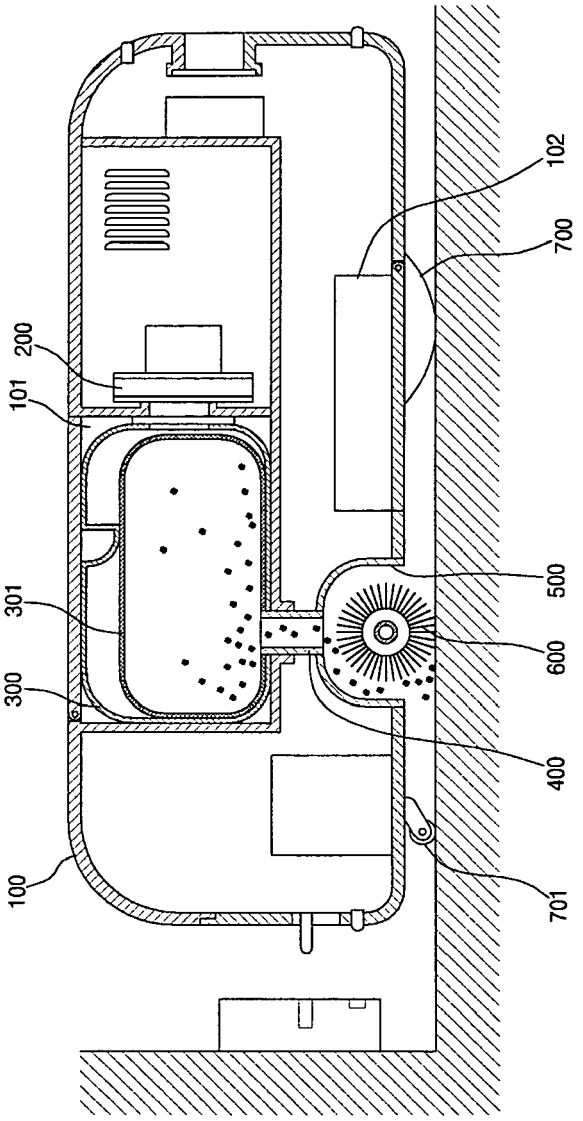


Fig.2

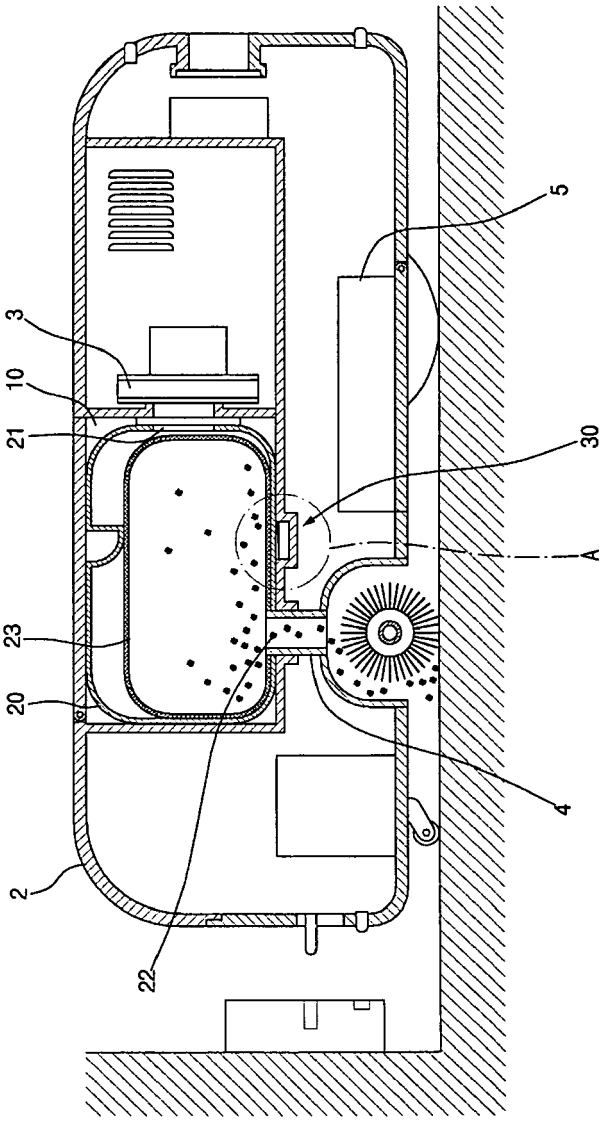


Fig.3

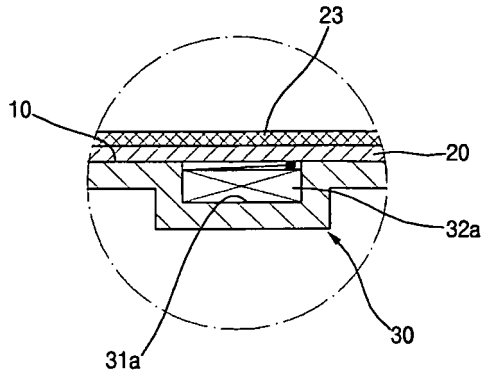


Fig.4

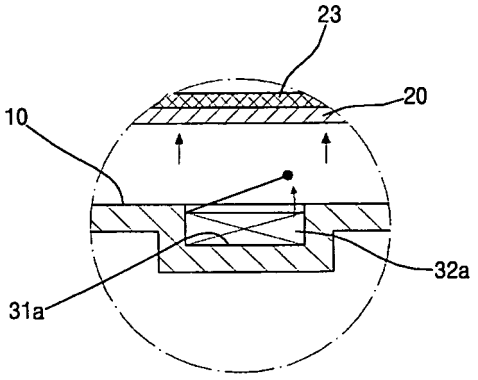


Fig.5

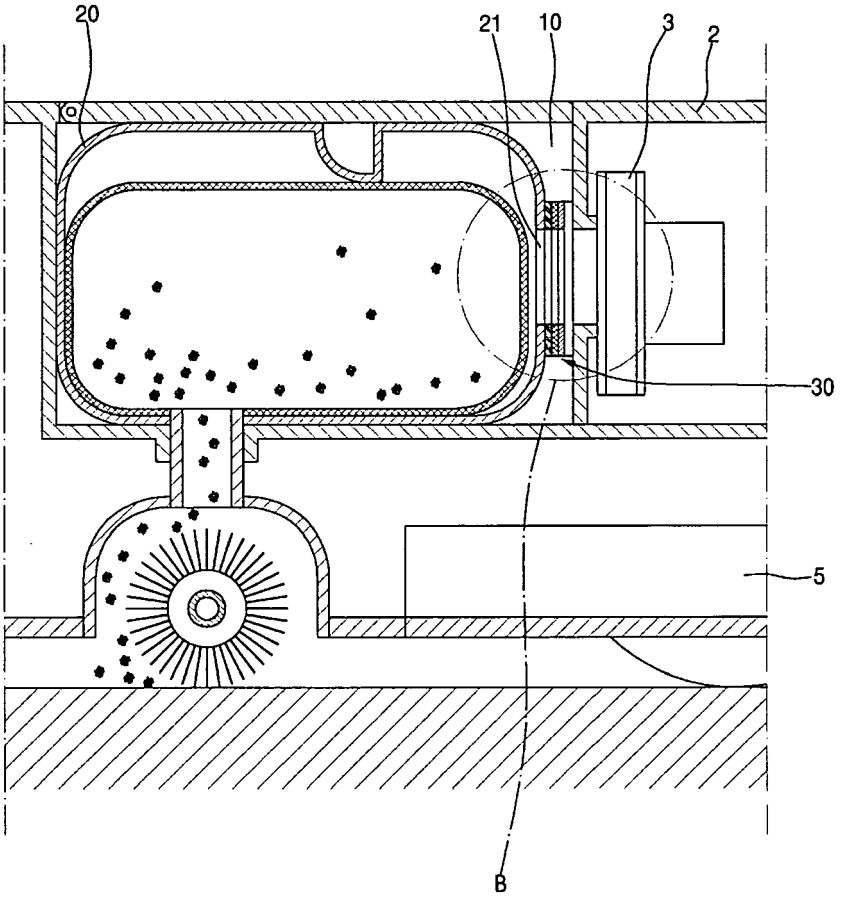


Fig.6

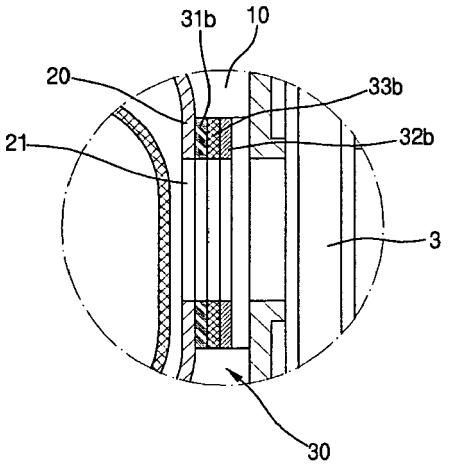


Fig.7

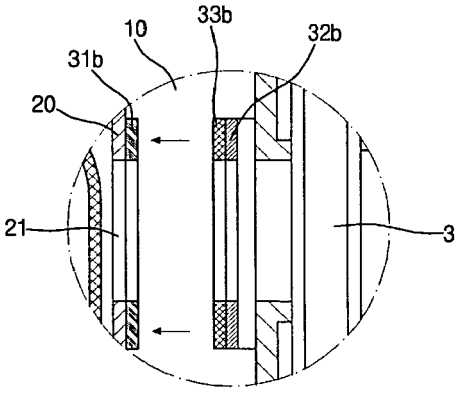


Fig.8

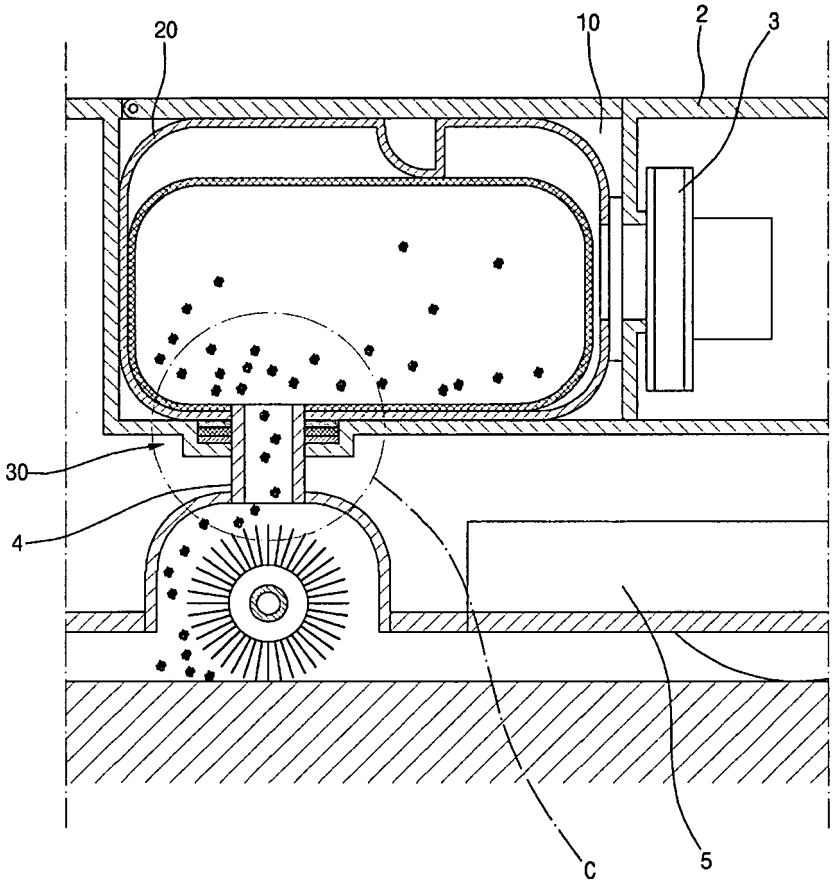


Fig.9

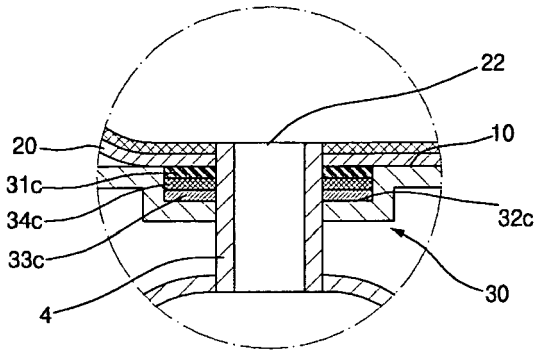


Fig.10

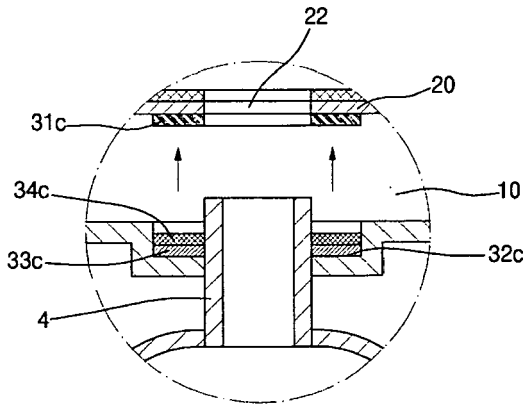


Fig.11

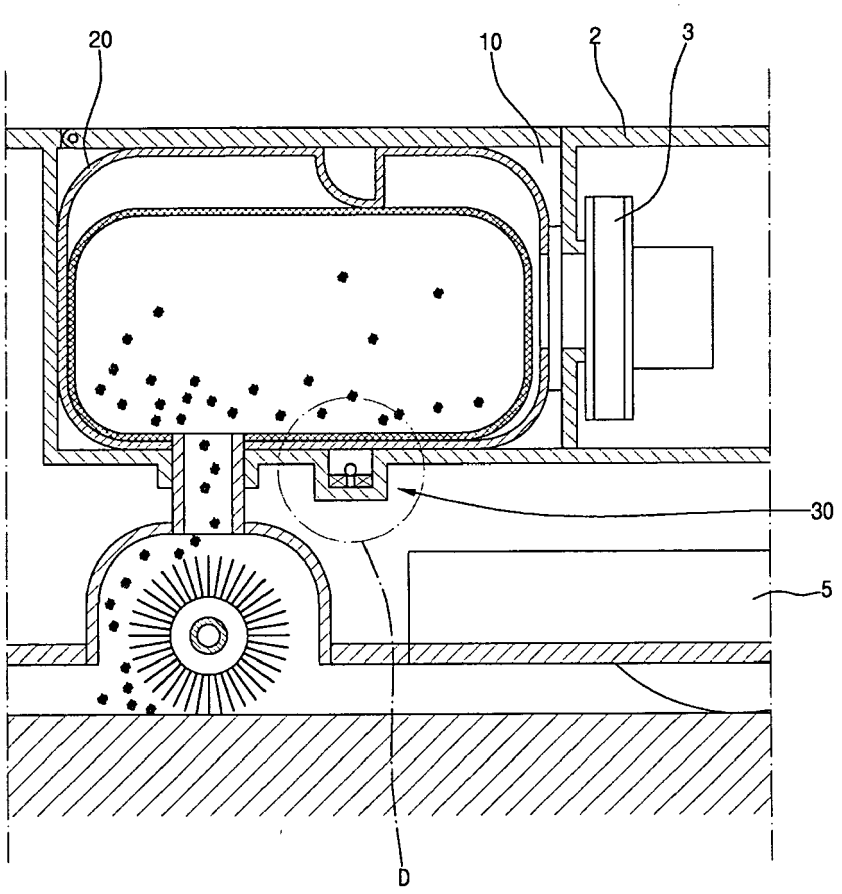


Fig.12

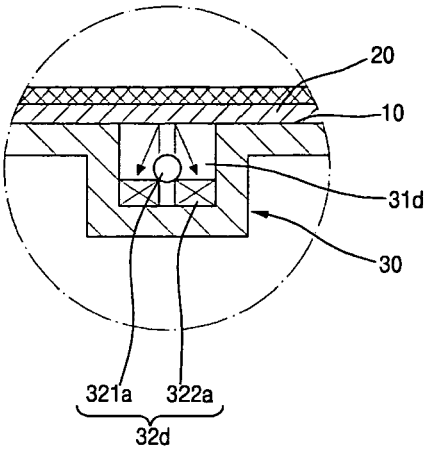


Fig.13

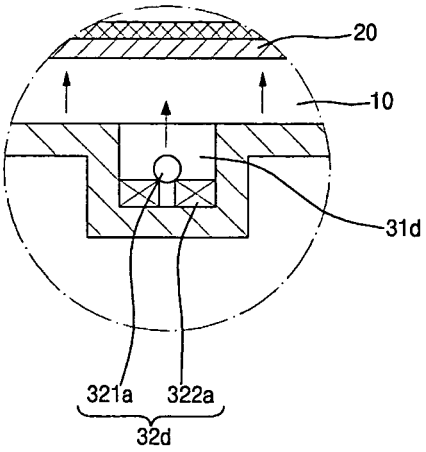


Fig.14

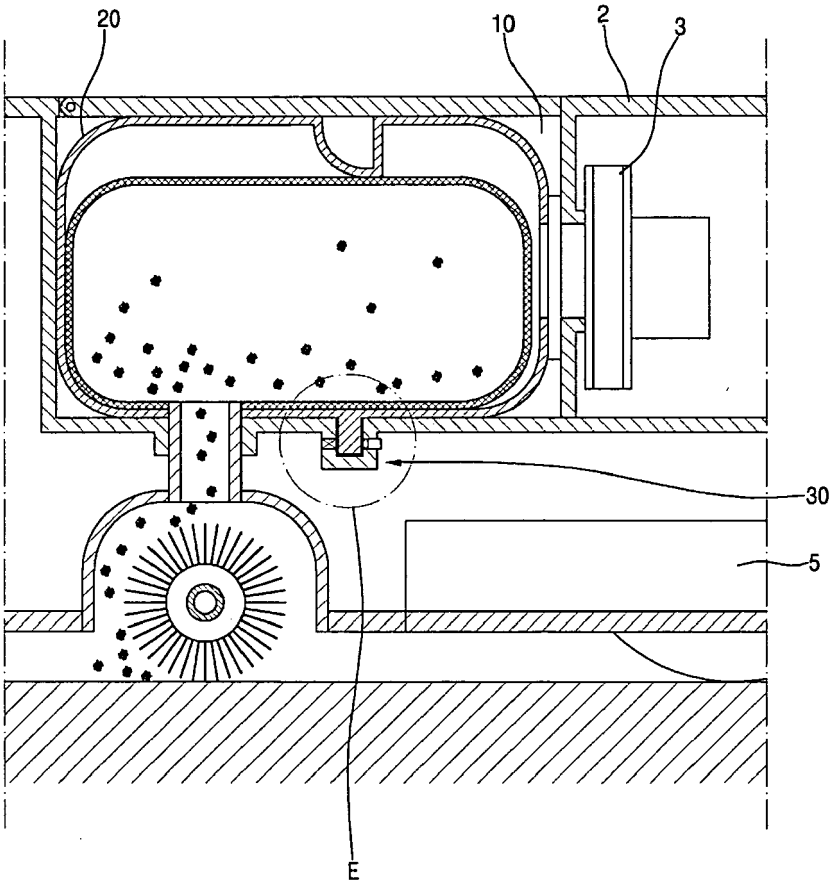


Fig.15

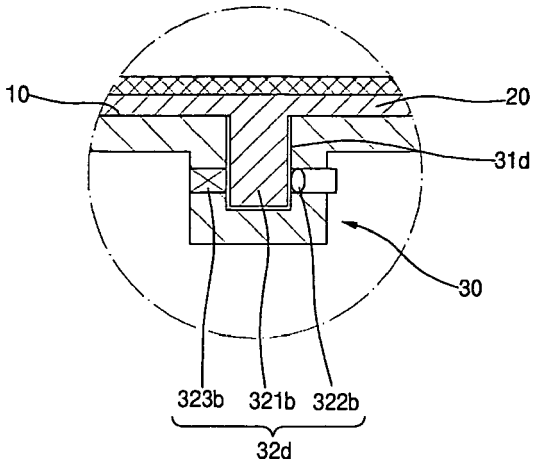


Fig.16

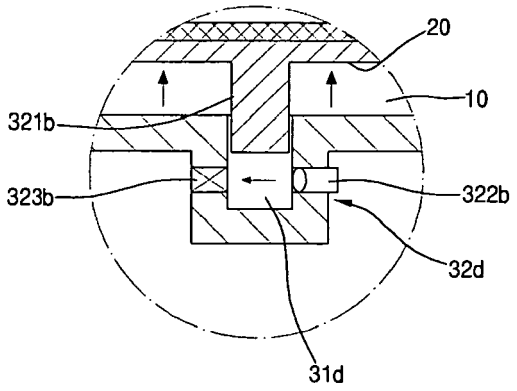


Fig.17

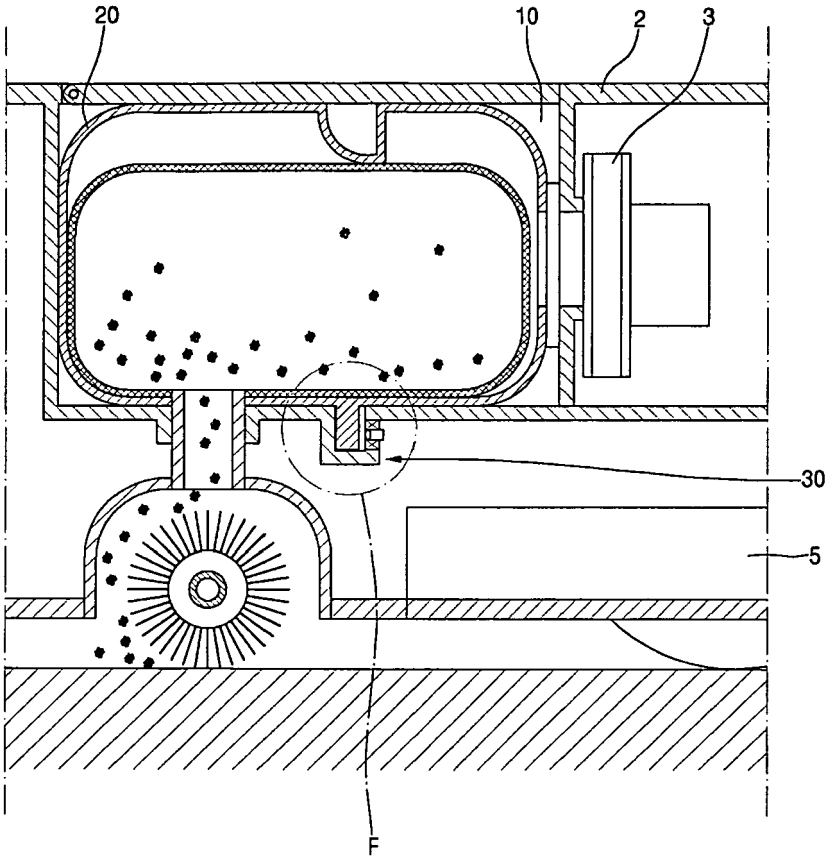


Fig.18

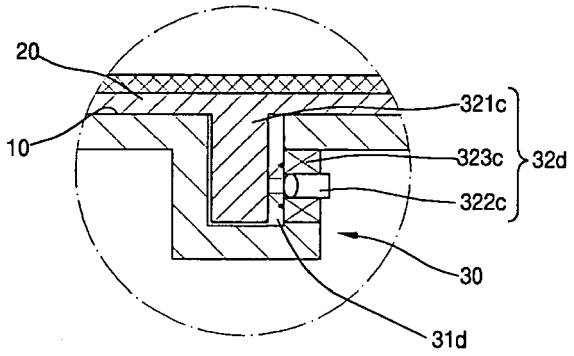


Fig.19

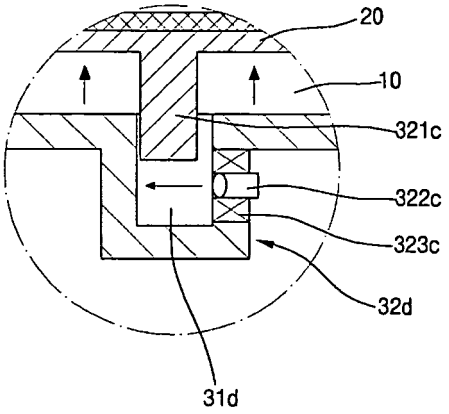


Fig.20

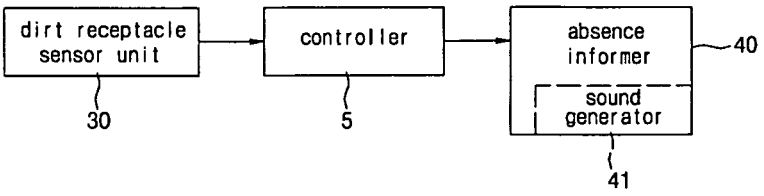
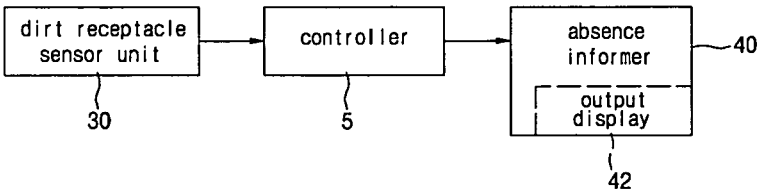

dirt receptacle sensor unit
30
controller
5
absence informer
40
sound generator
41

Fig.21


dirt receptacle sensor unit
30
controller
5
absence informer
40
output display
42