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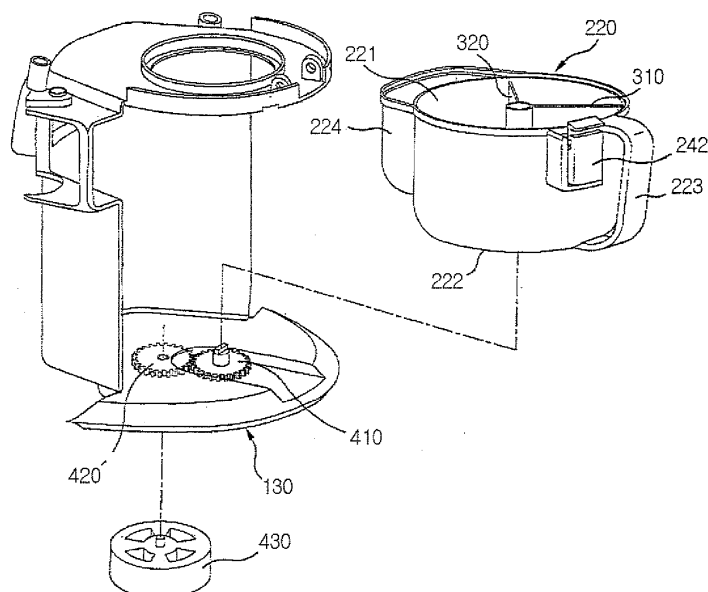
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(54) **Method of controlling vacuum cleaner**

(57) There is provided a method of controlling a vacuum cleaner having a dust collection unit in which dusts are stored. The method includes storing the dusts in the

dust collection unit using an operation of a suction motor and compressing the dusts stored in the dust collection unit using at least one movable pressing member to reduce a volume of the dusts.

Fig. 5



Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a vacuum cleaner control method, and more particularly, to a vacuum cleaner control method that can increase the dust collection capacity of a dust collection unit and easily discharge dusts collected.

Description of the Related Art

[0002] Generally, a vacuum cleaner is a device that can suck air containing dusts using vacuum pressure generated by a suction motor mounted in a main body and filter off the dusts in a main body.

[0003] The vacuum cleaner is classified into a canister type and an upright type. The canister type vacuum cleaner includes a main body and a suction nozzle connected to the main body by a connection pipe. The upright type vacuum cleaner includes a main body and a suction nozzle integrally formed with the main body.

[0004] Meanwhile, a dust collection unit mounted in a cyclone type vacuum cleaner separates dusts from air using a cyclone principle and the air whose dusts are removed is discharged out of the main body.

[0005] The cyclone dust collection unit includes a dust collection body, an air inlet through which the air is sucked into the dust collection body, a cyclone unit for separating dusts from the air sucked into the dust collection body, a dust storing unit for storing the separated dusts, and an air outlet through which the air whose dusts are filtered off in the cyclone unit is discharged.

[0006] Meanwhile, the dusts stored in a lower space of the dust collection body, i.e., in the dust storing unit, rotates along an inner circumference of the dust collection body by a rotational current generated in the dust collection body during the operation of the vacuum cleaner.

[0007] Furthermore, when the vacuum cleaner is turned off, the dusts are settled down in a low-density state.

[0008] Therefore, in the conventional dust collection unit, when a predetermined amount or more of dusts is collected in the dust collection unit during the operation of the vacuum cleaner, the dusts rise while rotating along an inner wall of the dust collection body and thus invades the cyclone unit formed at an upper space of the dust collection body. Therefore, the dusts that are not separated get along the discharge current to be discharged through the air outlet. This causes the deterioration of the dust collection performance.

[0009] When the vacuum cleaner is turned off, the dusts are settled down on the bottom of the dust collection body with the low-density state. In this case, the dusts accumulated in the dust collection body has a larger vol-

ume compared with the weight thereof, and thus the dust collection body must be frequently emptied in order to maintain the dust collection performance.

[0010] Accordingly, in order to improve the convenience in use of the vacuum cleaner, an effort to maximize the dust collection capacity of the dusts and improve the dust collection performance has been endeavored.

SUMMARY OF THE INVENTION

[0011] Accordingly, the present invention is directed to a vacuum cleaner control method that substantially obviates one or more problems due to limitations and disadvantages of the related art.

[0012] An object of the present invention is to provide a vacuum cleaner control method for increasing a dust collection capacity of a dust collection unit.

[0013] Another object of the present invention is to provide a vacuum cleaner control method for automatically performing the compression of the dusts in the dust collection unit.

[0014] Still another object of the present invention is to provide a vacuum cleaner control method that keep performing the dust compression operation even when the vacuum cleaner is turned off, thereby making it easy to discharge the dusts.

[0015] Additional advantages, objects, and features of the invention will be set forth in part in the description which follows and in part will become apparent to those having ordinary skill in the art upon examination of the following or may be learned from practice of the invention. The objectives and other advantages of the invention may be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

[0016] To achieve these objects and other advantages and in accordance with the purpose of the invention, as embodied and broadly described herein, there is provided a method of controlling a vacuum cleaner having a dust collection unit in which dusts are stored, the method including: storing the dusts in the dust collection unit using an operation of a suction motor; and compressing the dusts stored in the dust collection unit using at least one movable pressing member to reduce a volume of the dusts.

[0017] In another aspect of the present invention, there is provided a method of controlling a vacuum cleaner having a dust collection unit in which dusts separated from air sucked by a suction motor are stored, the method including: stopping an operation of the suction motor; and stopping a first pressing member after the first pressing member moves to a second pressing member, the first and second pressing member being provided in the dust collection unit.

[0018] According to the above-described present invention, since the dusts stored in the dust collection unit is compressed by a pair of the pressing members and thus the volume thereof can be minimized, the dust col-

lection capacity in the dust collection unit can be maximized.

[0019] In addition, since the dust collection capacity is maximized, there is no need for the user to frequently empty the dust collection unit.

[0020] Since the compression state of the dusts in the dust collection unit can be maintained even when the operation of the vacuum cleaner is stopped, the dusts stored in the dust collection unit can be easily discharged during emptying the dust collection unit.

[0021] Since the dust discharge request is displayed when the predetermined amount or more of the dusts are collected in the dust collection unit, the user can easily know the dust collection unit empty timing.

[0022] It is to be understood that both the foregoing general description and the following detailed description of the present invention are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this application, illustrate embodiment(s) of the invention and together with the description serve to explain the principle of the invention. In the drawings:

[0024] Fig. 1 is a perspective view of a dust collection unit of a vacuum cleaner according to an embodiment of the present invention, when the dust collection unit is separated from the vacuum cleaner;

[0025] Fig. 2 is a perspective view of a dust collection mounting portion and a dust collection unit of the vacuum cleaner of Fig. 1, when the dust collection unit is separated from the dust collection unit mounting portion;

[0026] Fig. 3 is a partially-cutaway perspective view of the dust collection unit;

[0027] Fig. 4 is an enlarged view of a portion A in Fig. 3;

[0028] Fig. 5 is a perspective view illustrating a coupling arrangement between a dust collection unit and a driving unit provided to compress the dusts stored in the dust collection unit;

[0029] Fig. 6 is a perspective view of a dust separating unit and a dust collection container of the dust collection unit;

[0030] Fig. 7 is a lower perspective view of Fig. 6;

[0031] Fig. 8 is a flowchart illustrating a compression process of dusts in the dust collection unit;

[0032] Figs. 9 through 13 are top plane views of the dust collection container, illustrating a dust compression process in the dust collection unit; and

[0033] Fig. 14 is a flowchart illustrating a method of controlling a compression member when a suction motor is turned off during the dust compression process in the dust collection unit.

DETAILED DESCRIPTION OF THE INVENTION

[0034] Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings. Wherever possible, the same reference numbers will be used throughout the drawings to refer to the same or like parts.

[0035] Fig. 1 is a perspective view of a dust collection unit of a vacuum cleaner according to an embodiment of the present invention, when the dust collection unit is separated from the vacuum cleaner.

[0036] Referring to Fig. 1, a vacuum cleaner includes a main body 100 in which a suction motor (not shown) for generating vacuum pressure in the vacuum cleaner is provided and a dust collection unit 200 for separating the dusts in air and storing the same.

[0037] Although not shown in Fig. 1, the vacuum cleaner includes a suction nozzle sucking the air containing the dusts and an extension pipe connecting the suction nozzle to the main body 100.

[0038] In this embodiment, the suction nozzle and the extension pipe are well known in the art, the detailed description thereof will be omitted herein.

[0039] A main body suction portion 110 through which the air containing the dusts are sucked is formed at a front-lower end of the main body 100.

[0040] A main body discharge portion 120 through which the air whose dusts are separated is formed at a side of the main body. The dust collection unit 200 includes a dust separation portion 210 for separating the dusts from the air and a dust collection container 220 for storing the dusts separated from the dusts.

[0041] Here, the dust separation unit 210 includes a cyclone unit 211 that separates the dusts from the air using a cyclone theory, i.e., a centrifugal force difference. Therefore, the dusts separated by the cyclone unit 211 are stored in the dust collection container 220.

[0042] Meanwhile, it is preferable that the dust collection unit 200 is designed to maximize the dust collection capacity of the dusts stored therein. Therefore, the dust collection unit 200 is preferably provided with additional unit for minimizing the volume of the dusts stored in the dust collection container 220.

[0043] The following will describe the dust collection unit that is maximized in the dust collection capacity according to the present invention with reference to Figs. 2 and 5.

[0044] Fig. 2 is a perspective view of a dust collection mounting portion and a dust collection unit of the vacuum cleaner of Fig. 1, when the dust collection unit is separated from the dust collection unit mounting portion, Fig. 3 is a partially-cutaway perspective view of the dust collection unit, Fig. 4 is an enlarged view of a portion A in Fig. 3, and Fig. 5 is a perspective view illustrating a coupling arrangement between a dust collection unit and a driving unit provided to compress the dusts stored in the dust collection unit;

[0045] Referring to Figs. 2 and 5, the dust collection unit 200 is detachably mounted on the main body 100.

[0046] The main body 100 is provided with a dust collection unit mounting portion 130 on which the dust collection unit 200 is mounted.

[0047] A pair of pressing members 310 and 320 are provided in the dust collection unit 200 to reduce the volume of the dusts stored in the dust collection container 220, thereby increasing the dust collection capacity.

[0048] Here, the pair of pressing members 310 and 320 compress the dusts by the interaction thereof and thus reduce the volume of the dusts. Therefore, the density of the dusts stored in the dust collection container 220 decreases and thus the maximum dust collection capacity of the dust collection container 220 increases.

[0049] For descriptive convenience, the pair of the pressing members 310 and 320 are respectively referred as first and second pressing members 310 and 320.

[0050] In this embodiment, at least one of the first and second pressing members 310 and 320 is movably provided in the dust collection container 220 so that the dusts are effectively compressed by the pressing members 310 and 320.

[0051] That is, when the first and second pressing members 310 and 320 are rotatably provided in the dust collection container 220, the first and second pressing members 310 and 320 rotate and move toward each other so that a gap between the first and second plates 310 and 320 is reduced and thus the dusts between the first and second plates 310 and 320 are compressed.

[0052] In this embodiment, the first pressing member 310 is rotatably provided in the dust collection container 220 and the second pressing member 220 is fixed in the dust collection container 220.

[0053] Accordingly, the first pressing member 310 becomes a rotational plate and the second pressing member 310 becomes a stationary plate.

[0054] Meanwhile, the dust collection container 320 is provided with a dust storing portion 221 defining a space on which the dusts are stored. The dust storing unit 221 is formed surrounding a rotational locus of a free end 311 of the first pressing member 310.

[0055] That is, the second pressing member 320 may be provided between an axis of the rotational shaft 312, which is a rotational center of the first pressing member 310, and an inner circumference of the dust storing portion 221.

[0056] That is, the second pressing member 320 is provided on a plan connecting the axis of the rotational shaft 312 to the inner circumference of the dust storing portion 221. At this point, the second pressing member 320 shields partly or completely the space defined between the inner circumference of the dust storing portion 221 and the axis of the rotational shaft 312 so that the dusts are pushed and compressed against the first pressing member 310.

[0057] A first end 321 of the second pressing member 320 is integrally formed on the inner circumference of the

dust storing portion 221 and a second end of the second pressing member 320 is integrally formed on the fixing shaft 322 provided on a common axis with the rotational shaft 312 of the first pressing member 310.

[0058] Alternatively, only the first end of the second pressing member 320 is integrally formed on the inner circumference of the dust storing portion 221 or only the second end of the second pressing member is integrally formed on the fixing shaft 322. That is, the second pressing member 320 is fixed on at least one of the inner circumference of the dust storing portion 221 and the fixing shaft 322.

[0059] However, even when the first end of the second pressing member 320 is not integrally formed on the inner circumference of the dust storing portion 221, it is preferably that the first end of the second pressing member 320 is positioned near the inner circumference of the dust storing portion 221.

[0060] Furthermore, even when the second end of the second pressing member 320 is not integrally connected to the fixing shaft 322, it is preferable that the second end of the second pressing member 320 is positioned near the fixing shaft 322.

[0061] The reason for positioning the second pressing member 320 is to prevent the dusts rushing in by the first pressing member 310 from leaking through a gap formed in a side direction of the second pressing member 320.

[0062] The first and second pressing members 310 and 320 are formed of rectangular plates. The rotational shaft 312 of the first pressing member 310 may be provided on a common axis with the axis defining the center of the dust storing portion 221.

[0063] Meanwhile, the fixing shaft 322 protrudes inward from an end of the dust storing portion 221. The fixing shaft 322 is provided with a hollow portion extending in the axial direction. The rotational shaft 312 is assembled in the hollow portion. That is, a portion of the rotational shaft 312 is inserted downward into the hollow portion of the fixing shaft 322.

[0064] With the above-described structure, the vacuum cleaner of this embodiment further includes a driving unit 400 connected to a rotational shaft 312 of the first pressing member 310 and rotating the first pressing member 310.

[0065] The following will describe the dust collection unit 200 and the driving unit 400 with reference to Figs. 4 and 5.

[0066] The driving unit 400 includes a driving motor 430 generating driving power, and power transmission units 410 and 420 rotating the first pressing member 310 by transmitting the driving power of the driving motor 430 to the first pressing member 310.

[0067] That is, the power transmission units 410 and 420 includes a driven gear 410 coupled to the rotational shaft 312 of the first pressing member 310 and a driving gear 420 transmitting power to the driven gear 410.

[0068] The driving gear 420 is coupled to the rotational shaft 870 to rotate by the driving motor 430.

[0069] Therefore, when the driving motor 430 rotates, the driving gear 420 coupled to the driving motor 430 rotates. The rotational force of the driving motor 430 is transmitted to the driven gear 410 and thus to the first plate 310, thereby rotating the first pressing member 310.

[0070] Meanwhile, the driving motor 430 is provided at a lower portion of the dust collection unit mounting portion 130 and the driving gear 420 is coupled to the rotational shaft of the driving motor 430 and provided on a bottom of the dust collection unit mounting portion 130.

[0071] A portion of the outer circumference of the driving gear 420 is exposed at the bottom of the dust collection unit mounting portion 130.

[0072] Therefore, it is preferable that a motor receiving portion (not shown) in which the driving motor 430 is installed is provided under the bottom of the dust collection unit mounting portion 130. The dust collection unit mounting portion 130 is provided at the bottom with an opening 131 through which a portion of the outer circumference of the driving gear 420 is exposed.

[0073] Meanwhile, the rotational shaft 312 of the first pressing member 310 is inserted downward into the hollow portion of the fixing shaft 322 and the driven gear 410 is inserted upward into the hollow portion of the fixing shaft 322, thereby being coupled to the rotational shaft 312.

[0074] The rotational shaft 312 is provided with a stepped portion 312c supported on the upper end of the fixing shaft 322. The rotational shaft 312 is divided into upper and lower shafts 312a and 312b with reference to the stepped portion 312c. The upper shaft 312a is coupled to the first pressing member 310 and the lower shaft 312b is coupled to the driven gear 410.

[0075] Here, in order to allow the lower shaft 312b to be coupled to the driven gear 410, the lower shaft 312b is provided with a groove 312d in which a gear shaft of the driven gear 410 is inserted.

[0076] Here, the groove 312d may be formed in a variety of shapes such as circle, square and the like. The gear shaft of the driven gear 410 is formed in a shape corresponding to the groove 312d.

[0077] Therefore, when the driven gear 410 is coupled to the rotational shaft 312, the driven gear 410 is exposed out of the dust collection container 220.

[0078] As the driven gear 410 is exposed to an external side of the dust collection container 220, the driven gear 410 is engaged with the driving gear 420 when the dust collection unit mounting portion 130 is mounted on the dust collection unit 200.

[0079] Meanwhile, the driving motor 430 may be a reversible motor.

[0080] That is, the driving motor 430 may be a synchronous motor. The synchronous motor rotates clockwise and counterclockwise by itself. When a force applied to the motor is a reference value or more when the motor rotates in a direction, the motor rotates in the other direction.

[0081] At this point, the force applied to the motor is a

torque generated as the first pressing member 310 presses the dusts. When the resistance reaches a reference value, the rotational direction of the motor is converted.

[0082] Since the synchronous motor is well known in the art, the detailed description thereof will be omitted herein. The feature that the reversible motor 870 is the synchronous motor is one of the spirit of the present invention).

[0083] When the first pressing member 310 reaches a peak point where it cannot rotate by the compressed dusts, it is preferable that the first pressing member 31 keeps pressing the dusts for a predetermined time.

[0084] Here, the peak point means a case where the resistance reaches the reference value.

[0085] When the resistance reaches the reference value, the power rotating the first pressing member 310, i.e., electric power applied to the driving motor 430 is cut off for a predetermined time so that the first pressing member 310 keeps the pressing state of the dusts. When the predetermined time passes, the electric power is applied again to the driving motor 430 so that the first pressing member 31 moves.

[0086] At this point, the cutting timing of the electric power applied to the driving motor 430 is a case where the resistance reaches the reference value. Therefore, when the driving motor is driven again, the rotational direction of the driving motor will be opposite to that in which the driving motor rotated before the power is cut off.

[0087] Meanwhile, it is preferable that the first pressing member 310 moves away from the compressed dusts so that the compressed dusts stored in the dust collection container 220 can be easily discharged.

[0088] At this point, the first pressing member 310 is spaced apart from the second pressing member 320 by 180°. Here, the spacing of the first pressing member 310 away from the compressed dusts is realized by the driving motor 430.

[0089] Accordingly, in the dust storing portion 221, the compressed dusts contacts the inner circumference of the dust storing unit 221 and the second pressing member, the dust collection container 220 can be easily emptied.

[0090] When a predetermined amount or more of the dusts are collected in the dust collection container 220, an indication for allowing the user to empty the dust collection container 220 is displayed in order to prevent the deterioration of the dust collection performance and the overload of the motor.

[0091] To realize this, an indicator (not shown) is provided on the main body 100, the dust collection unit 200, or a handle (not shown). When the predetermined amount or more of the dusts are collected in the dust collection container 220 and thus the rotational range of the first pressing member 310 becomes a predetermined angle or less, the indication for letting the user to know the empty timing is displayed on the indicator.

[0092] Fig. 6 is a perspective view of the dust separating unit and dust collection container of the dust collection

unit and Fig. 7 is a bottom perspective view of Fig. 6.

[0093] Referring to Figs. 6 and 7, the dust separation unit 210 is coupled to an upper portion of the dust collection container 220 and thus the dusts are separated in the dust separation unit 210 are directed downward and stored in the dust collection container 220.

[0094] The dust separation unit 210 is provided at an outer circumference with an air inlet 211a formed on a normal direction of the dust separation portion 210. A cover 221d is detachably provided on a top of the dust separation unit 210.

[0095] The cover 211d is provided at a center with an air outlet 211b through which the air whose dusts are separated by the cyclone unit 211 in the separation unit 210.

[0096] A hollow air exhaust member 211c is coupled to the air outlet 211b and the hollow air exhaust member 211c is provided at a circumference with a plurality of through holes for exhausting the air directed from the cyclone unit 211.

[0097] A partition plate 230 is formed at a lower portion of the dust separation unit 210. The partition plate 230 functions to divide the dust separation unit 210 and the dust collection unit 220. The partition plate 230 prevents the dusts from flying into the dust collection container 220 in a state where the dust separation unit 210 is coupled to the dust collection container 220.

[0098] The partition plate 230 is provided with a dust discharge hole 231 for discharging the dusts from the cyclone unit 211 to the dust separation unit 210.

[0099] At this point, the dust discharge hole 231 may be formed at an opposite side of the second pressing member 320.

[0100] The reason for forming the dust discharge holes 231 at the opposite side of the second pressing member 320 is to maximize an amount of the dusts compressed by the opposite sides of the second pressing member 320 to maximize the dust collection capacity and to prevent the dusts from flying during the collection of the dusts.

[0101] As described above, the dust separation unit 210 and the dust collection container 220 are respectively provided with upper and lower handles 212 and 223.

[0102] The dust collection unit 200 is provided with a hook device so that the dust collection container 220 can be coupled to the dust separation unit 210 in a state where the dust collection container 220 is mounted on the dust separation unit 210.

[0103] That is, a hook receiver 241 is provided on the lower end of the dust separation unit 210 and a hook 242 hooked on the receiver 241 is formed on an upper end of the outer circumference of the dust collection container 220.

[0104] Meanwhile, when the cyclone unit 211 is referred as a main cyclone unit and the dust storing unit 221 is referred as a main storing unit, the dust collection unit 200 may further includes at least one sub-cyclone unit provided on the main body and a sub-storing unit

224 provided on the dust collection unit 200.

[0105] Here, the sub-storing unit 224 functions to secondarily separate the dusts contained in the air exhausted from the main cyclone 211 and the sub-storing unit 224 functions to store the dusts separated by the sub-cyclone unit.

[0106] The sub-storing unit 224 is provided on an outer circumference of the dust collection unit 200 in a state where an upper end thereof is opened.

[0107] In this embodiment, the sub-storing unit 224 is provided on the outer circumference of the dust collection container 220 and a sub-dust inlet portion 213a communicating with the sub-storing unit 224 is provided on the circumference of the dust separation portion 210.

[0108] Here, a sub-dust inlet portion 213a selectively communicating with the dust discharge hole 141 of the sub-cyclone unit 140 is formed on an outer wall of the sub-dust inlet portion 213. A bottom of the sub-dust inlet portion 213a is opened to communicate with the sub-storing unit 224.

[0109] Accordingly, when the main cyclone unit 211 is mounted on the main body 100, the sub-dust inlet hole 213a is connected to the dust discharge hole 141 of the sub-cyclone unit 140.

[0110] Therefore, the dusts separated in the sub-cyclone unit are stored in the sub-storing unit 224 through the sub-dust inlet portion 213a.

[0111] The following will describe the operation of the vacuum cleaner of the embodiment.

[0112] First, when power is applied to the vacuum cleaner and the air containing the dusts is sucked into the suction nozzle by the vacuum pressure generated by the suction motor.

[0113] The air directed into the suction nozzle 40 is introduced into the main cyclone unit through the air inlet 211a via the main body suction unit 110. The air introduced into the main cyclone unit is guided in a tangential direction of the inner wall of the main cyclone unit 211 to create spiral current. Therefore, the dusts contained in the air are separated from the air by a centrifugal difference between them.

[0114] The dusts spirally moving downward along the inner wall of the main cyclone unit 211 are stored in the main storing unit 221 after passing through the dust discharge hole 231 of the partition plate 230.

[0115] The air whose dusts are primarily separated by the main cyclone unit 211 is exhausted through the air outlet 211b via the air exhaust member 211c and then directed into the sub-cyclone unit.

[0116] Accordingly, the dusts separated in the sub-cyclone unit are stored in the sub-storing unit 224 and the dusts separated in the sub-cyclone unit are discharged from the sub-cyclone unit. Then, the dusts are introduced into the main body 100 and discharged from the main body through the main body discharge unit 120.

[0117] Meanwhile, most of the dusts introduced into the vacuum cleaner are stored in the main storing unit 221 during cleaning. The dusts stored in the main storing

unit 221 are compressed by the first and second pressing members 310 and 320 to a minimum volume. Therefore, a large amount of dusts can be stored in the main storing unit 221.

[0118] When a predetermined amount or more of the dusts is stored in the dust collection container 220, the indicator operates so that the user knows the fact that the dust collection container 220 must be emptied.

[0119] Then, the user separates the dust collection unit 200 from the main body 100 and empties the same.

[0120] The following will describe a compression process of dusts stored in the dust collection container 220 during the operation of the vacuum cleaner.

[0121] Fig. 8 is a flowchart illustrating a compression process of dusts in the dust collection unit, and Figs. 9 through 13 are top plane views of the dust connection container, illustrating a dust compression process in the dust collection unit;

[0122] The dusts separated in the cyclone unit 211 is first stored in the dust storing unit 221, in the course of which the pressing members 310 and 320 compress the dusts stored in the dust storing unit 221.

[0123] When the driving motor 430 rotates in a direction, the rotational power of the driving motor 430 is transmitted to the driven gear 410 to rotate the driven gear 410. By the rotation of the driven gear 410, the rotational shaft 312 and the first pressing member 310 rotate in a direction (S110).

[0124] At this point, since the driving gear 420 is engaged with the driven gear 410, the driving gear 420 rotates in a same direction as the driving motor 430 and the driven gear rotates in an opposite direction to the driving motor 430. That is, the driven gear 410 and the first pressing member 310 rotate in an opposite direction to the driving motor 430.

[0125] As described above, when the first pressing member 310 rotates in a direction (a counterclockwise direction in Fig. 9), the first pressing member 310 presses the dusts toward the second pressing member 320, thereby compressing the dusts. The first pressing member 310 keeps rotating until the resistance reaches the reference value.

[0126] That is, the resistance is compared with the reference value (S120). When it is determined that the resistance value is equal to or greater than the reference value, the electric power applied to the driving motor 430 is cut off so as to stop the dust compression operation of the first pressing member 310 (S130).

[0127] Then, the first pressing member 310 keeps a state compressing the dusts for a predetermined time at the stopped position. When a predetermined time passes, the driving motor 430 is driven again and the first pressing member 310 rotates in an opposite direction (S140).

[0128] Here, since the first pressing member 310 stops moving in a state where the resistance reaches the reference value, the rotational direction of the first pressing member 310 is converted to rotate clockwise as shown

in Fig. 10.

[0129] When the first pressing member 310 rotates clockwise, the first pressing member 310 presses the dusts toward the other surface of the second pressing member 320, thereby compressing the dusts.

[0130] Then, it is determined if the resistance applied to the first pressing member 310 reaches the reference value (S150).

[0131] When it is determined that the resistance value is equal to or greater than the reference value, the electric power applied to the driving motor 430 is cut off so as to stop the dust compression operation of the first pressing member 310 (S160).

[0132] The first pressing member 310 keeps a state compressing the dusts for a predetermined time at the stopped position. When a predetermined time passes, the driving motor 430 is driven again and the first pressing member 310 rotates in an opposite direction.

[0133] The above-described compression process is continuously repeated during the operation of the vacuum cleaner.

[0134] During the above-described compression process, it is determined if a rotational range θ is equal to or less than a reference value θ_p (S170).

[0135] When it is determined that a rotational range θ is equal to or less than a reference value θ_p , an empty request indication is noticed (S180).

[0136] When the vacuum cleaner is turned of, the dust compression process is finished.

[0137] Fig. 14 is a flowchart illustrating a method of controlling the pressing member when the suction motor is turned of during the dust compression process in the dust collection unit.

[0138] Referring to Fig. 14, when the vacuum cleaner is turned on, the dusts are separated from the air and stored in the dust storing unit 221. In addition, a process for compressing the dusts stored in the dust storing unit 221 by the pressing members 310 and 320 is performed (S100). Since the compression process is already described above, a detailed description thereof will be omitted herein.

[0139] Then, it is determined if the vacuum cleaner is turned off (S200). When the suction motor is turned off, the first pressing member 310 moves toward a side of the second pressing member 320.

[0140] That is, the pressing member 310 keeps moving toward the second pressing member 320, in the course of which it is determined if the resistance applied to the first pressing member 310 reaches a reference value. When it is determined that the resistance is equal to or greater than the reference value, the first pressing member 310 stops moving (S230).

[0141] Here, the stopping of the first pressing member 310 is realized by cutting off the electric power applied to the driving motor 430.

[0142] That is, when the suction motor is turned off, the first pressing member 310 is not immediately stopped but stopped after it moves toward the second pressing

member 320 until the resistance reaches the reference value.

[0143] As the first pressing member 310 is pressed after it presses the dusts toward the second pressing member 320 until the resistance reaches the reference value, the dust compression operation of the first and second pressing members 310 and 320 is kept. The stopping of the suction motor means the stopping of the vacuum cleaner.

[0144] As the dust compression operation of the first and second pressing members 310 and 320 is kept, the dust collection unit 200 can be easily emptied.

[0145] In addition, as the dust compression operation of the first and second pressing members 310 and 320 is kept, the compression operation by the movement of the first pressing member 310 can be easily performed during the next cleaning operation even when the dust collection unit 200 is not emptied.

[0146] As described above, even after the suction motor is turned off after the dust compression process is performed by the pressing members 310 and 320, the dust compression operation is kept. The compression process by the pressing members 310 and 320 may not be realized during the operation of the vacuum cleaner but realized when the suction motor is turned off.

[0147] That is, when the vacuum cleaner operates, the first pressing member 310 that is capable of rotating maintains the stopped state. When the vacuum cleaner stops operating, the first pressing member 310 moves toward one side of the second pressing member 320 and then stops. At this point, in order to effectively compress the dusts, after the first pressing member 310 moves to a first surface of the second pressing member 320 and further moves again to a second surface of the second pressing member 320, it may stop.

[0148] In addition, an additional first pressing member that can rotate together with the first pressing member 310 may be further provided. In this case, when the suction motor stops operating, the pressing members move toward the opposite surfaces of the second pressing member 320 and then stops, as a result of which the dust compression operation can be simultaneously realized at the both surfaces of the second pressing member 320.

[0149] Although the present invention is applied to the canister type vacuum cleaner by way of example, the present invention can be also applied to an upright type vacuum cleaner as well as a robot vacuum cleaner.

[0150] It will be apparent to those skilled in the art that various modifications and variations can be made in the present invention. Thus, it is intended that the present invention covers the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

Claims

1. A method of controlling a vacuum cleaner having a

dust collection unit in which dusts are stored, the method comprising:

storing the dusts in the dust collection unit using an operation of a suction motor; and compressing the dusts stored in the dust collection unit using at least one movable pressing member to reduce a volume of the dusts.

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2. The method of claim 1, wherein the compressing of the dusts includes moving the movable pressing member to a first surface of a stationary member fixed in the dust collection unit.

3. The method of claim 2, wherein the compressing of the dusts further includes moving the movable pressing member, which is moved to the first surface, to a second surface of the stationary member.

4. The method of claim 2 or 3, wherein the compressing of the dusts further includes determining if a resistance applied to the movable pressing member is equal to or greater than a reference value.

5. The method of claim 4, wherein, when the resistance is equal to or greater than the reference value, the pressing member is stopped for a predetermined time.

6. The method of claim 5, wherein, after the movable pressing member is stopped for the predetermined time, the movable pressing member moves to an opposite direction.

7. The method of claim 1, wherein the compressing of the dusts includes determining if a moving range of the movable pressing member is equal to or less than a reference value.

8. The method of claim 7, further comprising, when the moving range is less than the reference value, letting a user to know the fact.

9. The method of claim 1, further comprising, after the suction motor stops operating, stopping the movable pressing member after moving the movable pressing member to one side of a stationary member fixed in the dust collection unit.

10. The method of claim 1, wherein the pressing member rotates in the dust collection unit.

11. A method of controlling a vacuum cleaner having a dust collection unit in which dusts separated from air sucked by a suction motor are stored, the method comprising:

stopping an operation of the suction motor; and

stopping a first pressing member after the first pressing member moves to a second pressing member, the first and second pressing member being provided in the dust collection unit.

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12. The method of claim 11, wherein the first pressing member is a rotational member and the second pressing member is a stationary member fixed in the dust collection unit.

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13. The method of claim 12, wherein the rotational member compresses the dusts between the rotational and stationary members at a stopped location thereof.

14. The method of claim 12, wherein the rotational member stops when a resistance applied to the rotational member becomes higher than a reference value.

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15. The method of claim 12, wherein the rotational member moves toward a first surface of the stationary member when the suction motor stops operating.

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16. The method of claim 15, wherein the first surface of the stationary member faces a rotating direction of the rotational member.

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17. The method of claim 15, wherein, after the rotational member moves toward the first surface of the stationary member, the rotational member moves toward a second surface of the stationary member and stops.

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18. The method of claim 12, further comprising an additional rotational member, wherein, when the suction motor stops operating, one of the rotational members stops after moving toward a first surface of the stationary member and the other of the rotational members stops after moving toward a second surface of the stationary member.

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19. The method of claim 11, wherein, during the operation of the suction motor, the dusts stored in the dust collection unit is compressed by the pressing members.

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Fig.1

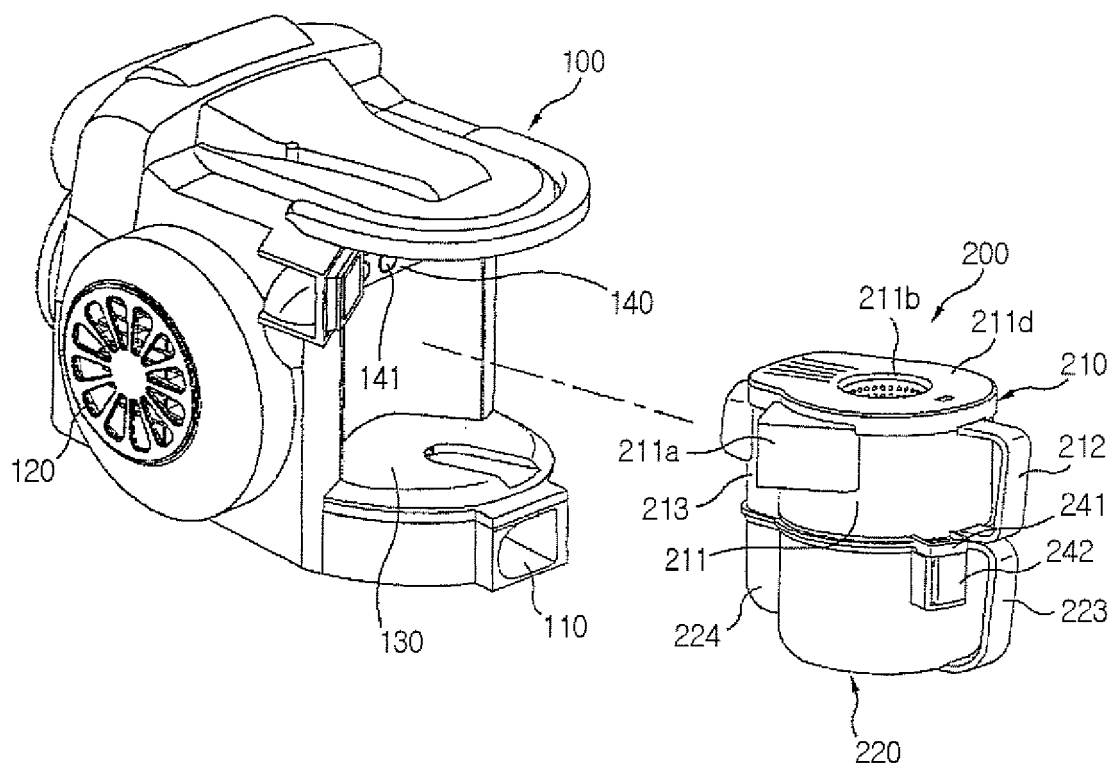


Fig.2

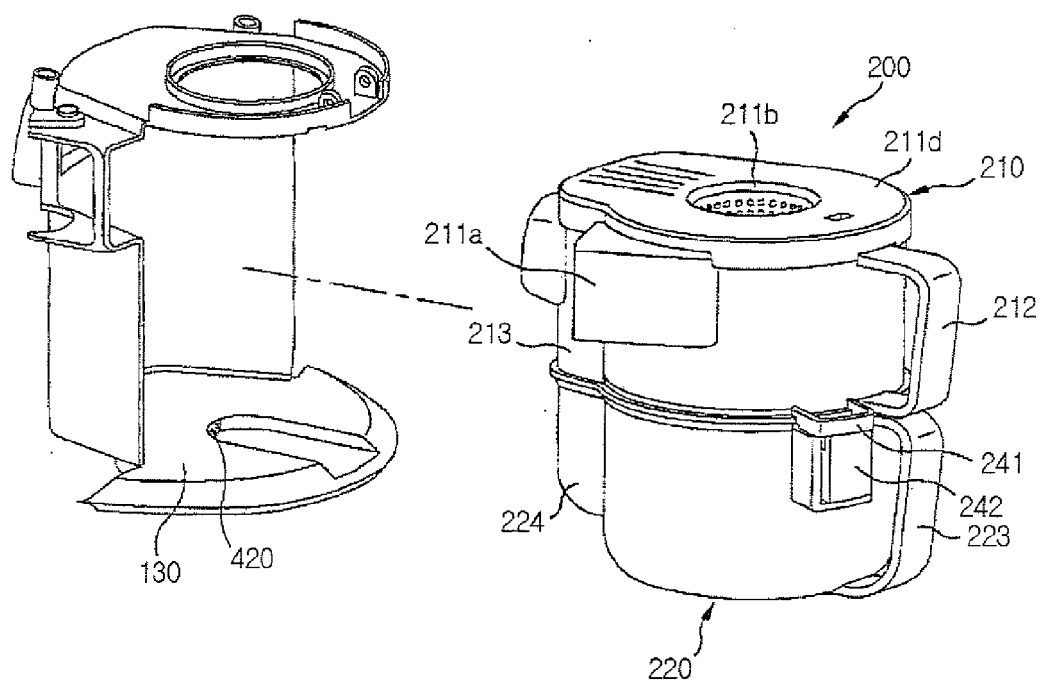


Fig.3

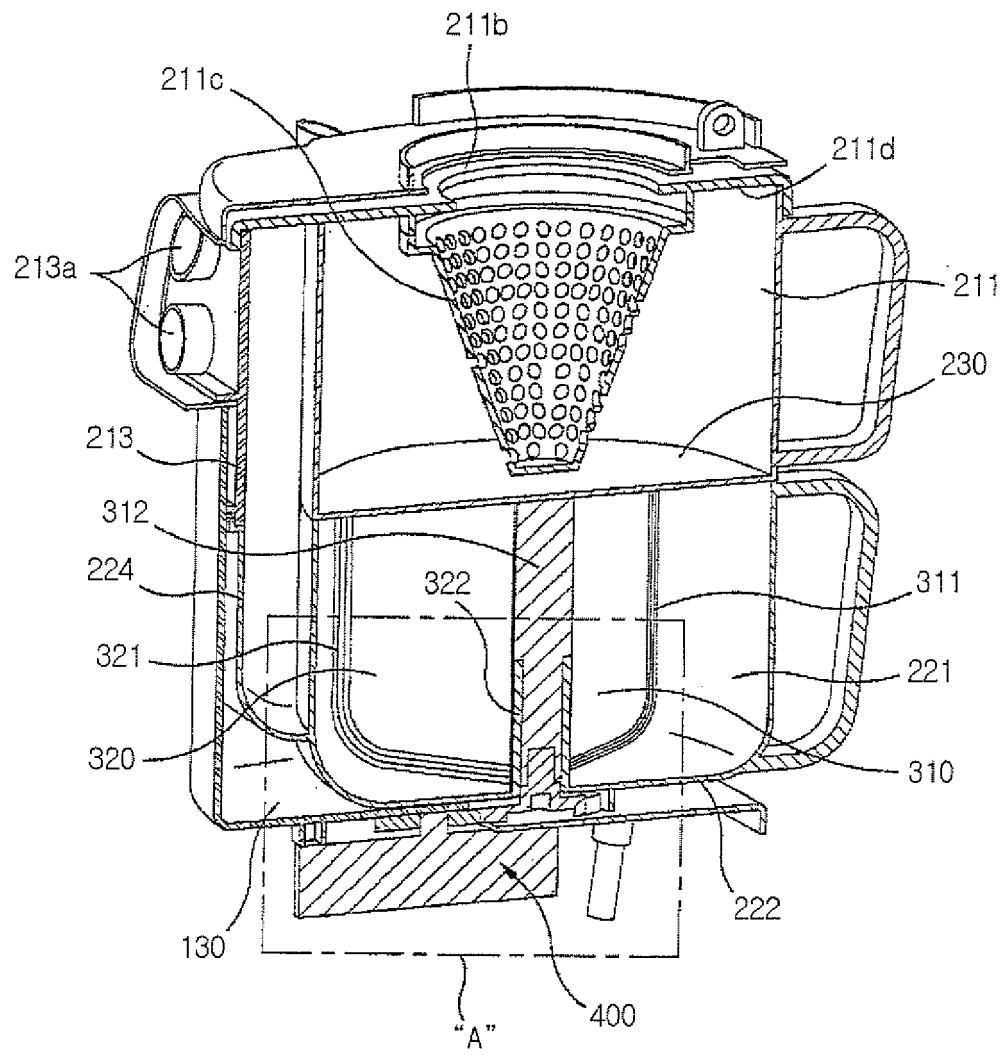


Fig.4

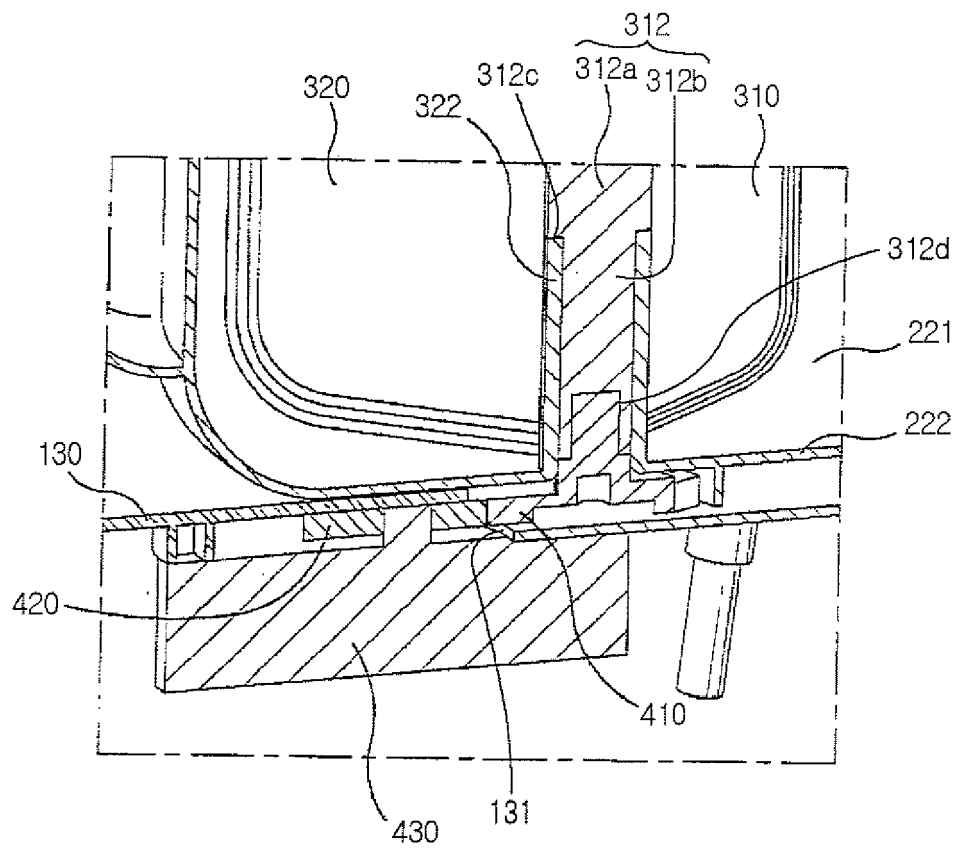


Fig.5

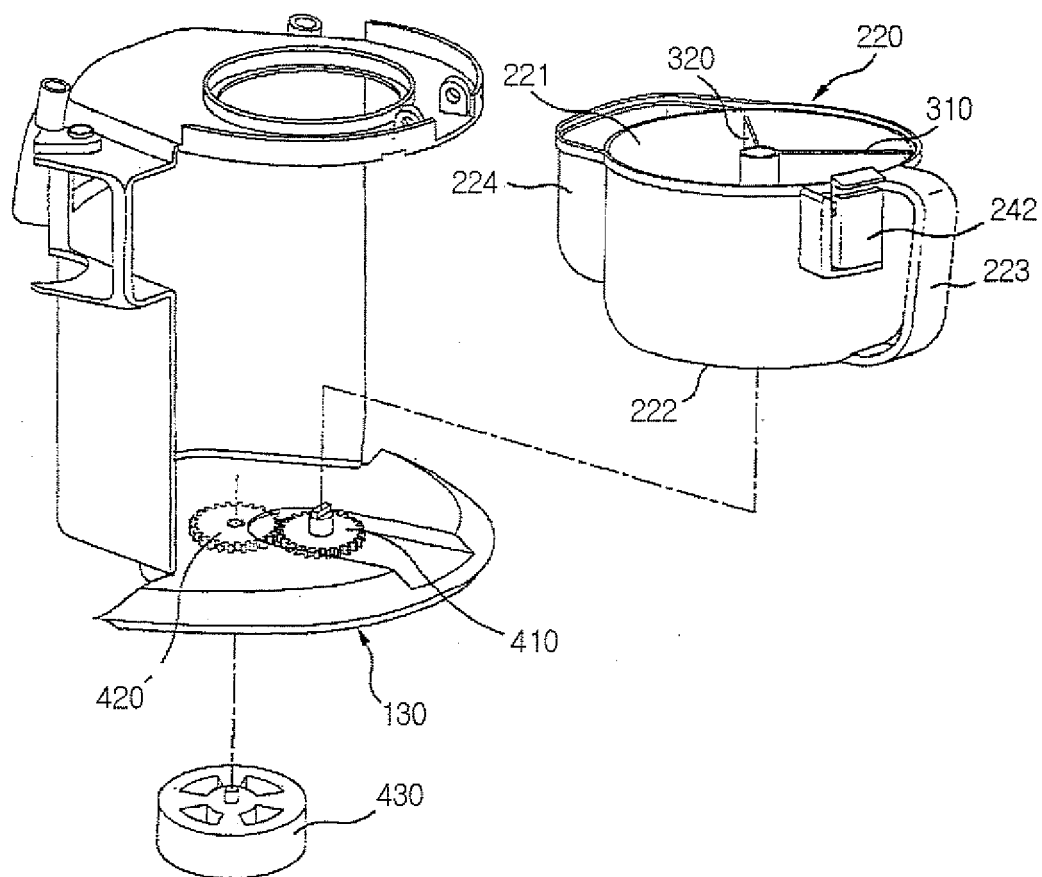


Fig. 6

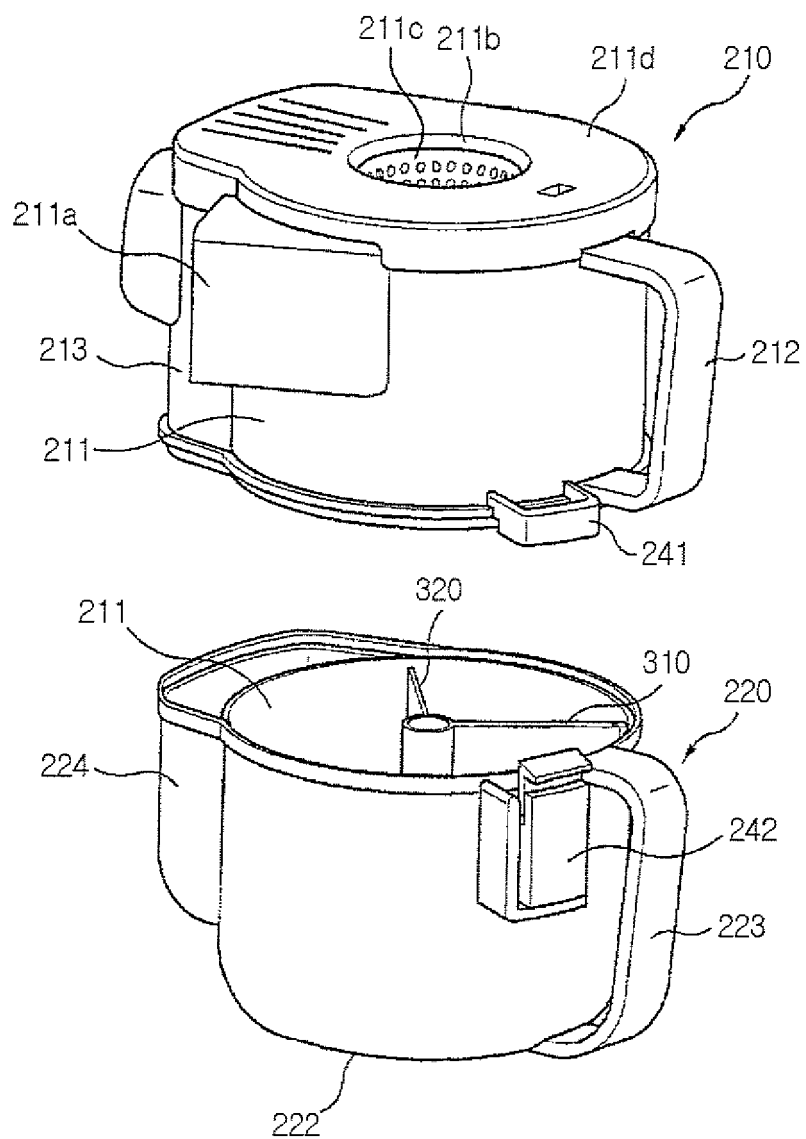


Fig.7

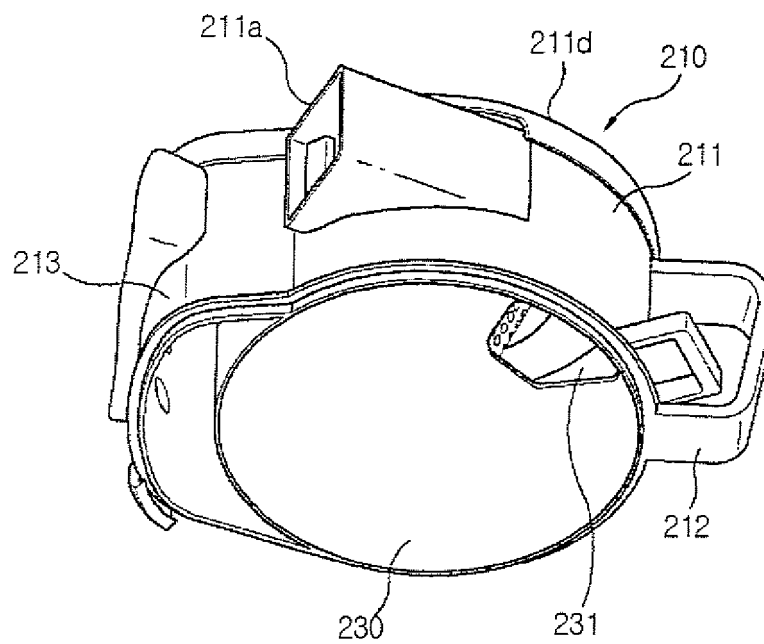


Fig.8

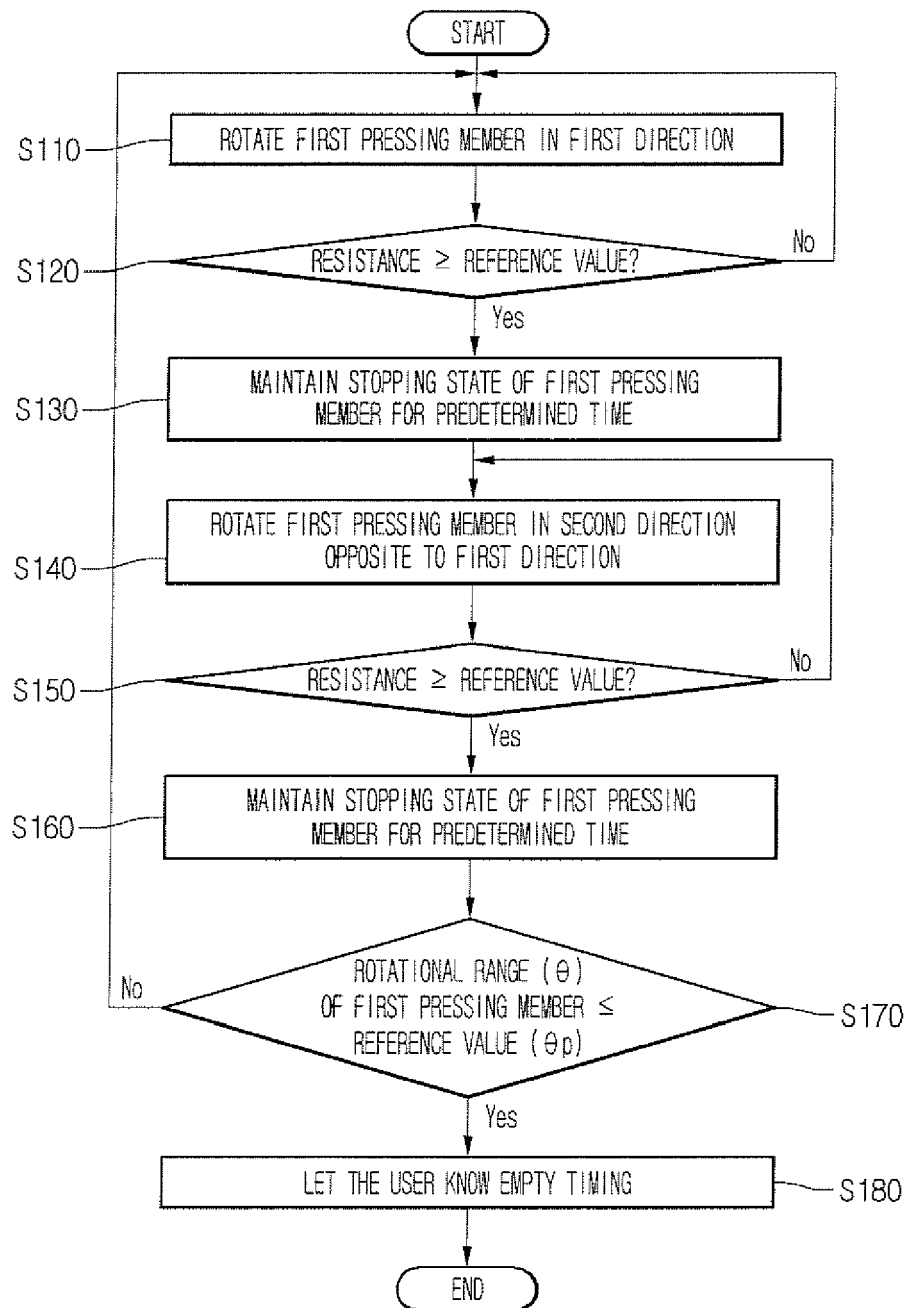


Fig. 9

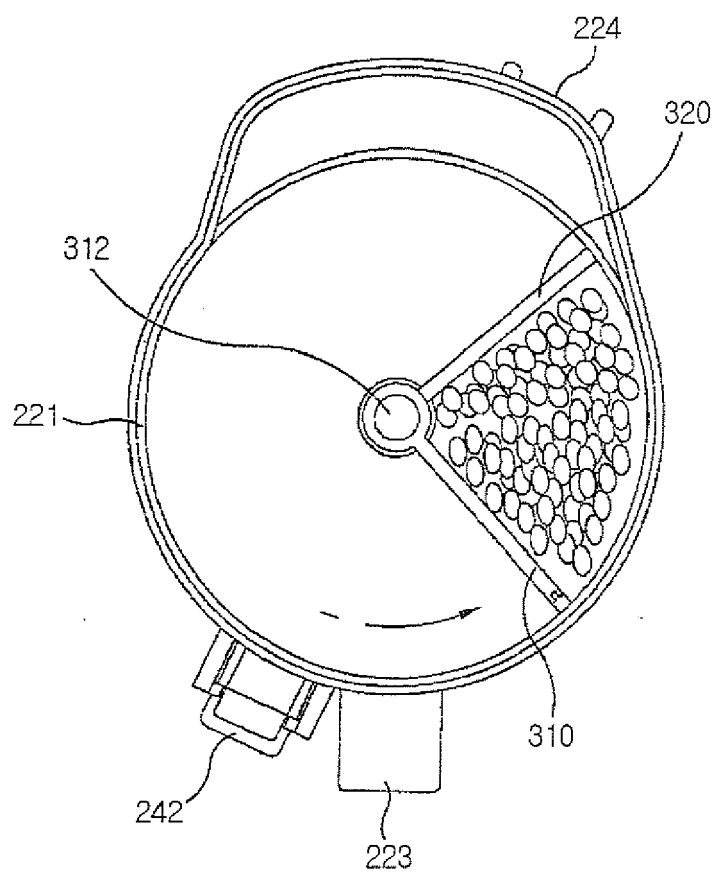


Fig.10

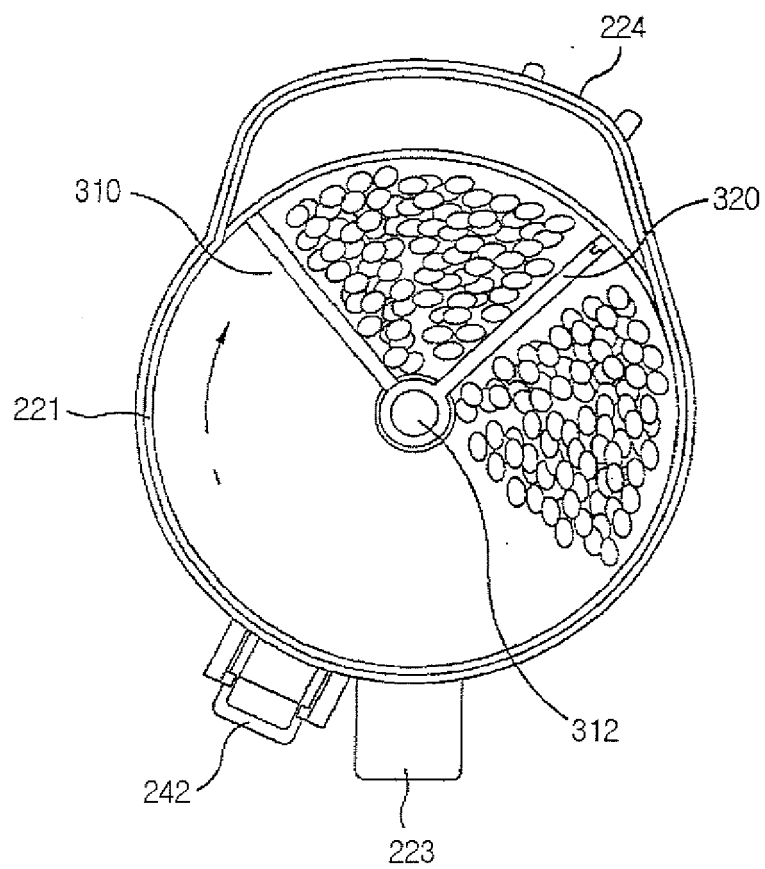


Fig.11

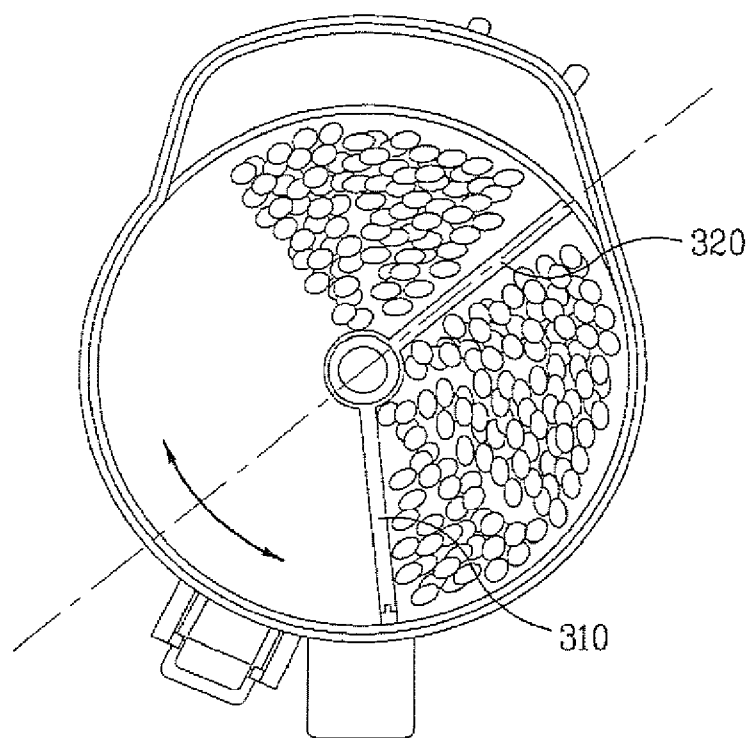


Fig.12

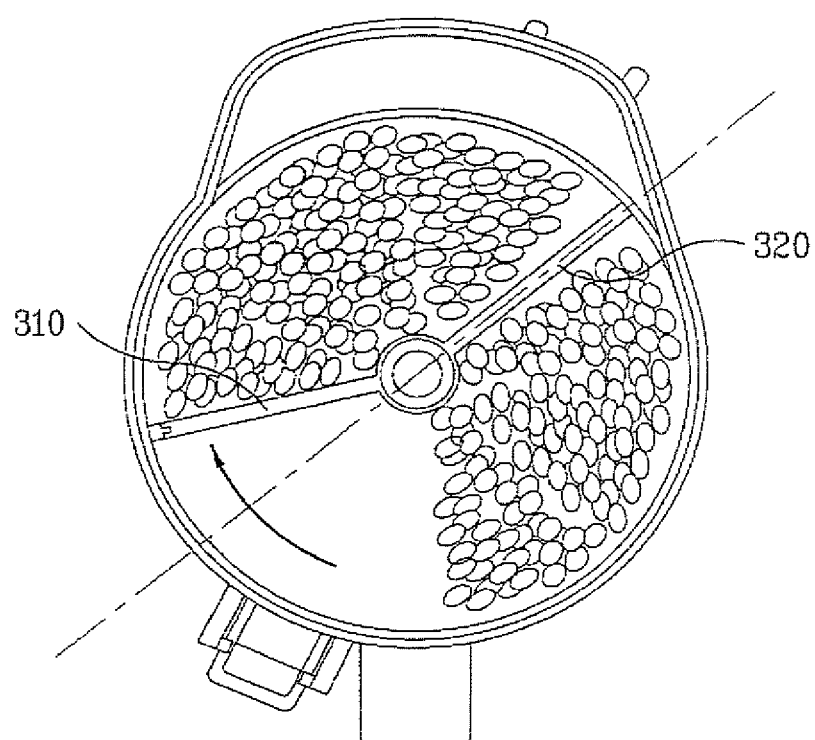


Fig.13

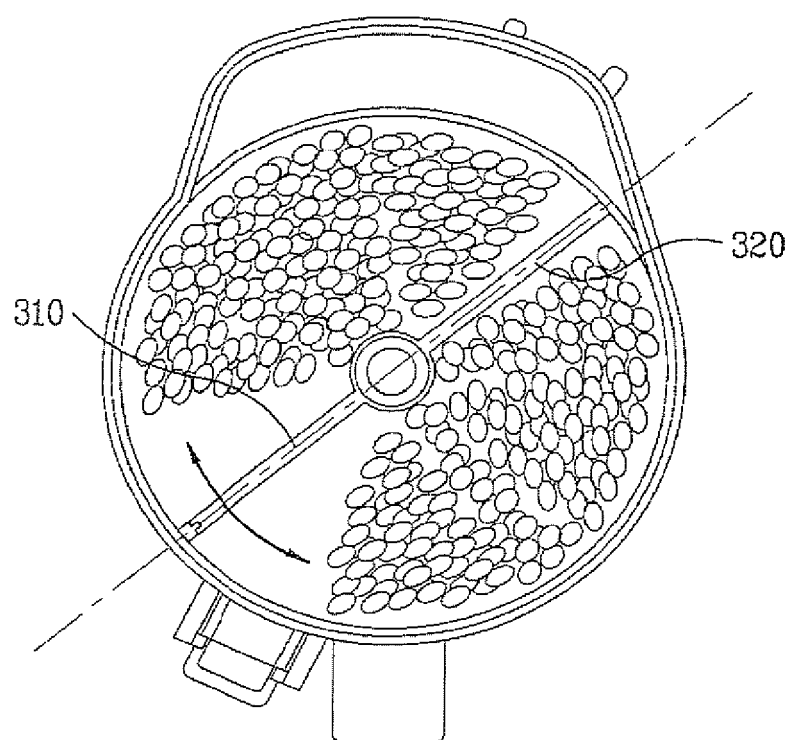


Fig.14

