

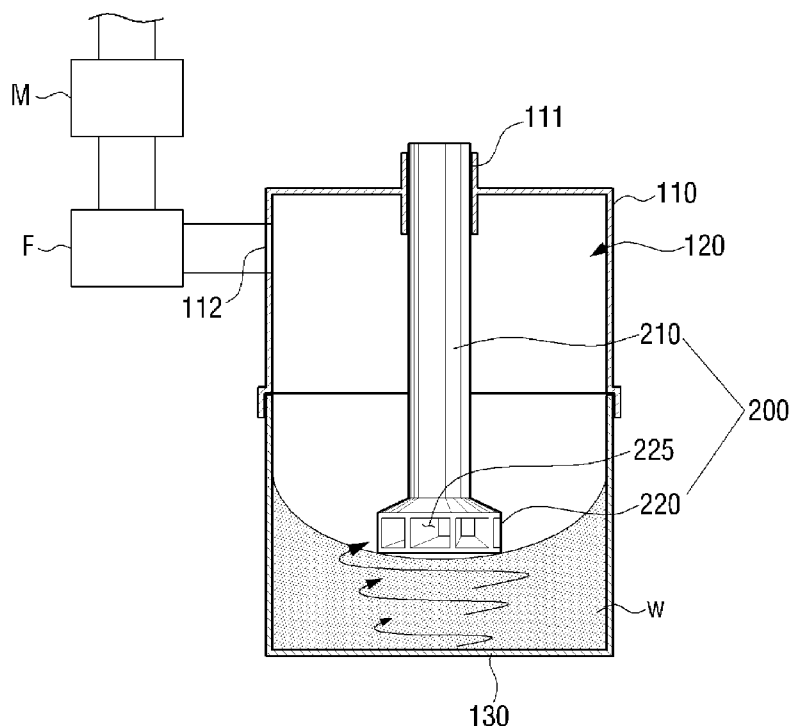


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| <p>(51) International Patent Classification:
 <i>A47L 9/18</i> (2006.01) <i>A47L 9/16</i> (2006.01)</p> <p>(21) International Application Number:
 PCT/KR2009/008025</p> <p>(22) International Filing Date:
 31 December 2009 (31.12.2009)</p> <p>(25) Filing Language: English</p> <p>(26) Publication Language: English</p> <p>(30) Priority Data:
 10-2009-0005233 21 January 2009 (21.01.2009) KR
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- (54) Title:** DUST SEPARATOR AND VACUUM CLEANER HAVING THE SAME

[Fig. 2]



(57) Abstract: A dust separator of a vacuum cleaner stores collecting water and comprises an inlet through which dirt-entrained air is drawn in and an outlet through which filtered air is discharged. The inlet is disposed in a center of the dust separator and the dust separator comprises a rotating device to uniformly spray the air drawn in through the inlet in all directions on a horizontal plane, thereby rotating the air. The collecting water shakes in a uniform pattern by the air sprayed by the rotating device.



NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE,

ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *without international search report and to be republished upon receipt of that report (Rule 48.2(g))*

Description

Title of Invention: DUST SEPARATOR AND VACUUM CLEANER HAVING THE SAME

Technical Field

- [1] The present invention relates to a vacuum cleaner, and more particularly, to a dust separator of a vacuum cleaner which separates dust or dirt from air using water.

Background Art

- [2] A dust separator for separating dust or dirt from air using water is well known to the related art. Examples of a related-art dust separator using water are disclosed in EP 1 088 508 A2 and DE 197 20 101 C1. The dust separators disclosed in the above documents have a configuration in which an air inflow pipe is put into water to allow drawn-in air to pass through the water. Therefore, the water irregularly shakes due to the air flowing into the water and a considerable amount of water overflows along the drawn-in air. The overflow of water can be prevented by providing a plurality of ribs or pipes to abruptly change the flow of air.
- [3] However, if such a configuration is employed, the dust separator becomes complicated and enlarged and thus it is difficult to employ the dust separator in a small-sized vacuum cleaner. Also, since the water irregularly shakes without a uniform pattern, a contact ratio between water and dust is reduced and the water and the dust are not well mixed, and as a result, separation efficiency deteriorates.
- [4] Japanese Patent Laid-Open No. H01-305917 and Japanese Patent Publication No. 2981823 disclose a wet-type electric cleaner which fills water in a cyclone dust separator and separate dust or dirt from air. The wet-type dust separator allows air to flow in through one side of the dust-separator and rotates the air in water. Accordingly, the air flowing in through an air inlet pushes the water in an opposite direction such that the water at the opposite side shakes higher and more irregularly than at the air inlet.
- [5] If such a configuration is employed, a partition or a flange should be provided to prevent overflow of the water toward a suction motor, and a contact area between water and dirt is reduced due to the irregular shaking movement of water and dust separation efficiency deteriorates.

Disclosure of Invention

Technical Problem

- [6] An aspect of the present invention is to provide a dust separator of a vacuum cleaner which improves dust separation efficiency.
- [7] Another aspect of the present invention is to provide a dust separator of a vacuum

cleaner which has a low probability that water overflows and has a simplified configuration.

Solution to Problem

- [8] According to a first exemplary embodiment of the present invention, a dust separator of a vacuum cleaner stores collecting water and comprises an inlet through which dirt-entrained air is drawn in and an outlet through which filtered air is discharged. The inlet is disposed in a center of the dust separator and the collecting water shakes in a uniform pattern by the air drawn in through the inlet.
- [9] The dust separator may further comprise a rotating device to rotate the air drawn in through the inlet.
- [10] The rotating device may comprise a guide pipe which is disposed in a center of a dust separator body to move down the air drawn in through the inlet; and a nozzle assembly which rotates the air which is moved down along the guide pipe.
- [11] The nozzle assembly may comprise a plurality of spiral channels arranged in a horizontal direction, and also may comprise an upper plate which fluidly communicates with the guide pipe; a lower plate which is connected to a lower side of the upper plate; and a plurality of blades which is interposed between the upper plate and the lower plate to form the spiral channels.
- [12] The nozzle assembly may be positioned on the same level as a surface of the collecting water or lower than the surface of the collecting water. The nozzle assembly may be positioned higher than a surface of the collecting water and 1/3 of the nozzle assembly may be put into the collecting water.
- [13] The dust separator may form a part of an exterior of the vacuum cleaner and may be formed of a transparent material such that inner movement and rotation is visually checked.
- [14] According to a second exemplary embodiment of the present invention, a dust separator of a vacuum cleaner comprises: a dust separator body which comprises first and second separators which store collecting water and comprise an inlet through which dirt-entrained air is drawn in and an outlet through which filtered air is discharged; and a rotating device which is disposed in a center of at least one of the first and the second separators to rotate the air drawn in through the inlet, wherein the collecting water shakes in a uniform pattern by the air discharged through the rotating device.
- [15] The first and the second separators may be arranged in parallel to each other.
- [16] The first and the second separators may share a dust receptacle which is removably mounted to lower sides of the first and the second separators.
- [17] A plurality of the second separators may be arranged outside the first separator.

- [18] The second separator may be exposed to be observed from the outside and may be formed of a transparent material such that inner movement and rotation in the second separator is visually checked.
- [19] According to the first and the second exemplary embodiments of the present invention, the dust separator may further comprise a filter unit which absorbs water from air discharged to a suction motor.
- [20] According to a third exemplary embodiment of the present invention, a dust separator of a vacuum cleaner, comprises: a first separator which stores collecting water and comprises an inlet through which dirt-entrained air is drawn in and an outlet through which filtered air is discharged; and a second separator which stores collecting water and receives air which has been filtered firstly by the first separator through the outlet and separates dirt from the firstly filtered air using inertia, wherein the collecting water stored in the first separator shakes in a uniform pattern by the air drawn in through the inlet.
- [21] The first separator may comprise a rotating device.
- [22] According to a fourth exemplary embodiment of the present invention, a dust separator of a vacuum cleaner comprises: a first separator which collects large dirt; a second separator which is arranged in parallel to the first separator and filters off minute dust from air which has been filtered firstly by the first separator; and a dust receptacle which is connected to lower sides of the first and the second separators and collects the dirt separated from air by the first and the second separators, wherein the dust receptacle comprises a first receptacle which stores collecting water to collect dirt of the first separator, and a second receptacle which collects dirt of the second separator.
- [23] According to an exemplary embodiment of the present invention, a vacuum cleaner comprises: a cleaner body in which a suction motor is mounted; and a dust separator which is disposed in the cleaner body to collect dirt, as described above.

Advantageous Effects of Invention

- [24] According to the present invention, the dust separator of the vacuum cleaner improves dust-separation efficiency.
- [25] Also, the dust separator of the vacuum cleaner has a low probability that water overflows and has a simplified configuration.

Brief Description of Drawings

- [26] FIGS. 1 and 2 are views illustrating an example of a dust separator of a vacuum cleaner according to a first exemplary embodiment of the present invention;
- [27] FIGS. 3 to 5 are perspective views illustrating diverse examples of a nozzle assembly of a rotating device shown in FIGS. 1 and 2;

[28] FIGS. 6 and 7 are views illustrating an example of a dust separator of a vacuum cleaner according to a second exemplary embodiment of the present invention;

[29] FIG. 8 is a view illustrating an example of a dust separator of a vacuum cleaner according to a third exemplary embodiment of the present invention; and

[30] FIGS. 9 and 10 are views illustrating an example of a dust separator of a vacuum cleaner according to a fourth exemplary embodiment of the present invention.

Best Mode for Carrying out the Invention

[31] For a dust separator for separating dust from air by bring dust-entrained air into contact with collecting water contained in the dust separator, a technique to rotate dust-entrained air and spraying it into the collecting water, thereby shaking the collecting water and thus enlarging a contact area between the air and the water has been already disclosed.

[32] However, if the collecting water irregularly shakes or a vortex is generated due to the spraying of air, the water overflows outside the dust separator due to its shaking movement.

[33] In order to move the water uniformly in a constant pattern, the height and direction of the sprayed air should be taken into consideration when the dust-entrained air is sprayed into the collecting water.

[34] Also, in a two-phase dust separator, relatively larger dirt is removed from air in the first phase and minute dust is removed from air in the second phase. In a dust separator using collecting water, large dirt is easily collected simply by being in contact with water, but, minute dust is collected by collision with a small water drop rather than by being in contact with water.

[35] Therefore, in order to improve efficiency of the second phase in which minute dust is collected, a device should be designed to generate small water drops as many as possible from the collecting water.

[36] Therefore, the present invention has an optimal height of sprayed air which can allow collecting water to move in a stable and uniform pattern without a vortex when a cleaner is operated, and also sprays the air in all directions, i.e., 360° on a horizontal plane.

[37] Hereinafter, a dust separator of a vacuum cleaner according to exemplary embodiments of the present invention will be described with reference to the accompanying drawings.

[38] FIGS. 1 and 2 are views illustrating an example of a dust separator of a vacuum cleaner according to a first exemplary embodiment of the present invention.

[39] The dust separator of the vacuum cleaner according to the first exemplary embodiment of the present invention stores collecting water W in a dust separator body

110.

- [40] The dust separator body 110 includes an inlet 111 through which dust-entrained air is drawn in and an outlet 112 through which air separated from dust is discharged, and a dust receptacle 130 is removably mounted to a lower side of the dust separator body 110.
- [41] The inlet 111 is disposed on the center of the top of the dust separator body 110, and the outlet 112 is disposed at the wall surface of one side of the upper portion of the dust separator body 110 and is connected to a suction motor M which is disposed in a cleaner body of the vacuum cleaner.
- [42] The dust receptacle 130 stores the collecting water W of a predetermined water level to collect dust from in the air drawn in through the inlet 111.
- [43] A rotating device 200 is connected to the inlet 111 to allow the air drawn in from a cleaning surface to rotate the collecting water S in a uniform pattern.
- [44] The rotating device 200 includes a guide pipe 210 and a nozzle assembly 220.
- [45] The guide pipe 210 is disposed in the center of the dust separator body 110 to move the air drawn in through the inlet 111 downward in the dust separator.
- [46] The nozzle assembly 220 rotates the air which flows and moves down through the guide pipe 210 around the collecting water W, thereby shaking the collecting water W. That is, as shown in FIGS. 1 and 2, the nozzle assembly 220 generates a whirling current in the air which is discharged through a plurality of spiral channels 225 arranged in a horizontal direction. If a whirling current is generated in discharged air, the collecting water W shakes in the shape of $\Rightarrow U \Leftarrow$ due to the effect of the whirling current such that the water level at opposite side wall surfaces increases as shown in FIG. 2. Then, dust included in the air discharged through the nozzle assembly 220 is mixed with the shaking collecting water W so that the dust can be effectively collected.
- [47] The nozzle assembly 220 includes an upper plate 221, a lower plate 222, and a blade 223 as shown in FIGS. 3 to 5.
- [48] A penetrating hole 221a is formed on the upper plate 220 to fluidly communicate with the guide pipe 210, and the lower plate 222 is connected to the lower side of the upper plate 221.
- [49] The upper plate 221 may be formed in the shape of a downwardly inclining cone and the lower plate 222 may be formed in a disk shape. Accordingly, the air drawn in from the guide pipe 210 is bent by the lower plate 222 to be discharged in a direction perpendicular to the inflow direction.
- [50] A plurality of blades 223 are interposed between the upper plate 221 and the lower plate 222, forming the plurality of spiral channels 225 to generate a whirling current in the air drawn in from the guide pipe 210. The blade 223 may have diverse thickness as shown in FIGS. 3 to 5. Due to the presence of the blades 223, the air drawn in from the

guide pipe 210 forms a whirling current and is discharged in the perpendicular direction to the inflow direction.

- [51] As shown in the dotted lines of FIGS. 1 and 2, the collecting water W stored in the dust separator body 110 has diverse water levels. That is, the nozzle assembly 220 may be positioned right on the water surface of the collecting water W (h1) during a non-operation, may be completely put into the collecting water W (h2), or may be positioned such that only 1/3 of the spiral channel 225 is put into the collecting water W (h).
- [52] An experiment shows a result that the dust-collecting efficiency is higher when only 1/3 of the spiral channel 225 is put into the collecting water W than when the nozzle assembly 220 is completely put into the collecting water W or positioned right on the water surface.
- [53] Also, in order to prevent water in the dust separator from moving toward the suction motor M, which is disposed in a cleaner body (not shown) to generate a negative pressure, a filter unit F for absorbing water may be disposed on a channel between the suction motor M and the outlet 112.
- [54] FIGS. 6 and 7 are views illustrating an example of a dust separator according to a second exemplary embodiment of the present invention.
- [55] As shown in FIGS. 6 and 7, a dust separator according to a second exemplary embodiment of the present invention includes a first separator 310 to collect large dirt, a second separator 320 to collect small dirt, and a dust receptacle 330 to collect the dirt collected in the first and the second separators 310, 320. Collecting water W of a predetermined water level is stored in the dust receptacle 330 corresponding to the first and the second separators 310, 320.
- [56] The first separator 310 according to the second exemplary embodiment of the present invention includes an inlet 312 disposed at an eccentric position of a first separator body 311 and an outlet 313 disposed in the center of the first separator body 311 to discharge filtered air. Thus, the drawn-in air including dirt shakes the collecting water in a uniform pattern.
- [57] The first separator 310 is not greatly different from a general cyclone dust separator in its constitution and is slightly different from that in that it stores the collecting water W in the dust receptacle 330 corresponding to the bottom.
- [58] The second separator 320 filters again the air which has been filtered firstly in the first separator 310, and, as shown in FIG. 6, has a rotating device 200 disposed in the center. The rotating device 200 is positioned such that about 1/3 of its end is put into the collecting water W.
- [59] The rotating device 200 is the same as in the first embodiment and thus detailed description is omitted.

- [60] The second separator 320 collects minute dirt which has not been separated from the air in the first separator 310 and one or more second separators 320 may be arranged in parallel to the first separator 310. The air separated from the dirt by the collecting water W is discharged out of the second separator 320 through a discharge port 321.
- [61] The dust receptacle 330 removably connected to the lower sides of the first and the second separators 310, 320 is formed of a transparent material so that a user can see rotational movement of the collecting water W generated by the rotating device 200 and check the degree of collecting dust.
- [62] FIG. 8 is a view illustrating a dust separator of a vacuum cleaner according to a third exemplary embodiment of the present invention.
- [63] A dust separator according to a third exemplary embodiment of the present invention includes a first separator 410 in which collecting water W is stored and a second separator 420 to separate dirt from air which has been separated from dirt firstly in the first separator 410.
- [64] As shown in FIG. 8, the dust separator includes the first separator 410 disposed in the center thereof and the second separator 420 disposed outside the first separator 410, and the first and the second separators 40, 420 each store collecting water W.
- [65] The first separator 410 has an inlet 411 disposed on the center of the top of a body thereof to allow external air to flow in therethrough, and a rotating device 200 is connected to the inlet 411 to form a whirling current in the drawn-in air. The configuration of the rotating device 200 is the same as that of the first embodiment.
- [66] The second separator 420 is arranged outside the first separator 410 in parallel to the first separator 410. As shown in FIG. 8, the air which has been filtered firstly by the first separator 410 is discharged through the upper portion of the body. The minute dust of the discharged air is mixed with the collecting water W stored in the second separator 420 and is collected due to inertia. The filtered air is discharged through a discharge port 422.
- [67] Since the first separator 410 and the second separator 420 are constituted by being connected with a dust receptacle 430, an inner wall surface and a bottom of the dust receptacle 430 correspond to the body of the first separator 410, and an outer wall surface of the dust receptacle 430, the body, and the bottom of the dust receptacle 430 correspond to the body of the second separator 420. Therefore, the first separator 410 in which large dirt is collected and the second separator 420 in which minute dust is collected are simultaneously emptied by removing the dust receptacle 430. The dust receptacle 430 is formed of a transparent material to allow a user to see the inside so that the user can check the amount of collected dust and the contamination degree of the collecting water W.
- [68] FIGS. 9 and 10 are views illustrating a dust separator according to a fourth

exemplary embodiment of the present invention.

- [69] As shown in FIGS. 9 and 10, a dust separator according to a fourth exemplary embodiment of the present invention includes a first separator 510 in which collecting water W is stored, and a second separator 520 to filter again air which has been filtered firstly in the first separator 510.
- [70] The first separator 510 has the same configuration as a general cyclone dust separator such that dirt centrifugally separated from air by a whirling current formed by air drawn in through a suction inlet 511 is mixed with the collecting water W and thus air is filtered. That is, in a conventional cyclone dust separator, centrifugally-separated dirt is scattered along with a whirling current, but, in the first separator according to the fourth exemplary embodiment of the present invention, centrifugally-separated dirt is mixed with the collecting water W and shakes along with the collecting water W, so that the dirt can be prevented from being scattered or flowing into the second separator 520.
- [71] The second separator 520 is arranged in parallel to the first separator 510 and one or more second separators 520 may be provided. The second separator 520 may have a cyclone body of a conical configuration and may store collecting water W as in the first separator 510. However, it is more preferable that the second separator 520 does not store collecting water W.
- [72] The air filtered secondarily by the second separator 520 is discharged to the outside through a discharge outlet 521.
- [73] Also, the first and the second separators 510, 520 are designed to share a dust receptacle 530, so that the dust 530 can collect large dirt and minute dirt together.
- [74] Hereinafter, operation of the dust separator of the vacuum cleaner according to the first exemplary embodiment of the present invention will be explained with reference to FIGS. 1 and 5.
- [75] The dust separator according to the first exemplary embodiment of the present invention stores collecting water W of a predetermined water level (h) therein. The predetermined water level (h) may be set to allow only 1/3 of the spiral channel 225 of the nozzle assembly 220 of the rotating device 200 to be put into the collecting water W.
- [76] Of course, the spiral channel 225 may be positioned on the same level as the water level of collecting water W, may be positioned lower or higher than the water level. The position of the spiral channel 225 with respect to the collecting water W may be properly adjusted depending on the amount of the air drawn in through the spiral channel 225. That is, if the amount of air drawn in through the spiral channel 225 is small, the spiral channel 225 is positioned on the same level as the water level of the collecting water W or lower than the water level of the collecting water W, and, if the amount of air drawn in through the spiral channel 225 is great, the spiral channel 225 is

positioned higher than the water level of the collecting water W. Such adjustment of the water level is resulted from several experiments, and, considering a general amount of air in a vacuum cleaner, it is preferable that 1/3 of the spiral channel 225 is put into the collecting water W. If the spiral channel 225 is completely put into or exposed from the collecting water in the general vacuum cleaner, the dust-collecting efficiency relatively deteriorates.

- [77] If the rotating device 200 is disposed in the center of the dust separator, the drawn-in air is discharged close to the water surface of the collecting water W and thus the shaking movement of the collecting water W is more stabilized and the contact ratio between the water and dust is improved.
- [78] When the vacuum cleaner operates, dirt is drawn in along with ambient air due to a negative pressure of the suction motor M. The dirt-entrained air forms a whirling current when passing through the spiral channel 225 and shakes the stored collecting water W in a uniform pattern. The uniform pattern may change depending on the amount of discharged air. For example, the collecting water W shakes in the shape of ∇ such that the water level at the sidewall surfaces goes up as shown in FIG. 2. That is, the collecting water W generates a vortex with reference to the center of the dust separator body 110 and thus maintains the maximum contact area with the dirt-entrained air discharged through the spiral channel 225, so that the dust-collecting efficiency can be improved. Also, the dirt included in the air is mixed with the whirling water W, thereby being efficiently collected without being scattered. Also, since the collecting water w spreads toward the walls of the dust separator body 110, it does not overflow outside the outlet 112.
- [79] The filtered air which is discharged through the outlet 112 passes through the filter unit F so that the water is prevented from permeating into the suction motor M.
- [80] If the dust receptacle 130 is formed of a transparent material, the user can check the process of collecting dust with his/her eyes and thus can instantly know the contamination degree of the collecting water W and determine when the dust receptacle 130 is emptied.
- [81] FIGS. 6 and 7 are a view illustrating the dust separator according to the second exemplary embodiment of the present invention.
- [82] As shown in FIGS. 6 and 7, the dust separator includes the first separator 310 and the second separator 320 which store the collecting water W such that large dirt is collected in the first separator 310 and minute dust which has not been filtered off in the first separator 310 is collected in the second separator 320.
- [83] The inlet 312 of the first separator 310 is disposed at the eccentric position with respect to the body 311 such that the air flows into the body 311 while generating a whirling current and is separated from the dirt by a centrifugal force. The dirt separated

from the air is mixed with the collecting water W, thereby being prevented from flowing into the second separator 320.

[84] The firstly filtered air is discharged close to the collecting water W by the rotating device 200 disposed in the center of the second separator 320, and the discharged air shakes the collecting water W in the shape of $\nabla U \nabla$, maintaining the maximum contact area with the collecting water, and the minute dust in the air is mixed with the collecting water W and is collected.

[85] The air filtered by the second separator 320 passes through the filter unit F so that water can be prevented from permeating into the suction motor M.

[86] FIG. 8 is a view illustrating the dust separator according to the third exemplary embodiment of the present invention.

[87] As shown in FIG. 8, the dust separator includes the first separator 410 and the second separator 420 in which collecting water W is stored. Large dirt is collected in the first separator 410, whereas minute dust which has not been filtered off in the first separator 410 is collected in the second separator 420.

[88] Unlike in the second exemplary embodiment, in the third exemplary embodiment, the rotating device 200 is disposed in the center of the first separator 410 and the second separator 420 is disposed outside the first separator 410.

[89] That is, the inlet 411 is disposed on the center of the top of the first separator 410 and the rotating device 200 is connected to the inlet 411 such that the air is discharged close to the water surface of the collecting water while forming a whirling current.

[90] Accordingly, the air discharged through the spiral channel 225 of the rotating device 200 shakes the collecting water W in the shape of $\nabla U \nabla$ such that the dirt included in the air is mixed with the collecting water W and is separated from the air. The filtered air is discharged to the second separator 420 through the upper portion of the first separator 410 and is discharged to the outside through the discharge port 422.

[91] At this time, the dirt and the water drop which have not been collected are mixed with the collecting water W of the second separator 420 due to the inertia which is generated by a change in the flow of the discharged air, so that the dirt and the water drop can be prevented from flowing outside the dust separator.

[92] In order to prevent the water remaining in the filtered air from permeating into the suction motor M, a channel is designed to allow the discharged air to pass through the filter unit F.

[93] FIGS. 9 and 10 are views illustrating the dust separator according to the fourth exemplary embodiment of the present invention.

[94] The dust separator of the fourth exemplary embodiment is the same as that of the second exemplary embodiment explained with reference to FIG. 6 in that the first separator 510 and the second separator 520 has the same configuration as a con-

ventional cyclone dust separator and is different from that in that collecting water is not stored in the second separator 520.

[95] Although various example embodiments of the present general inventive concept have been illustrated and described, it will be appreciated by those skilled in the art that changes may be made in these example embodiments without departing from the principles and spirit of the general inventive concept, the scope of which is defined in the appended claims and their equivalents.

[96]

[97]

Claims

- [Claim 1] A dust separator of a vacuum cleaner which stores collecting water and comprises an inlet through which dirt-entrained air is drawn in and an outlet through which filtered air is discharged, wherein the inlet is disposed in a center of the dust separator and the dust separator comprises a rotating device to uniformly spray the air drawn in through the inlet in all directions on a horizontal plane, thereby rotating the air, wherein the collecting water shakes in a uniform pattern by the air sprayed by the rotating device.
- [Claim 2] The dust separator as claimed in claim 1, wherein the rotating device comprises:
a guide pipe which is disposed in a center of a dust separator body to move down the air drawn in through the inlet; and
a nozzle assembly which rotates the air which is moved down along the guide pipe.
- [Claim 3] The dust separator as claimed in claim 2, wherein the nozzle assembly comprises a plurality of spiral channels arranged in a horizontal direction.
- [Claim 4] The dust separator as claimed in claim 3, wherein the nozzle assembly comprises:
an upper plate which fluidly communicates with the guide pipe;
a lower plate which is connected to a lower side of the upper plate; and
a plurality of blades which is interposed between the upper plate and the lower plate to form the spiral channels.
- [Claim 5] The dust separator as claimed in claim 4, wherein the nozzle assembly is positioned on the same level as a surface of the collecting water or lower than the surface of the collecting water.
- [Claim 6] The dust separator as claimed in claim 4, wherein the nozzle assembly is positioned higher than a surface of the collecting water.
- [Claim 7] The dust separator as claimed in claim 4, wherein 1/3 of the nozzle assembly is put into the collecting water.
- [Claim 8] The dust separator as claimed in claim 1, wherein the dust separator forms a part of an exterior of the vacuum cleaner and is formed of a transparent material such that inner movement and rotation is visually checked.
- [Claim 9] A dust separator of a vacuum cleaner, comprising:

a dust separator body which comprises first and second separators which store collecting water and comprise an inlet through which dirt-entrained air is drawn in and an outlet through which filtered air is discharged; and

a rotating device which is disposed in a center of at least one of the first and the second separators to rotate the air drawn in through the inlet, wherein the collecting water shakes in a uniform pattern by the air discharged through the rotating device.

[Claim 10] The dust separator as claimed in claim 9, wherein the rotating device comprises:

a guide pipe which is disposed in a center of the dust separator body to move down the air drawn in through the inlet; and

a nozzle assembly which rotates the air which is moved down along the guide pipe.

[Claim 11] The dust separator as claimed in claim 10, wherein the nozzle assembly comprises a plurality of spiral channels arranged in a horizontal direction.

[Claim 12] The dust separator as claimed in claim 11, wherein the nozzle assembly comprises:

an upper plate which fluidly communicates with the guide pipe; and
a lower plate which is connected to a lower side of the upper plate; and
a plurality of blades which is interposed between the upper plate and the lower plate to form the spiral channels.

[Claim 13] The dust separator as claimed in claim 9, wherein the first and the second separators are arranged in parallel to each other.

[Claim 14] The dust separator as claimed in claim 9, wherein the first and the second separators share a dust receptacle which is removably mounted to lower sides of the first and the second separators.

[Claim 15] The dust separator as claimed in claim 9, wherein a plurality of the second separators is arranged outside the first separator.

[Claim 16] The dust separator as claimed in claim 9, wherein the second separator is exposed to be observed from the outside and is formed of a transparent material such that inner movement and rotation in the second separator is visually checked.

[Claim 17] The dust separator as claimed in claim 9, further comprising a filter unit which absorbs water from air discharged to a suction motor.

[Claim 18] A dust separator of a vacuum cleaner, comprising:
a first separator which stores collecting water and comprises an inlet

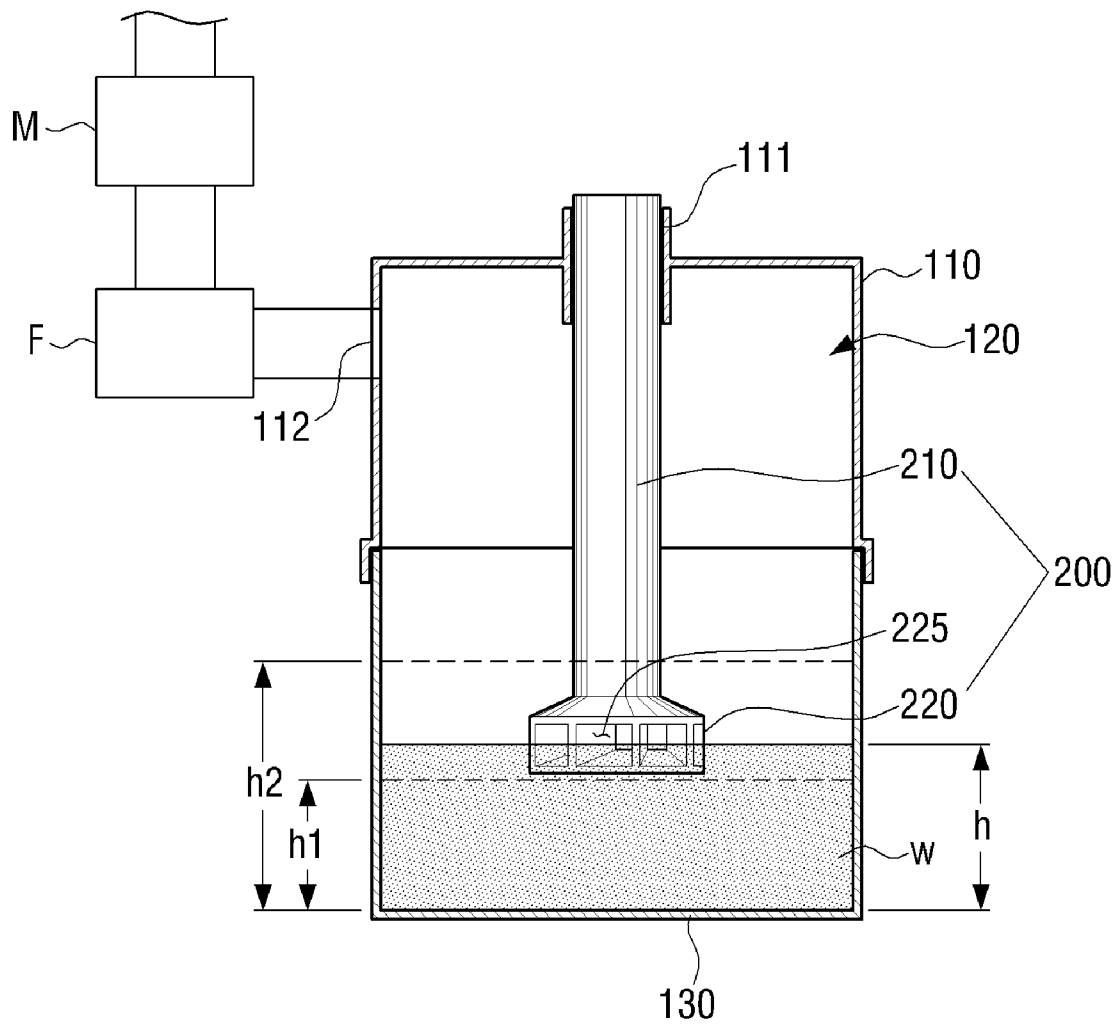
through which dirt-entrained air is drawn in and an outlet through which filtered air is discharged; and
a second separator which stores collecting water and receives air which has been filtered firstly by the first separator through the outlet and separates dirt from the firstly filtered air using inertia, wherein the collecting water stored in the first separator shakes in a uniform pattern by the air drawn in through the inlet.

[Claim 19] The dust separator as claimed in claim 18, wherein the first separator comprises a rotating device.

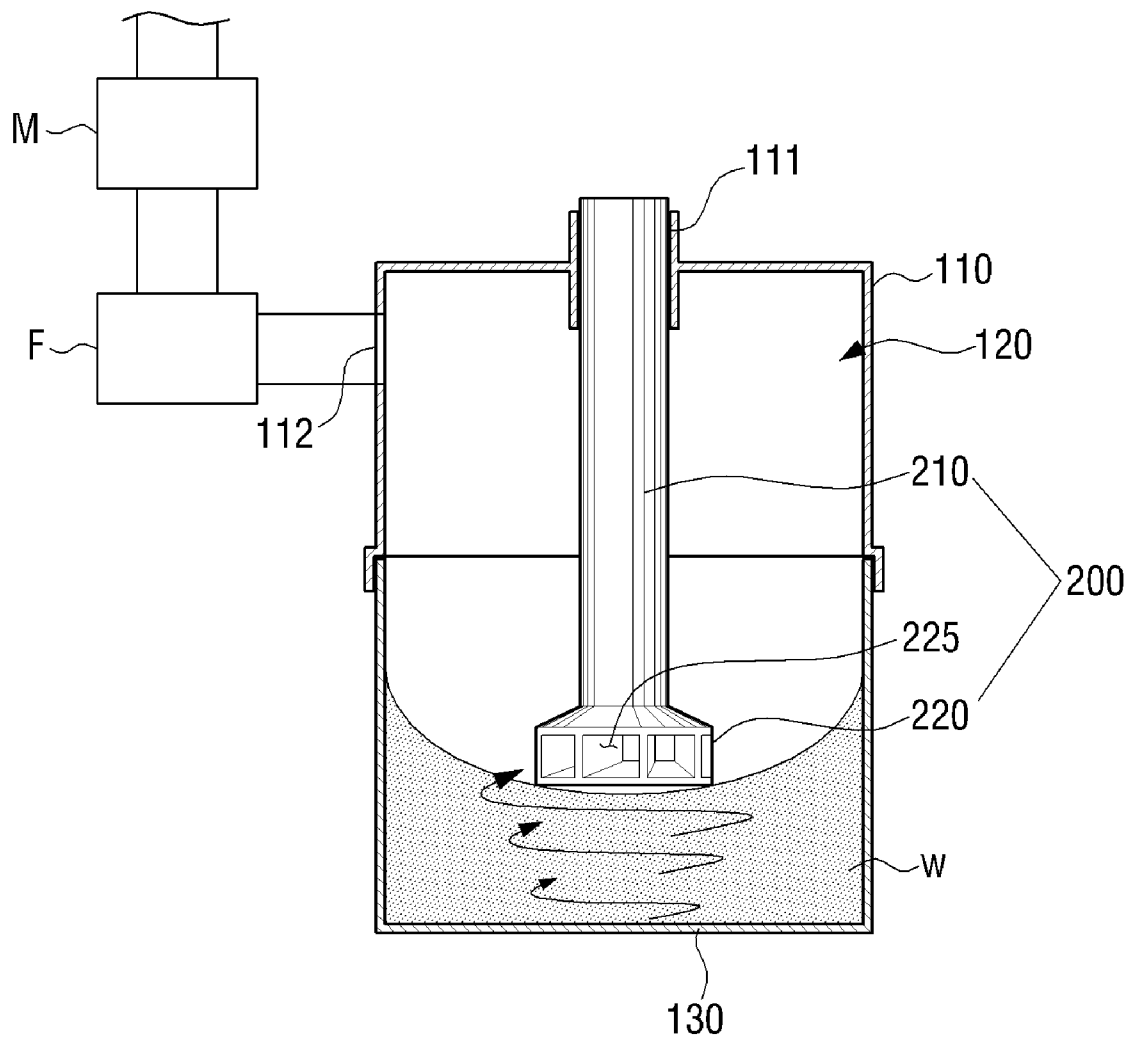
[Claim 20] A dust separator of a vacuum cleaner, comprising:
a first separator which collects large dirt;
a second separator which is arranged in parallel to the first separator and filters off minute dust from air which has been filtered firstly by the first separator; and
a dust receptacle which is connected to lower sides of the first and the second separators and collects the dirt separated from air by the first and the second separators,
wherein the dust receptacle comprises a first receptacle which stores collecting water to collect dirt of the first separator, and a second receptacle which collects dirt of the second separator.

[Claim 21] A vacuum cleaner comprising:
a cleaner body in which a suction motor is mounted; and
a dust separator which is disposed in the cleaner body to collect dirt, as claimed in any one of claims 1 to 20.

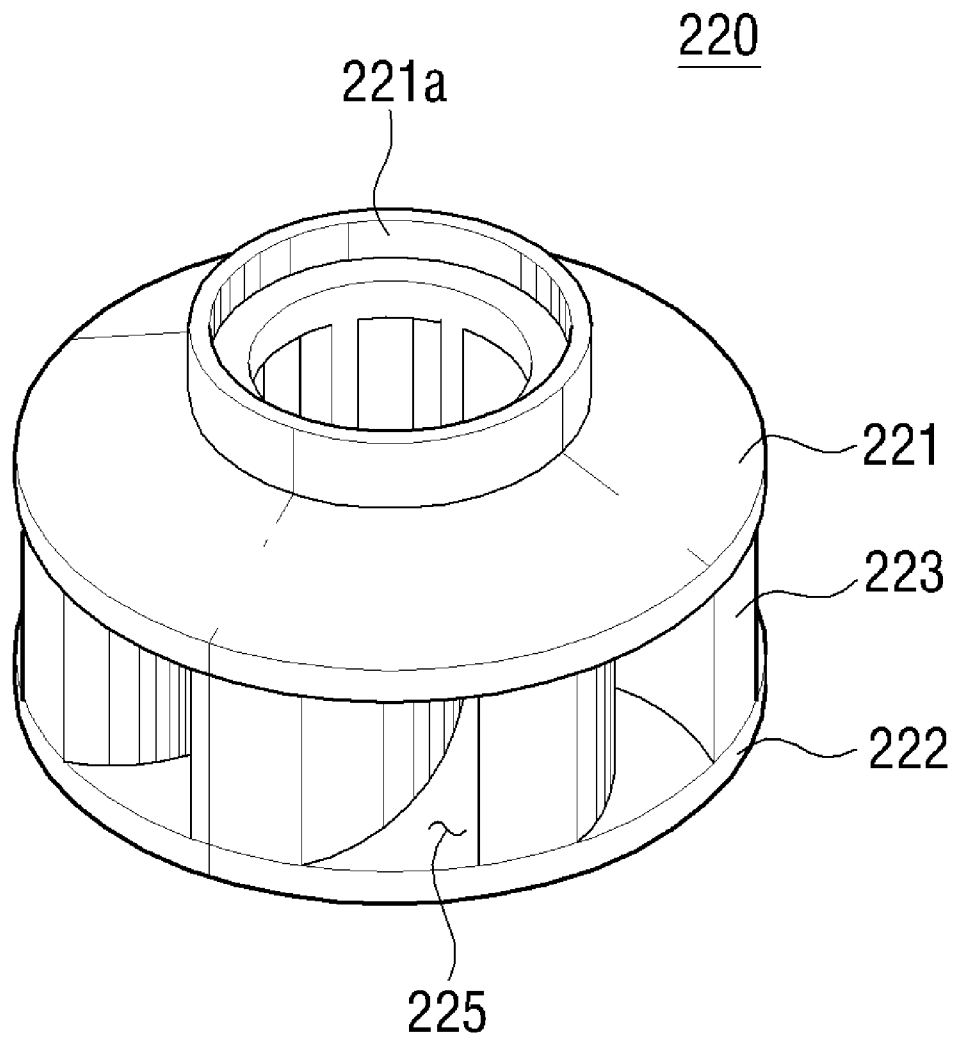
[Fig. 1]



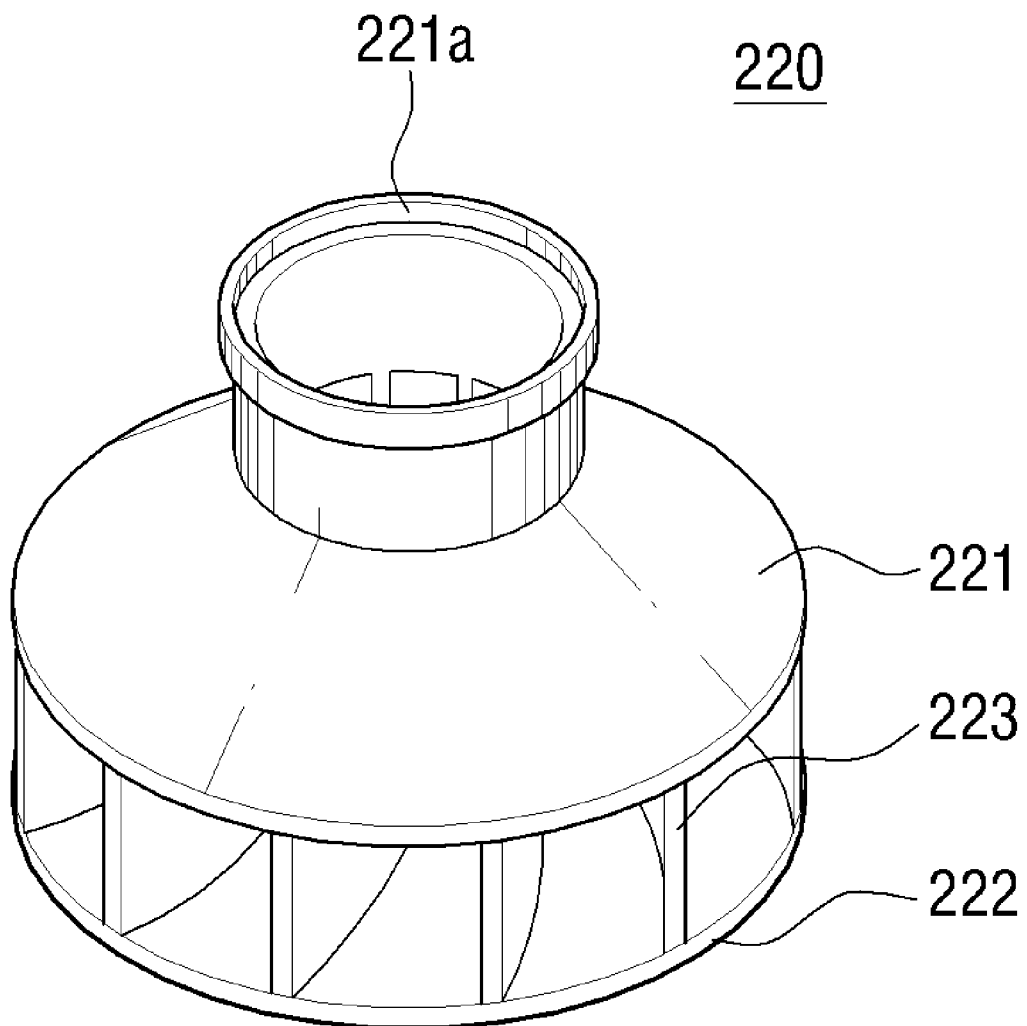
[Fig. 2]



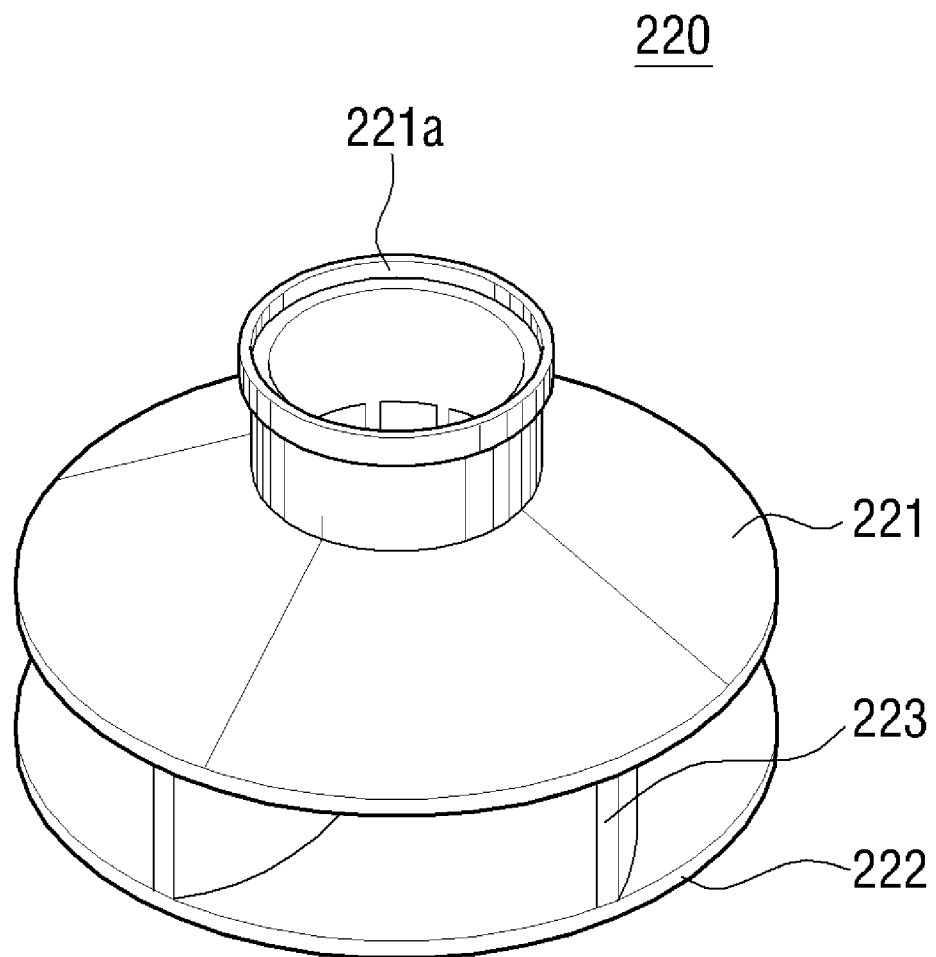
[Fig. 3]



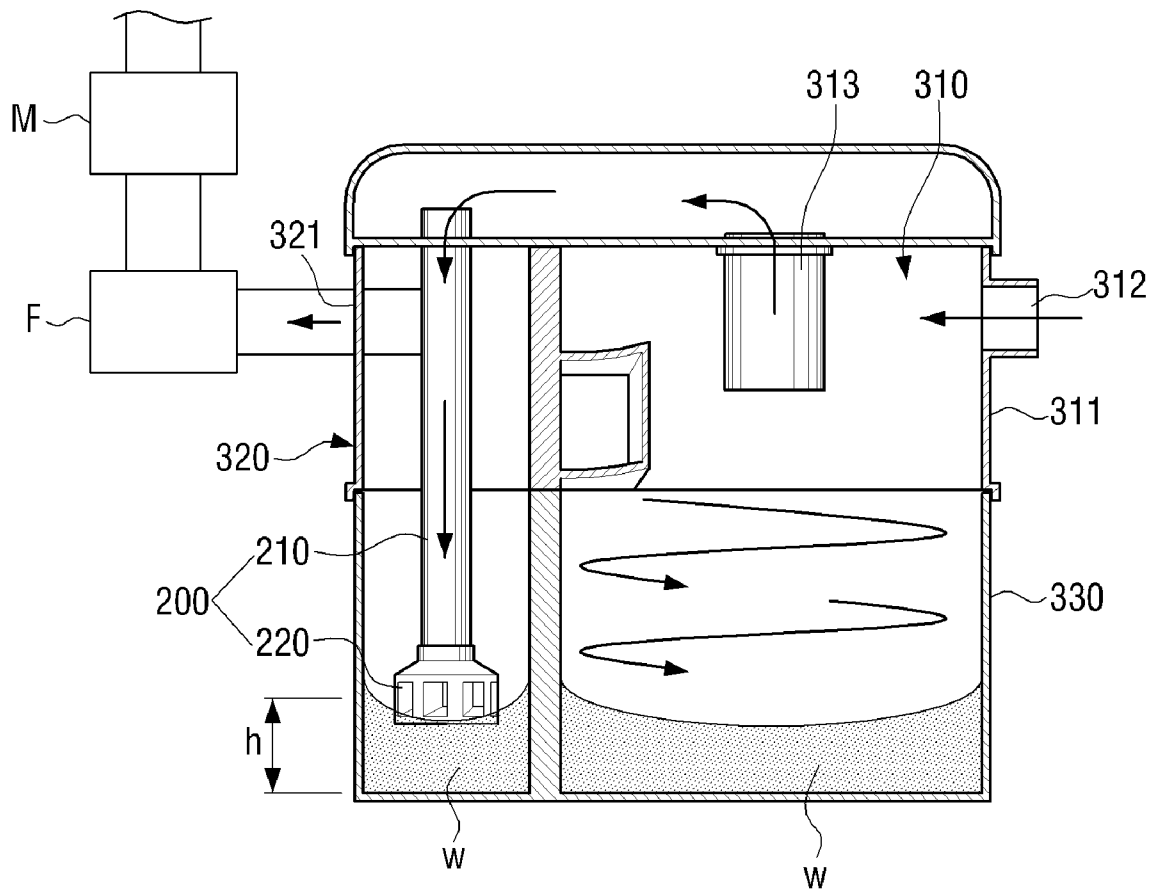
[Fig. 4]



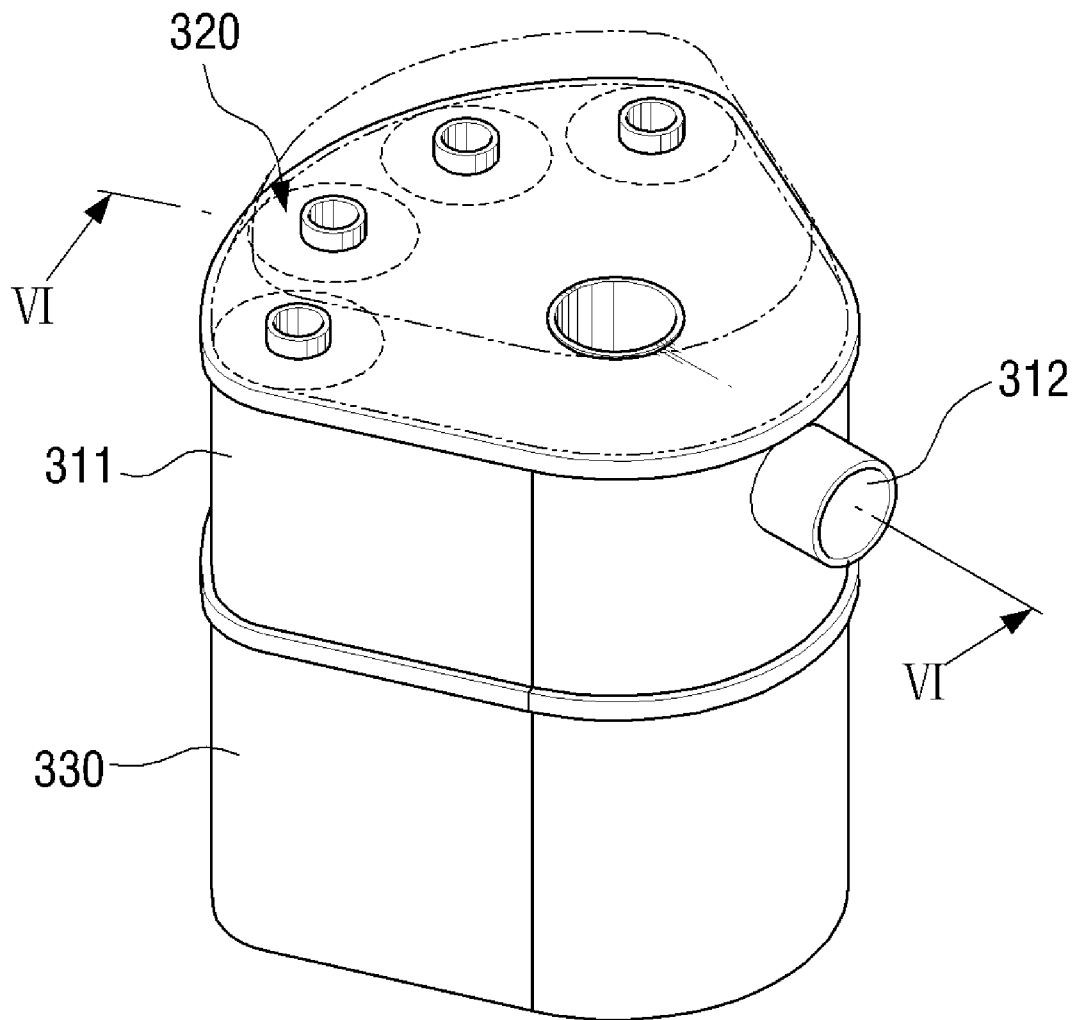
[Fig. 5]



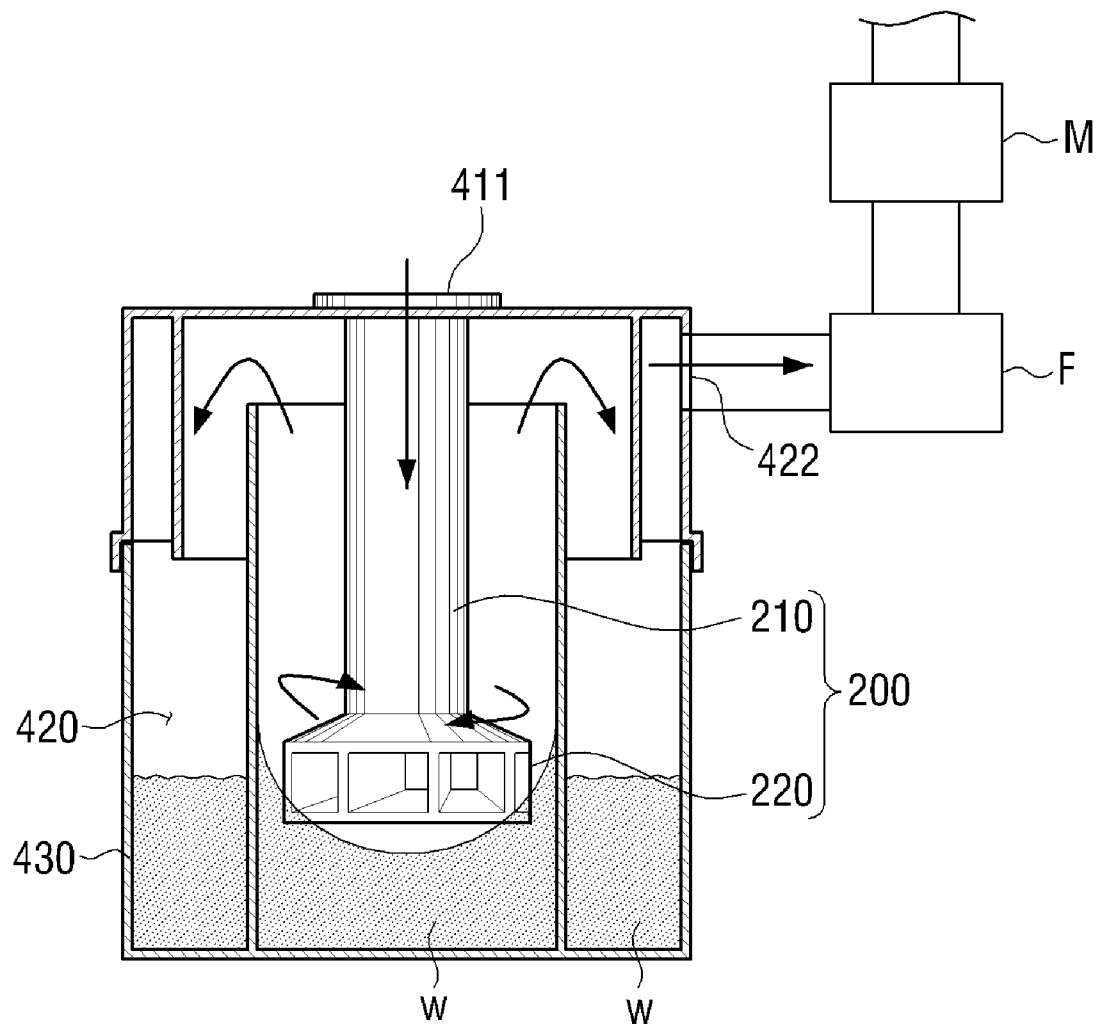
[Fig. 6]



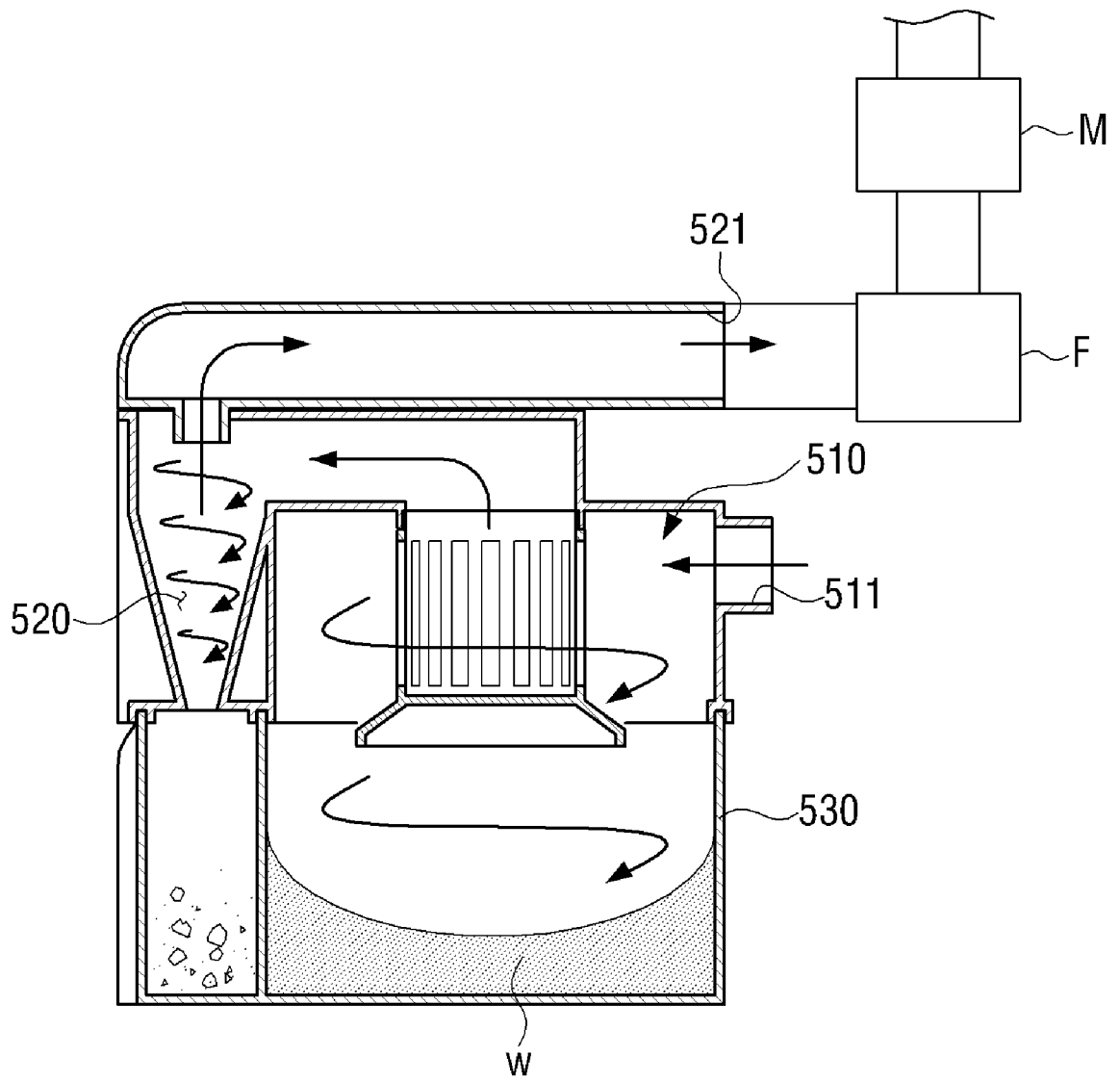
[Fig. 7]



[Fig. 8]



[Fig. 9]



[Fig. 10]

