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(54) **VACUUM CLEANER HAVING SELF-CLEANING FUNCTION AND SELF-CLEANING METHOD THEREFOR**

(57) A vacuum cleaner having self-cleaning function, the vacuum cleaner has a vacuum cleaning mode and a self-cleaning mode; in the vacuum cleaning mode, the air stream successively passes through the suction mouthpiece(22), the air inlet, the filter(30), the fan(11) and the air outlet(141), and in the self-cleaning mode, the air stream successively passes through the air replenishing opening(451) and the fan(11), and then strikes the cleaning side of the filter(30); an air replenishing valve (70) is provided at the air replenishing opening(451), in the vacuum cleaning mode, the suction mouthpiece(22) is opened and the air replenishing valve (70) controls the air replenishing opening(451) to be closed, and in the self-cleaning mode, the suction mouthpiece(22) is closed and the air replenishing valve (70) controls the air replenishing opening(451) to be opened; the tube wall of the suction mouthpiece(22) of the hose(21) is pressed against the air replenishing valve (70) so as to close the suction mouthpiece(22), and control the air replenishing valve(70) to open the air replenishing opening(451), the tube wall of the suction mouthpiece(22) of the hose(21) is separated from the air replenishing valve(70) so as to open the suction mouthpiece(22), and control the air replenishing valve(70) to close the air replenishing open-

ing(451).The present invention also relates to a self-cleaning method of the vacuum cleaner with self-cleaning function.

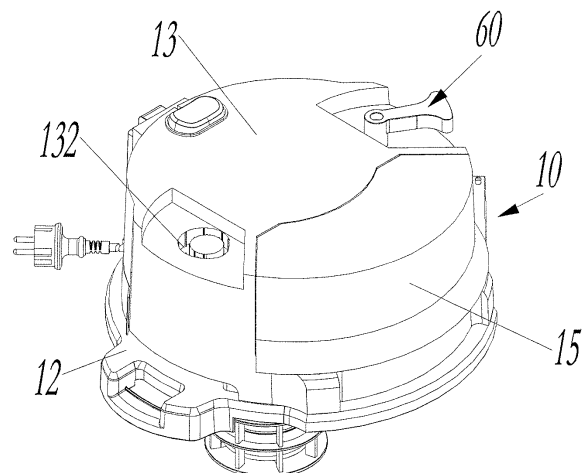


Fig. 1

Description

TECHNICAL FIELD

[0001] The present invention relates to the field of vacuum cleaners, in particular to a vacuum cleaner with a self-cleaning function, and the present invention further relates to a self-cleaning method of the vacuum cleaner.

BACKGROUND

[0002] Vacuum cleaners are widely used in the cleaning of various places. Generally speaking, a vacuum cleaner generally includes a machine head assembly, a filter assembly, and a drum assembly. The filter assembly is arranged in a closed space formed by buckling the machine head assembly and the drum assembly. Generally, the outer edge of the machine head, the outer edge of the filter assembly and the upper edge of the drum assembly are successively overlapped and assembled in the axial direction and are compressed, thereby effectively preventing dust from leaking out.

[0003] A dust drum vacuum cleaner is a common household appliance. In the prior art, the dust drum vacuum cleaner has large power and large air inlet, so the burden of a filter is heavy. After working for a long time, dust is easy to accumulate in the air duct, so that the effective dust collection time is influenced, and the dust collection effect is seriously attenuated; meanwhile, the service life of the filter is also reduced. In addition, when the existing vacuum cleaner is used, a user needs to frequently disassemble the vacuum cleaner to clean the filter, the cleaning workload is large, and poor experience is brought to the user.

[0004] Therefore, it is necessary to provide an improved vacuum cleaner to solve the above-mentioned problems.

SUMMARY

Technical Solution

[0005] The object of the present invention is to provide a vacuum cleaner with a self-cleaning function.

[0006] To achieve the above object, the present invention provides a vacuum cleaner with self-cleaning function, comprising a machine head assembly, a dust drum, a hose connected to the machine head assembly or the dust drum, and a filter connected to the machine head assembly, wherein the machine head assembly includes a fan and an air inlet and air outlet communicated with the outside, the hose has a suction mouthpiece communicated with the outside, the suction mouthpiece is communicated with the air inlet, the fan is arranged between the filter and the air outlet, an air replenishing opening is provided between filter and the fan, the filter has a cleaning side and a non-cleaning side, the vacuum cleaner has a vacuum cleaning mode and a self-cleaning mode;

in a vacuum cleaning mode, the air stream successively passes through the suction mouthpiece, the air inlet, the filter, the fan and the air outlet, and in a self-cleaning mode, the air stream successively passes through the air replenishing opening and the fan, and then strikes the cleaning side of the filter; the air replenishing valve is provided at the air replenishing opening, in the vacuum cleaning mode, the suction mouthpiece is opened and the air replenishing valve controls the air replenishing opening to be closed, and in the self-cleaning mode, the suction mouthpiece is closed and the air replenishing valve controls the air replenishing opening to be opened; the tube wall of the suction mouthpiece of the hose is pressed against the air replenishing valve so as to close the suction mouthpiece, and control the air replenishing valve(70) to open the air replenishing opening, the tube wall of the suction mouthpiece of the hose is separated from the air replenishing valve so as to open the suction mouthpiece, and control the air replenishing valve to close the air replenishing opening.

[0007] As a further improvement of the invention, the outer surface of the machine head assembly is provided with a suction mouthpiece closing member, and the air replenishing valve is at least partially arranged in the suction mouthpiece closing member.

[0008] As a further development of the invention, the suction mouthpiece closing member comprises a protrusion, and the outer diameter of the protrusion is matched with the inner diameter of the suction mouthpiece.

[0009] As a further improvement of the present invention, the suction mouthpiece closing member further comprises a hose clamping groove which is arranged around the protrusion; and the tube wall of the suction mouthpiece is inserted into the hose clamping groove to press against the air replenishing valve.

[0010] As a further improvement of the invention, the hose clamping groove is provided with a groove outer wall and a groove inner wall; and the distance between the groove outer wall and the groove inner wall corresponds to the thickness of the tube wall of the suction mouthpiece.

[0011] As a further development of the invention, the air replenishing valve does not protrude out of the suction mouthpiece closing member as a whole.

[0012] As a further improvement of the invention, the machine head assembly comprises a fan base for supporting the fan and a top cover covering the fan base, and the air replenishing valve is arranged between the fan base and the top cover.

[0013] As a further improvement of the invention, the top cover is provided with a hose clamping groove, and the hose is inserted into the hose clamping groove to close the suction mouthpiece and control the air replenishing valve to open the air replenishing opening.

[0014] As a further improvement of the invention, the air replenishing valve comprises an air replenishing valve body and an air replenishing valve cover mounted on the base of the fan, the air replenishing valve body provided

with an air replenishing hole communicated with the air replenishing opening, and the air replenishing valve cover can move relative to the air replenishing valve body to open or close the air replenishing hole.

[0015] As a further improvement of the invention, the upper portion of air replenishing hole is provided with an air replenishing valve cap, an air replenishing hole and a protrusion adjacent to the air replenishing hole are provided in the hose clamping groove, the air replenishing valve cap partly passes through the air replenishing hole and abuts against the air replenishing valve cap, the hose is inserted into the hose clamping groove, the protrusion closes the suction mouthpiece, the tube wall of the suction mouthpiece presses against the air replenishing valve cap to drive the air replenishing valve cap move relative to the air replenishing valve body, in order to open the air replenishing hole.

[0016] As a further improvement of the invention, the air replenishing valve further comprises an elastic element abutting against the air replenishing valve cover, and the air replenishing valve cover can be kept at the position of closing the air replenishing hole under the action of the elastic element.

[0017] As a further improvement of the invention, the vacuum cleaner is further provided with an air replenishing mode, and in the air replenishing mode, air stream successively passes through the air replenishing opening, the fan and the air outlet.

[0018] As a further improvement of the invention, the vacuum cleaner has a first air chamber from the air inlet to the non-cleaning side of the filter, a second air chamber from the cleaning side of the filter to the fan, a third air chamber from the fan to the air outlet, and a fourth air chamber from the air outlet to the cleaning side of the filter, wherein the fourth air chamber is provided with a self-cleaning air port adjacent to the air outlet; when the vacuum cleaner is in the vacuum cleaning mode, the suction mouthpiece and the air outlet are opened, and the air replenishing opening is closed, so that external air stream successively passes through the suction mouthpiece, the air inlet, the first air chamber, the second air chamber and the third air chamber, and is discharged from the air outlet; when the vacuum cleaner is in the air replenishing mode, the air outlet and the air replenishing opening are opened, and the suction mouthpiece is closed, so that the external air stream successively passes through the air replenishing opening, the second air chamber and the third air chamber, and is discharged from the air outlet; and when the vacuum cleaner is in the self-cleaning mode, the air replenishing opening is opened, the suction mouthpiece and the air outlet are closed, so that the external air stream successively passes through the air replenishing opening, the second air chamber, the third air chamber and the fourth air chamber, and then enters the second air chamber for circulation after passing through the cleaning side of the filter.

[0019] As a further improvement of the present invention, the machine head assembly further includes a

switching valve operable to move between two positions, wherein in a first position, the switching valve opens the air outlet and closes the self-cleaning air port, and in a second position, the switching valve closes the air outlet and opens the self-cleaning air port.

[0020] As a further improvement of the invention, the switching valve comprises an operating handle, a rotating shaft driven by the operating handle and a switching valve cover relatively fixed with the rotating shaft, wherein the handle drives the switching valve cover through the rotating shaft to select one of the air outlet and the self-cleaning air port to close.

[0021] As a further improvement of the present invention, the machine head assembly is provided with a plurality of ejection holes corresponding to the cleaning side of the filter, and in the self-cleaning mode, the air stream strikes the cleaning side of the filter through the plurality of ejection holes, and the inner diameters of the plurality of ejection holes are increased along the direction from the inside to the outside of the fan.

[0022] As a further improvement of the present invention, the machine head assembly is provided with a plurality of ejection holes corresponding to the cleaning side of the filter, and in the self-cleaning mode, the air stream strikes the cleaning side of the filter through the plurality of ejection holes; the ratio of the total air outlet area of the ejection holes to the air passing area of the fourth air chamber is 1:1.

[0023] The invention further provides a self-cleaning method of the vacuum cleaner with self-cleaning function, wherein the self-cleaning method comprises the following steps: S1, connecting the hose with the air replenishing valve; S2, closing the air outlet; S3, opening the air outlet; and S4, separating the hose from the air replenishing valve.

[0024] As a further improvement of the present invention, in the above steps, step S2 and step S3 are circularly performed for a plurality of times between step S1 and step S4.

[0025] As a further improvement of the present invention, in the circulating process of step S2 and step S3, step S3 is maintained for a preset time, and thereafter step S2 is performed; the preset time is 1 to 3 seconds.

Beneficial Effect

[0026] The invention has the beneficial effects that: from the above technical solutions, it can be seen that the present invention has a number of outstanding substantial technical features, and after implementing the technical solution of the present invention, the significant technical progress thereof is mainly reflected in: (1) a self-cleaning system is additionally arranged on the traditional vacuum cleaner, so that the filter can be self-cleaned; (2) the effective dust collecting time of the vacuum cleaner is prolonged; (3) the self-cleaning effect is excellent, and the service life of the filter is prolonged; (4) the self-cleaning system decreases the disassembly

and cleaning frequency of a user and reduces the workload; (5) the design is ingenious, the structure is simple, the production is convenient, and the applicability is strong; (6) the external cold air entering from the air replenishing air passage can cool the fan, so that the temperature of the fan is reduced; and (7) the hose is connected to the air replenishing valve, so that the suction mouthpiece and the air replenishing valve can be simultaneously controlled to be opened and closed, thereby carrying out the self-cleaning of the filter, therefore the operation is very simple and convenient, and better user experience is achieved.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027]

Fig. 1 is a stereoscopic diagram of a machine head assembly of the vacuum cleaner of the present invention;

Fig. 2 is a schematic view showing the opening of the back cover of the machine head assembly of Fig. 1;

Fig. 3 is an exploded stereoscopic diagram of the machine head assembly of Fig. 1;

Fig. 4 is a stereoscopic diagram of the fan base of Fig. 3;

Fig. 5 is a partially exploded schematic view of the machine head assembly and switching valve of Fig. 1;

Fig. 6 is a front view of the machine head assembly of Fig. 1;

Fig. 7 is a cross-sectional view taken along line A-A of Fig. 6 with the switching valve in a first state;

Fig. 8 is similar to Fig. 7 with the switching valve in a second state;

Fig. 9 is a top view of the hood of Fig. 3;

Fig. 10 is a cross-sectional stereoscopic diagram taken along line B-B of Fig. 9;

Fig. 11 is a top view of the machine head assembly of Fig. 1;

Fig. 12 is a cross-sectional view taken along line C-C of Fig. 11 with the vacuum cleaner in a cleaning mode;

Fig. 13 is similar to Fig. 12, with the vacuum cleaner in a self-cleaning mode;

Fig. 14 is a cross-sectional view taken along line D-D of Fig. 11;

Fig. 15 is an enlarged schematic view of portion a of Fig. 14 with the air replenishing valve closed;

Fig. 16 is similar to Fig. 15 with the air replenishing valve open;

Fig. 17 is a top plan view of a suction mouthpiece closing member of the vacuum cleaner of the present invention;

Fig. 18 is a sectional view taken along line E-E in Fig. 11;

Fig. 19 is a schematic view of the vacuum cleaner

of the present invention with the hose disconnected from the air replenishing valve;

Fig. 20 is a schematic view of the connection of the hose of the vacuum cleaner of the present invention to the air replenishing valve;

Fig. 21 is a stereoscopic diagram of the rear cover of Fig. 3 (the upper portion visible);

Fig. 22 is a stereoscopic diagram of the rear cover of Fig. 3 (the lower portion visible);

Fig. 23 is a simplified structural diagram of the vacuum cleaner of the present invention in a vacuum cleaning mode;

Fig. 24 is a simplified structural diagram of the air replenishing mode of the vacuum cleaner of the present invention switched from the vacuum cleaning mode to the self-cleaning mode;

Fig. 25 is a simplified structural diagram of the vacuum cleaner of the present invention in the self-cleaning mode.

DETAILED DESCRIPTION

[0028] The present invention will be described in detail below with reference to embodiments shown in the drawings. These embodiments are not intended to limit the present invention, and structural or functional modifications made by those skilled in the art based on these embodiments are intended to be included within the scope of the present invention.

[0029] Referring to Figs. 1 to 25, a preferred embodiment of the vacuum cleaner of the present invention is shown. In this embodiment, the vacuum cleaner comprises a machine head assembly 10, a dust drum (not shown) and a filter 30 connected to the machine head assembly 10. Wherein, the dust drum can be hermetically snap-fitted with the machine head assembly 10 by a connecting member such as a snap member and the like, in addition, rollers can also be provided under the dust drum to facilitate the movement of the dust drum. The machine head assembly 10 is also connected with a hose 21, and the machine head assembly 10 is provided with an air inlet. One end of the hose 21 is communicated with the air inlet of the machine head assembly 10, the other end of the hose 21 is provided with a suction mouthpiece 22 communicated with the external environment, therefore external air can be discharged from the suction mouthpiece 22 through the air inlet after being filtered by a filter 30, and the filtered dust can fall into the dust drum. Of course, in other implementations, the hose may be alternatively connected to the dust drum.

[0030] The machine head assembly 10 includes a fan 11, a fan base 12 for supporting the fan 11, a fan hood 14 socketed on the fan 11, and a top cover 13 covering the upper portion of the fan 11, wherein the fan base 12 is provided with a filter groove 121, the filter groove 121 penetrates through the upper portion and the lower portion of the fan base 12, and the filter 30 is mounted in the filter groove 121. The filter 30 is preferably a flat plate

filter. The top cover 13 is provided with an opening through which the filter 30 can be exposed, and the opening is sealed by a rear cover 15 fitted to the top cover 13. The fan hood 14 is provided with an air outlet 141, the air outlet 141 is a main air outlet pipe formed on the fan hood 14, and correspondingly, the fan base 12 is provided with a matching groove 122 for accommodating the main air outlet pipe. The lower portion of the fan base 12 is connected with a tray 16, and the tray 16 is used to form an air stream channel with the fan base 12, the fan hood 14 and the like.

[0031] The vacuum cleaner has a first air chamber 41 extending from the air inlet to the filter 30, and the first air chamber is formed by the dust drum (not shown), the fan base 12 and the tray 16 in an enclosing manner. Extending from the filter 30 to the fan 11 forms a second air chamber 42 of the vacuum cleaner, which is formed by the fan base 12, the tray 16 and the fan hood 14. The upstream end of the second air chamber 42 is provided with a first air port 123, and the first air port 123 is provided on the fan base 12 and located inside the filter groove 121. The fan 11 includes a motor 111 and an impeller 112 driven by the motor, and the air inlet of the impeller 112 is in fluid communication with the downstream end of the second air chamber 42. Extending from the impeller 112 to the air outlet 141 forms a third air chamber 43 of the vacuum cleaner, and the third air chamber 43 is formed by the fan base 12 and the fan hood 14 in an enclosing manner. When the vacuum cleaner performs the cleaning operation, the external air enters from the suction mouthpiece 22 of the hose 21, successively passes through the first air chamber 41, the second air chamber 42 and the third air chamber 43 and is discharged from the air outlet 141. It can be seen from the above, the air enters from the suction mouthpiece of the hose, pass through the first air chamber 41, filter 30, the second air chamber 42, fan 11, the third air chamber 43, and is discharged from the air outlet, that is, the path through which the air passed forms the dust suction air passage of the vacuum cleaner. The inside formed by the hood 14, the filter 30, and the rear cover 15 in an enclosing manner is a clean space, and the outside is a non-clean space, that is, the inside of the filter 30 is a cleaning side, and the outside of the filter 30 is a non-cleaning side, or along the dust suction air passage, the downstream side of the filter 30 is the cleaning side, and the upstream side of the filter 30 is the non-cleaning side.

[0032] In addition, a fourth air chamber 44 is formed between the air outlet 141 and the cleaning side of the filter 30, and the fourth air chamber 44 has a second air port 142 disposed adjacent to the filter and a self-cleaning air port 143 disposed adjacent to the air outlet 141, wherein the fourth air chamber 44 is formed by the fan hood 14 and the rear cover 15 in an enclosing manner, and extends from the self-cleaning air port 143 to the cleaning side of the filter 30. Specifically, the self-cleaning air port 143 is provided on the wall of the main air outlet pipe. The fan base 12 is further provided with an

air replenishing chamber 45 which is arranged adjacent to the filter groove 121. An air replenishing opening 451 is provided at the bottom of the air replenishing chamber 45, and is in gas communication with the first port 123 on the downstream side of the filter 30. When the air replenishing opening 451 is opened, the external air can enter the second air chamber 42 from the air replenishing chamber 45 and then be discharged from the air outlet 141 through the fan 11 and the third air chamber 43, or the external air enters the second air chamber 42 from the air replenishing chamber 45, then enters the fourth air chamber 44 from the fan 11 and the third air chamber 43, passes through the second air port 142, then passes through the cleaning side of the filter 30, and then returns to the second air chamber 42, and the cycle is repeated, so that the air stream path from the self-cleaning air port 143 to the cleaning side of the filter 30 forms the self-cleaning air passage of the vacuum cleaner.

[0033] Referring to Figs. 5 to 17, a switching valve 60 is mounted on the top cover 13, and the switching valve 60 is disposed adjacent to the air outlet 141 and the self-cleaning air port 143. The switching valve 60 may be in two states: in case of the first state, as shown in Figs. 7 and 12, the self-cleaning air port 143 is closed and the air outlet 141 is opened, and in case of the second state, as shown in Fig. 8 and 13, the air outlet 141 is closed and the self-cleaning air port 143 is opened. When the switching valve 60 is in the first state, the vacuum cleaner has three modes: in case of the first mode, the air replenishing opening 451 is closed, and the air inlet is opened, so that the external air enters the first air chamber 41 from the air inlet, passes through the filter 30, the second air chamber 42, the fan 11 and the third air chamber 43, and is discharged from the air outlet 141, namely, the first mode is the vacuum cleaning mode of the vacuum cleaner, as shown in Fig. 18, the direction of the solid arrow is the direction of the air stream in the vacuum cleaning mode; in case of the second mode, the air replenishing opening 451 is opened, and the air inlet is closed, so that the external air enters the second air chamber 42 from the air replenishing opening 451, passes through the fan 11 and the third air chamber 43, and is discharged from the air outlet 141, namely, the second mode is the air replenishing mode of the vacuum cleaner; when the switching valve 60 is in the second state, the air replenishing opening 451 is opened, and the air inlet is closed, so that the external air enters the second air chamber 42 from the air replenishing opening 451, passes through the fan 11 and the third air chamber 45, enters the fourth air chamber 44 from the self-cleaning air port 143, passes through the cleaning side of the filter 30, and then returns to the second air chamber 42, and the cycle is repeated, namely, it is the self-cleaning mode of the vacuum cleaner, wherein the direction of the dotted arrow in Fig. 18 is the direction of the air stream in the self-cleaning mode.

[0034] Specifically, the switching valve 60 includes a handle 62 for operation and a rotating shaft 63 relatively

fixedly connected to the handle 62. The rotating shaft 63 is fixedly connected to the handle 62 through a spline and a screw. A switching valve cover 64 is fixedly disposed on the rotating shaft 63. The handle 62 is operated to, through the rotating shaft 63, drive the switching valve cover 64 to rotate, around the rotating shaft 63, between two positions, so that the switching valve 60 is in the first state or the second state. When the switching valve 60 is in the first state, the switching valve cover 64 closes the self-cleaning air port 143 and opens the air outlet 141, and when the switching valve 60 is in the second state, the switching valve cover 64 opens the self-cleaning air port 143 and closes the air outlet 141. Further, the switching valve 60 further includes an elastic member 61 which applies an elastic force to the switching valve cover 64 to make the same move towards the self-cleaning air port 143, that is, the switching valve 60 can be maintained in the first state under the action of the elastic member 61, and the handle 62 of the switching valve 60 is manually operated to overcome the action of the elastic member 61 to switch to the second state. The elastic element 61 is preferably a torsion spring, which can be socketed on the rotating shaft 63, wherein one end of the torsion spring is fixed relative to the rotating shaft 63, and the other end of the torsion spring 63 is fixed on the top cover 13. Of course, in other embodiments, the switching valve 60 can also be switched between the first state and the second state by an electrically controlled manner such as a steering engine or a turning angle electromagnet.

[0035] Referring to Figs. 15 and 16, in the present embodiment, the air replenishing opening 451 is opened or closed by opening or closing the air replenishing valve 70. The air replenishing valve 70 comprises an air replenishing valve body 71, an air replenishing hole 75 is formed in the air replenishing valve body 71, an air replenishing valve cover 72 is arranged on the lower side of the air replenishing hole 75, a spring 74 is arranged between the air replenishing valve cover 72 and the pierced air replenishing valve bottom wall, wherein the spring make the air replenishing valve cover 72 have the tendency of upwards closing the air replenishing hole 75, namely, the air replenishing valve 70 can be kept at the position of closing the air replenishing hole 75 under the action of the spring 74. An air replenishing valve cap 73 is arranged on the upper side of the air replenishing hole 75, a foot extends downwards from the air replenishing valve cap 73, and the foot penetrates downwards through the air replenishing hole 75 and abuts against the air replenishing valve cover 72. The downward movement of the air replenishing valve cap 73 can drive the air replenishing valve cover 72 to together overcome the force of the spring 74 so as to open the air replenishing hole 75. The air replenishing valve 70 is mounted between the air replenishing chamber 45 and the top cover 13. The top cover 13 is provided with an annular hose clamping groove 132, a through hole 132c is provided in the hose clamping groove 132, the air replenishing valve cap 73 is positioned above the through hole, and the foot of

the air replenishing valve cap 73 downwards penetrates through the through hole. The hose clamping groove 132 is matched with the tube wall of the suction mouthpiece 22 (i.e. the free end of the hose 21), when the tube wall of the suction mouthpiece 22 is inserted into the hose clamping groove 132, the protrusion 133 arranged in the middle of the hose clamping groove 132 closes the suction mouthpiece 22, and meanwhile, the tube wall of the suction mouthpiece 22 presses down the air replenishing valve cap 73, so that the air replenishing valve 70 is opened, and air between the top cover 13 and the fan base 12 can enter the air replenishing chamber 45 through the air replenishing hole 75, as shown in Fig. 16, the direction of the arrow is the direction of air stream when the air replenishing hole 75 is opened. Further, the top end of the air replenishing valve cap 73 is lower than the top end of the protrusion 132, that is, the air replenishing valve cap 73 does not protrude out of the hose clamping groove 132 as a whole, so that the air replenishing valve can be prevented from being triggered by mistake.

[0036] It can be seen from the above that, in the present embodiment, by the cooperation between the free end of the joint of the hose 21 and the air replenishing valve 70, the air replenishing valve 70 is controlled to open the air replenishing opening 451 while the hose suction mouthpiece 22 is closed, where the cooperation means that the tube wall of the suction mouthpiece 22 presses against the air replenishing valve 70 so as to control the air replenishing valve 70 to open the air replenishing opening 451, that is, the tube wall of the suction mouthpiece 22 abuts against and presses the air replenishing valve 70 down; the separation of the hose 21 from the air replenishing valve 70 is able to open the suction mouthpiece 22 and the air replenishing valve 70 closes the air replenishing opening 451. As shown in Fig. 19, the hose 21 is separated from the air replenishing valve 70, the suction mouthpiece 22 is in the open state, and the air replenishing valve 70 is in the close state, that is, the spring 74 presses against the air replenishing valve cover 72 to close the air replenishing hole 75. As shown in Fig. 20, the hose 21 is connected to the air replenishing valve 70, and the suction mouthpiece 22 is in the close state, that is, the protrusion 133 closes the suction mouthpiece 22; the air replenishing valve 70 is in the close state, the side wall of the hose 21 downwards presses the air replenishing valve cover 72, and the air replenishing valve cover 72 drives the air replenishing valve cover 72 to move downwards to open the air replenishing hole 75. In this embodiment, as shown in Fig. 17, the hose clamping groove 132 and the protrusion 133 forms a closing member for the suction mouthpiece. The outer diameter of the protrusion 133 is substantially equal to the inner diameter of the suction mouthpiece 22, and the ring width of the annular hose clamping groove 132 (the difference between the inner diameter of the outer periphery of the hose clamping groove 132 and the outer diameter of the protrusion 133, that is, the distance be-

tween the groove outer wall 132a and the groove inner wall 132b of the hose clamping groove 132) is substantially equal to the wall thickness of the suction mouthpiece 22, so that when the hose 21 is inserted into the annular hose clamping groove 132, the tube wall of the suction mouthpiece 22 is just inserted into the hose clamping groove 132, and the suction mouthpiece 22 is just closed by the protrusion 132. Normally, the thickness of the tube wall of the suction mouthpiece 22 is much smaller than the width of a human finger, so that it is ensured that a user can simultaneously close the suction mouthpiece and control the opening of the air replenishing valve only by inserting the suction mouthpiece 22 into a suction mouthpiece closing member and pressing down the hose clamping groove 132, and the air replenishing valve 70 cannot be opened only by using the limb (such as a finger) of the user, and therefore, the linkage control of the suction mouthpiece and the air replenishing valve is ensured, and the air replenishing valve is prevented from being triggered by mistake.

[0037] Furthermore, in order to improve the efficiency of the self-cleaning, a hole plate 151 is provided in the rear cover 15, and the hole plate 151 divides the interior of the rear cover 15 into an upper portion and a lower portion, wherein the upper portion is in fluid communication with the self-cleaning air port 143. The hole plate 151 is provided with a plurality of through ejection holes 152, and the ejection holes 152 forms a part of the self-cleaning air passage. The ejection holes 152 extend downwards to form ejection columns, the hole diameters of the ejection holes 152 of the preferred ejection columns are not more than 10 mm, specifically 5 mm to 9 mm, the center lines of the ejection holes 152 are approximately perpendicular to the flat filter, the air outlet direction from the second air port 142 is approximately perpendicular to the center lines of the ejection holes 152, and the air volume inside the fan assembly is greater than that outside the fan assembly, therefore the hole diameters of the ejection holes adjacent to the second air chamber inlet, namely the first air port, is set to be smaller than the hole diameters of the ejection holes far away from the second air chamber inlet, or the inner diameters of the ejection holes adjacent to the downstream of the dust collection air passage is smaller than the inner diameters of the ejection holes far away from the downstream of the dust collection air passage, thereby ensuring that the air stream inside and outside the second air chamber are more uniform. Preferably, the inner diameters of the plurality of ejection holes 152 increases in the direction from the inside to the outside of the fan 11, and the plurality of ejection holes 152 are regularly arranged with respect to the rotation axis of the fan 11. In this embodiment, four rows of ejection holes are provided, three ejection holes are provided in each row, and the inner diameters of the ejection holes in the same row are increased from inside to outside, specifically, the hole diameter of the innermost ejection hole is preferably 5 mm, the hole diameter of the middle ejection hole is preferably 7 mm, and the hole

diameter of the outermost ejection hole is preferably 9 mm. The connecting lines of the center lines of the ejection holes in each row may be arranged in parallel with each other or in the same radial direction as the rotation axis of the fan 11, and the sub-sections of the ejection holes having the same hole diameter of each row may be arranged in conformity with the arrangement of the filter, such as arc-shaped in the present embodiment. In addition, a grid-shaped side wall 153 is provided at one side of the hole plate 151, and the side wall 153 corresponds to the first air port 123 such that the clean air passing through the filter 30 can enter the first air port 123 from the grid of the side wall 153. In the present embodiment, the gap between the end of the ejection column and the clean side of the filter 30 is no more than 20 mm, more preferably 2 mm to 10 mm, and most preferably 5 mm, and the ratio of the total air outlet area of the ejection holes to the minimum air passing area of the fourth air chamber 44 is approximately 1:1. By the arrangement, better air stream ejection force and strike area on the filter can be achieved at the same time, and the optimal self-cleaning effect is achieved.

[0038] The self-cleaning method of the vacuum cleaner according to the invention comprises the following steps: S1, connecting the hose 21 with the air replenishing valve 70, so that the hose suction mouthpiece 22 is closed and the air replenishing opening 451 is opened, therefore air stream successively passes through the air replenishing opening 451, the fan 11 and the air outlet 141, specifically, the free end of the hose 21 is inserted into the hose clamping groove 132, the protrusion 133 in the clamping groove 132 closes the hose suction mouthpiece 22, the tube wall of the hose 21 downwards presses the air replenishing valve cap 73, and then the air replenishing valve 70 is opened, so that the air stream enters the second air chamber 42 and the third air chamber 43 through the air replenishing opening 451, and thereafter is discharged from the air outlet 141; S2, closing the air outlet 141, specifically, opening the switching valve 60 to close the air outlet 141 and open the self-cleaning air port 143, so that the external air stream successively passes through the air replenishing opening 451, the second air chamber 42, the third air chamber 43 and the fourth air chamber 44, strikes the clean side of the filter and then enters the second air chamber 42 to circulate; S3, opening the air outlet 141, specifically, closing the switching valve 60 to open the air outlet 141 and close the self-cleaning air port 143, so that the air stream enters the second air chamber 42 and the third air chamber 43 through the air replenishing opening 451, and then is discharged from the air outlet 141; and S4, separating the hose 21 from the air replenishing valve 70, so that the hose suction mouthpiece 22 is opened and the air replenishing opening 451 is closed.

[0039] Preferably, step S2 and step S3 are circularly performed for a plurality of times between step S1 and step S4, and further, step S3 can be maintained for a preset time in the circulating process, and thereafter step

S2 is performed. Preferably, the preset time is 1 to 3 seconds. The vacuum cleaner and the operation method according to the present invention will be described below in a simplified structural view.

[0040] Fig. 23 is a simplified structural diagram of the vacuum cleaner in the cleaning mode, in which the suction mouthpiece 22 and the air outlet 141 are both in the open state, the switching valve 60 closes the self-cleaning air port 143, and the air replenishing valve 70 closes the air replenishing opening 451. Under the action of the fan 11, air enters the first air chamber 41 from the suction mouthpiece 22 and the air inlet, and impurity dust in the air is intercepted by the filter 30, so that most of the impurity dust can fall into the non-clean air chamber, but some impurity dust can be stuck on the non-cleaning side of the filter 30. Clean air passes through the filter 30, successively passes through the second air chamber 42 and the third air chamber 43, and is finally discharged from the air outlet 141, and the arrow in the drawing schematically indicates the direction of air stream. With the prolongation of the use time of the vacuum cleaner, excessive impurity dust will accumulate on the non-cleaning side of the filter, resulting in a decrease in the suction force of the vacuum cleaner. When the user directly feels that the suction force is reduced or the vacuum cleaner itself senses an excessive accumulation of impurity dust through the sensor, it is necessary to activate the self-cleaning mode to remove the impurity dust accumulated on the non-cleaning side of the filter. The activation of the self-cleaning mode can be realized by a user through operating the hose and the switching valve, or can be realized through an automatic mode switching structure arranged in the vacuum cleaner, specifically through a mode of controlling an electromagnetic valve or other control modes known to those skilled in the art, and will not be described herein again.

[0041] Fig. 24 is a schematic structural diagram of the air replenishing mode of the vacuum cleaner switched from the vacuum cleaning mode to the self-cleaning mode, wherein the suction mouthpiece 22 is in the close state, the air outlet 141 is in the open state, the switching valve 60 closes the self-cleaning air port 143, and the air replenishing valve 70 is opened. Under the action of the fan 11, air enters the second air chamber 42 from the air replenishing opening 451, passes through the third air chamber 73, and is finally discharged from the air outlet 141, and the arrows in the drawing schematically indicates the direction of the air stream. At the moment, a low pressure area is formed in the first air chamber 41 and the fourth air chamber 44.

[0042] Fig. 25 is a schematic structural diagram of the vacuum cleaner in the self-cleaning mode, in which the suction mouthpiece 22 and the air outlet 141 are both in the close state, the switching valve 60 opens the self-cleaning air port 143, and the air replenishing valve 70 is kept open. At the moment, the air entering from the air replenishing opening 451 enters the fourth air chamber 44 through the second air chamber 42 and the third air

chamber 43 under the action of the fan 11, and is ejected from the ejection hole 152 corresponding to the cleaning side of the filter to strike the cleaning side of the filter, so that the impurity dust accumulated and stuck on the non-cleaning side of the filter are removed, and a self-cleaning action is completed.

[0043] In order to enhance the self-cleaning effect, the vacuum cleaner returns to the air replenishing mode from the self-cleaning mode, namely the air replenishing valve 70 is kept open, the self-cleaning air port 143 is closed and the air outlet 141 is opened, and then the vacuum cleaner returns to the self-cleaning mode from the air replenishing mode, and in this way, the self-cleaning action is repeated for a plurality of times. Finally, the vacuum cleaner returns to the vacuum cleaning mode from the air replenishing mode or the self-cleaning mode to finish the self-cleaning operation. From the above description, it can be found that the present invention adds a self-cleaning system on the traditional vacuum cleaner, so that the filter can be self-cleaned; the effective dust collection time of the vacuum cleaner is prolonged; the self-cleaning effect is excellent, and the service life of the filter is prolonged; the self-cleaning system reduces the disassembly and cleaning frequency of a user and reduces the workload; the design is ingenious, the structure is simple, the production is convenient, and the applicability is strong; the external cold air entering from the air replenishing opening 451 can cool the lower, so that the temperature of the fan is reduced; in addition, through the connection or separation of the hose and the air replenishing valve, the switch between the cleaning mode and the vacuum cleaning mode is realized, the operation is very simple and convenient, therefore better user experience is achieved.

[0044] It is to be understood that although the specification has been described in terms of embodiments, not every embodiment contains only one independent technical solution, and that such description is merely for purposes of clarity. One skilled in the art should take the specification as a whole, and the technical solution in each embodiment may be suitably combined to form additional embodiments that may be appreciated by those skilled in the art.

[0045] The above detailed description is only specific to the possible embodiments of the present invention, and is not intended to limit the scope of the present invention, and all equivalent embodiments or modifications that do not depart from the spirit of the present invention are intended to be included within the scope of the present invention.

Claims

1. A vacuum cleaner having self-cleaning function comprises
a machine head assembly(10),
a dust drum,

a hose (21) connected to the machine head assembly(10) or the dust drum, and
a filter (30) connected to the machine head assembly(10),

wherein the machine head assembly(10) includes a fan (11), an air inlet and air outlet (141) communicated with the outside, the hose(21) has a suction mouthpiece (22) communicated with the outside, the suction mouthpiece(22) is communicated with the air inlet, the fan(11) is provided between the filter(30) and the air outlet(141), an air replenishing opening (451) is provided between filter(30) and the fan(11), the filter(30) has a clean side and a non-clean side, the vacuum cleaner has a vacuum cleaning mode and a self-cleaning mode;

in the vacuum cleaning mode, the air stream successively passes through the suction mouthpiece(22), the air inlet, the filter(30), the fan(11) and the air outlet(141), and

in the self-cleaning mode, the air stream successively passes through the air replenishing opening(451) and the fan(11), and then strikes the cleaning side of the filter(30);

it is **characterized in that:**

an air replenishing valve (70) is provided at the air replenishing opening(451),

in the vacuum cleaning mode, the suction mouthpiece(22) is opened and the air replenishing valve (70) controls the air replenishing opening(451) to be closed, and

in the self-cleaning mode, the suction mouthpiece(22) is closed and the air replenishing valve (70) controls the air replenishing opening(451) to be opened;

the tube wall of the suction mouthpiece(22) of the hose(21) is pressed against the air replenishing valve (70) so as to close the suction mouthpiece(22), and control the air replenishing valve(70) to open the air replenishing opening(451),

the tube wall of the suction mouthpiece(22) of the hose(21) is separated from the air replenishing valve(70) so as to open the suction mouthpiece(22), and control the air replenishing valve(70) to close the air replenishing opening(451).

2. The vacuum cleaner according to claim 1, **characterized in that:** the outer surface of the machine head assembly (10) is provided with a suction mouthpiece closing member, and the air replenishing valve (70) is at least partially arranged in the suction mouthpiece closing member.
3. The vacuum cleaner according to claim 2, **characterized in that:** the suction mouthpiece closing member comprises a protrusion (133), and the outer

diameter of the protrusion (133) is matched with the inner diameter of the suction mouthpiece (22).

4. The vacuum cleaner according to claim 3, **characterized in that:** the suction mouthpiece closing member further comprises a hose clamping groove (132) which is arranged around the protrusion (133); and the tube wall of the suction mouthpiece (22) is inserted into the hose clamping groove (132) to press against the air replenishing valve(70).
5. The vacuum cleaner according to claim 4, **characterized in that:** the hose clamping groove (132) is provided with a groove outer wall (132a) and a groove inner wall (132b); and the distance between the groove outer wall (132a) and the groove inner wall (132b) corresponds to the thickness of the tube wall of the suction mouthpiece (22).
6. The vacuum cleaner according to claim 2, **characterized in that:** the air replenishing valve(70) does not protrude out of the suction mouthpiece closing member as a whole.
7. The vacuum cleaner according to any one of claims 1 to 6, **characterized in that:** the air replenishing valve(70) comprises an air replenishing valve body (71) and an air replenishing valve cover (72) mounted on the base of the fan(11), the air replenishing valve body(71) provided with an air replenishing hole (75) communicated with the air replenishing opening(451), and the air replenishing valve cover(72) can move relative to the air replenishing valve body(71) to open or close the air replenishing hole(75).
8. The vacuum cleaner according to claim 7, **characterized in that:** the upper portion of air replenishing hole(75) is provided with an air replenishing valve cap (73), a through hole and a protrusion (133) adjacent to the through hole are provided in the hose clamping groove(132), the air replenishing valve cap(73) partly passes through the through hole and abuts against the air replenishing valve cap(73), the hose(21) is inserted into the hose clamping groove(132), the protrusion(133) closes the suction mouthpiece(22), the tube wall of the suction mouthpiece (22) presses against the air replenishing valve cap(73) to drive the air replenishing valve cap(73) to move relative to the air replenishing valve body(71), in order to open the air replenishing hole(75).
9. The vacuum cleaner according to claim 7, **characterized in that:** the air replenishing valve(70) further comprises an elastic element (74) abutting against the air replenishing valve cover(72), and the air replenishing valve cover(72) can be kept at the position of closing the air replenishing hole(75) under the ac-

tion of the elastic element.

10. The vacuum cleaner according to any one of claims 1 to 6, **characterized in that:** the vacuum cleaner is further provided with an air replenishing mode, and in the air replenishing mode, air stream successively passes through the air replenishing opening(451), the fan(11) and the air outlet(141).
11. The vacuum cleaner according to claim 10, **characterized in that:** the vacuum cleaner has a first air chamber (41) from the air inlet to the non-cleaning side of the filter(30), a second air chamber (42) from the cleaning side of the filter(30) to the fan(11), a third air chamber (43) from the fan(11) to the air outlet(141), and a fourth air chamber (44) from the air outlet(141) to the cleaning side of the filter(30), wherein the fourth air chamber(44) is provided with a self-cleaning air port (143) adjacent to the air outlet(141); when the vacuum cleaner is in the vacuum cleaning mode, the suction mouthpiece(22) and the air outlet(141) are opened, and the air replenishing opening(451) is closed, so that external air stream successively passes through the suction mouthpiece(22), the air inlet, the first air chamber (41), the second air chamber (42) and the third air chamber(43), and is discharged from the air outlet(141); when the vacuum cleaner is in the air replenishing mode, the air outlet(141) and the air replenishing opening(451) are opened, and the suction mouthpiece(22) is closed, so that the external air stream successively passes through the air replenishing opening(451), the second air chamber(42) and the third air chamber(43), and is discharged from the air outlet(141); and when the vacuum cleaner is in the self-cleaning mode, the air replenishing opening(451) is opened, the suction mouthpiece(22) and the air outlet(141) are closed, so that the external air streams successively pass through the air replenishing opening(451), the second air chamber(42), the third air chamber(43) and the fourth air chamber(44), and then enters the second air chamber(42) for circulation after passing through the cleaning side of the filter(30).
12. The vacuum cleaner according to claim 11, **characterized in that:** the machine head assembly(10) further includes a switching valve (60) operable to move between two positions, wherein in a first position, the switching valve(60) opens the air outlet(141) and closes the self-cleaning air port(143), and in a second position, the switching valve(60) closes the air outlet(141) and opens the self-cleaning air port(143).
13. The vacuum cleaner according to claim 12, **characterized in that:** the switching valve(60) comprises an operating handle (62), a rotating shaft (63) driven by the operating handle(62) and a switching valve cover (64) relatively fixed with the rotating shaft(63), wherein the operating handle(62) drives the switching valve cover(64) through the rotating shaft(63) to select one of the air outlet(141) and the self-cleaning air port(143) to close.
14. The vacuum cleaner according to claim 10, **characterized in that:** the machine head assembly(10) is provided with a plurality of ejection holes (152) corresponding to the cleaning side of the filter(30), and in the self-cleaning mode, the air stream strikes the cleaning side of the filter(30) through the plurality of ejection holes; the ratio of the total air discharging area of the ejection holes to the air passing area of the fourth air chamber (44) is 1:1.
15. A self-cleaning method of the vacuum cleaner with self-cleaning function according to any one of claims 1 to 14, **characterized in that:** the self-cleaning method comprises the following steps: S1, connecting the hose(21) with the air replenishing valve(70); S2, closing the air outlet(141); S3, opening the air outlet(141); and S4, separating the hose(21) from the air replenishing valve(70).
16. The self-cleaning method of the vacuum cleaner according to claim 15, **characterized in that:** in the above steps, step S2 and step S3 are circularly performed for a plurality of times between step S1 and step S4.
17. The method of self-cleaning a vacuum cleaner according to claim 16, **characterized in that:** in the circulating process of step S2 and step S3, step S3 is maintained for a preset time, and thereafter step S2 is performed; the preset time is 1 to 3 seconds.

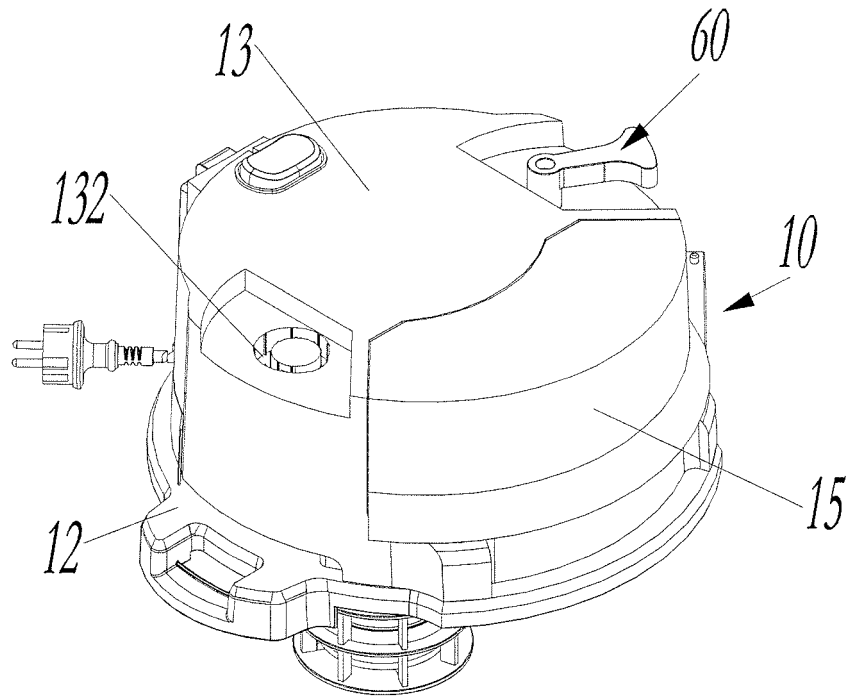


Fig. 1

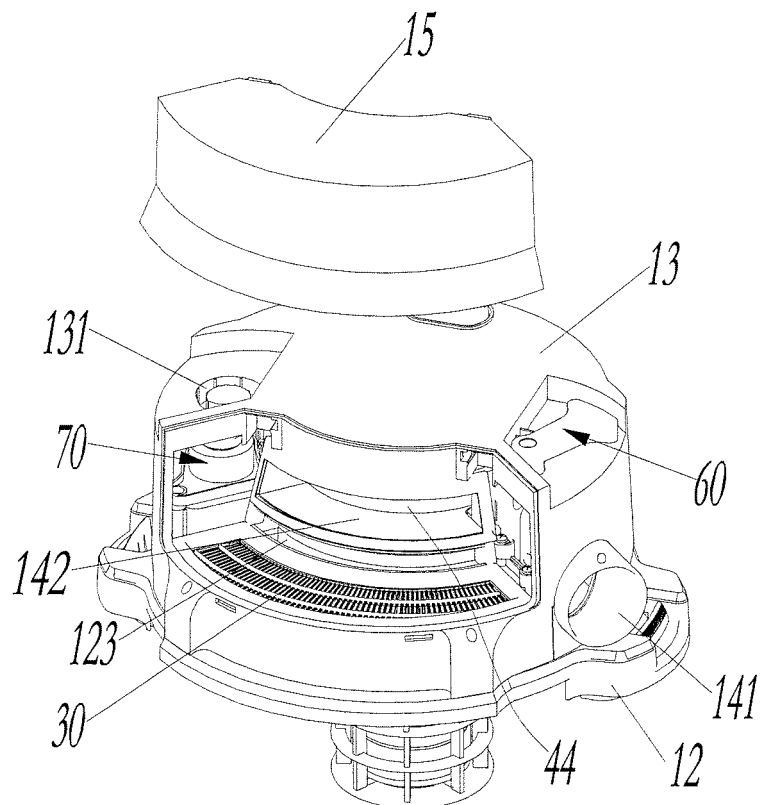


Fig. 2

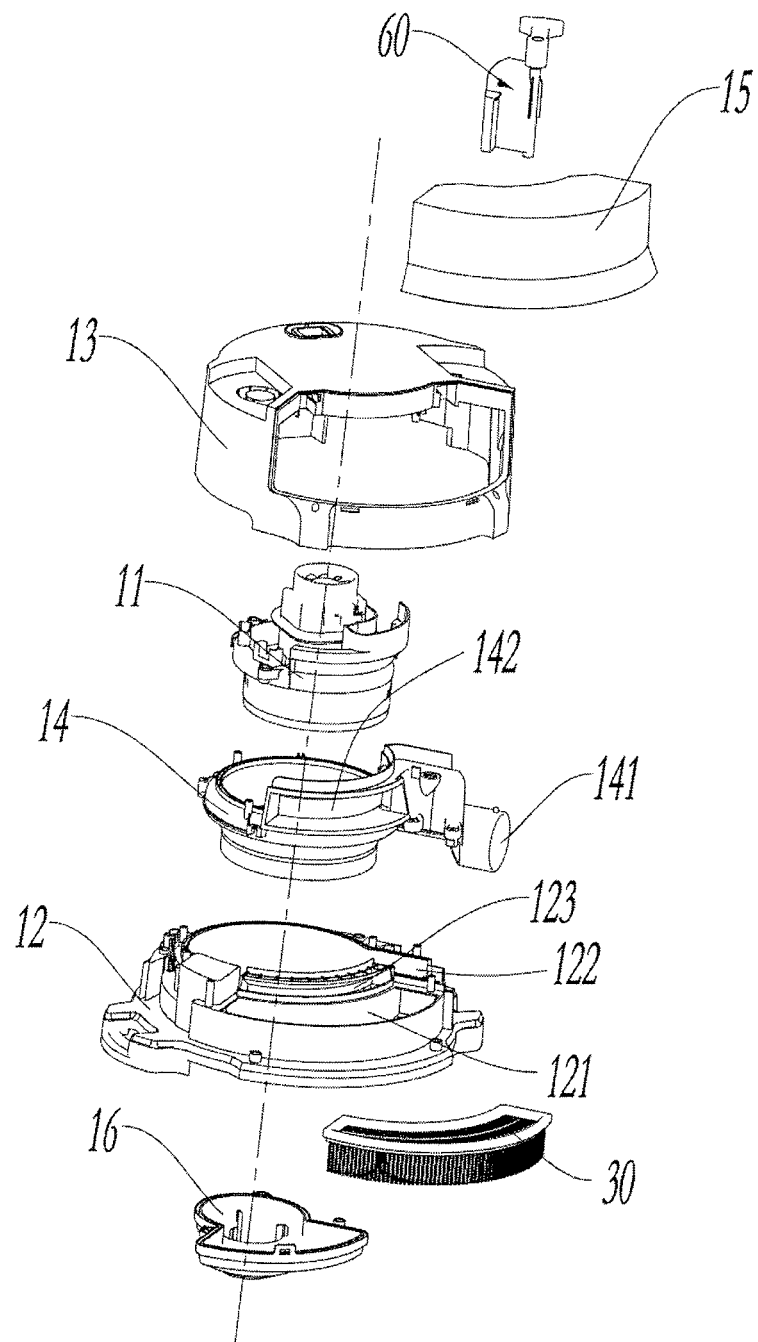


Fig. 3

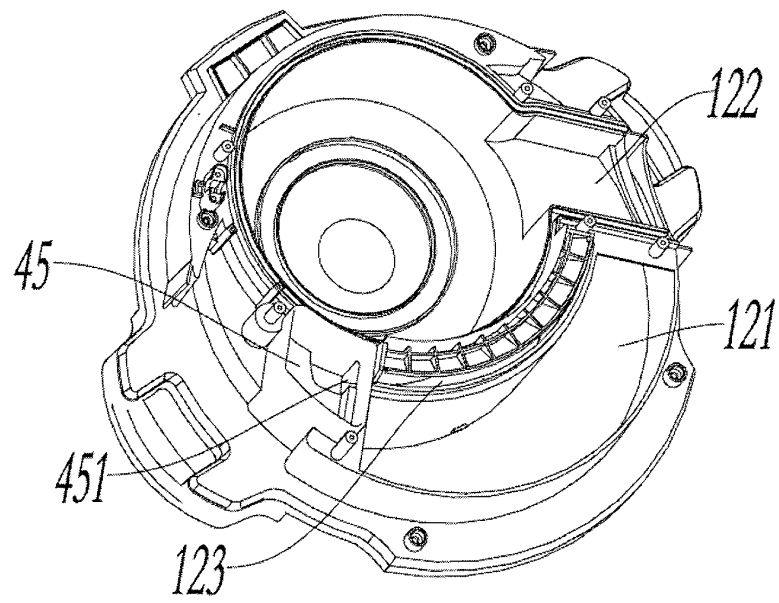


Fig. 4

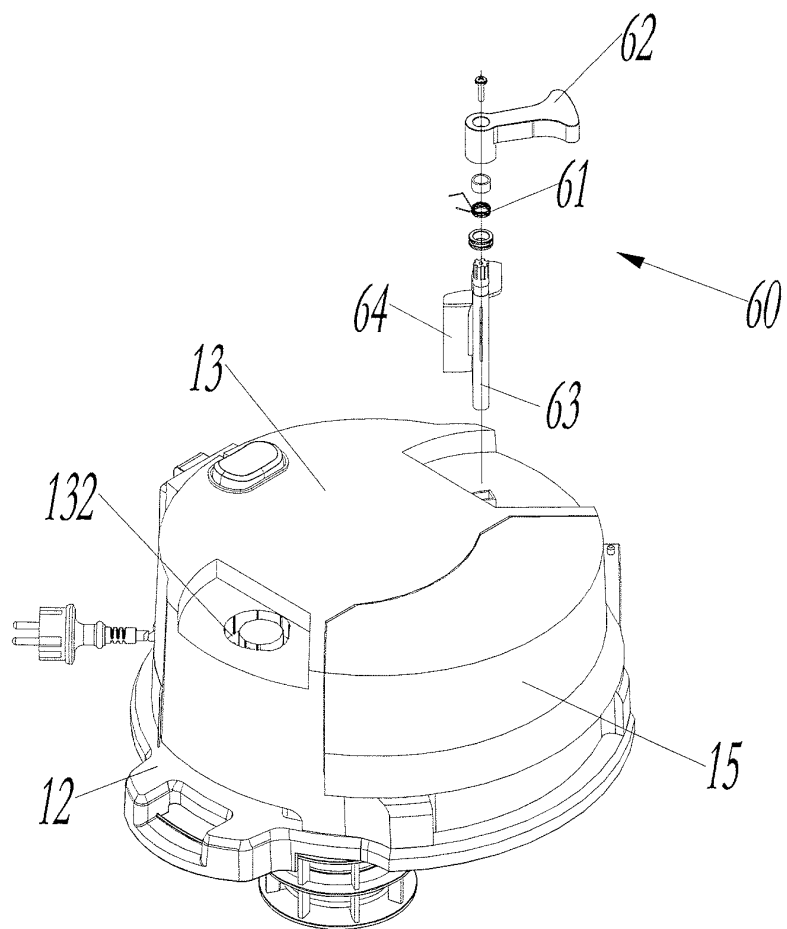


Fig. 5

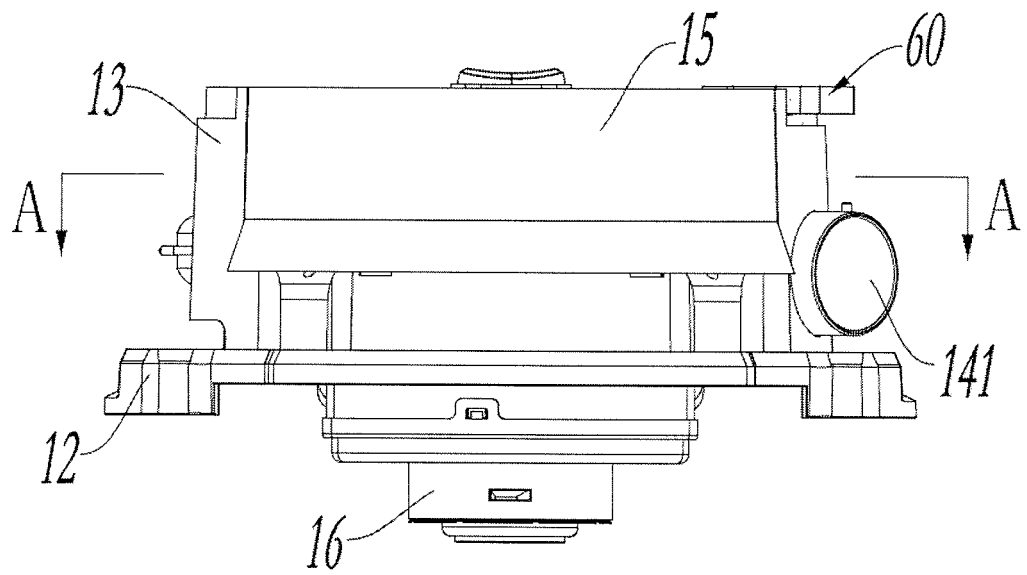


Fig. 6

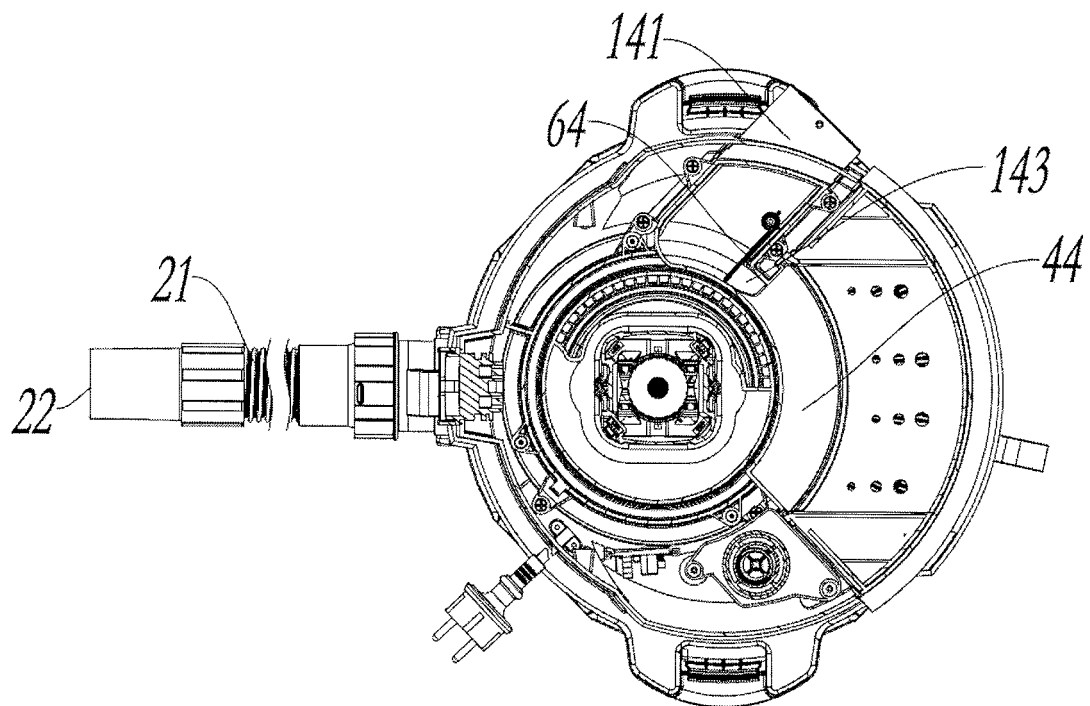


Fig. 7

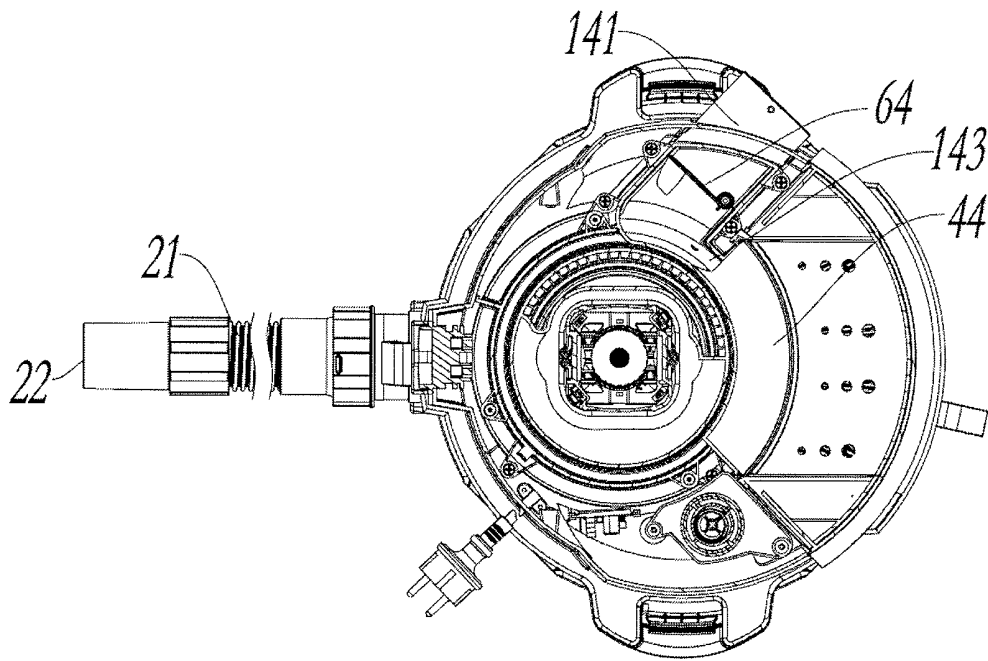


Fig. 8

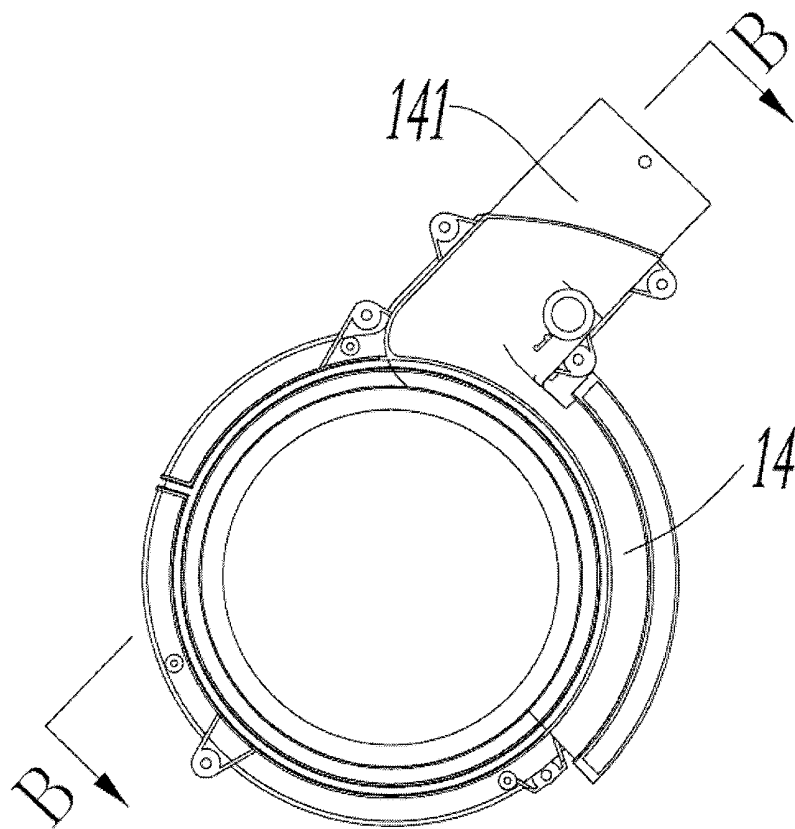


Fig. 9

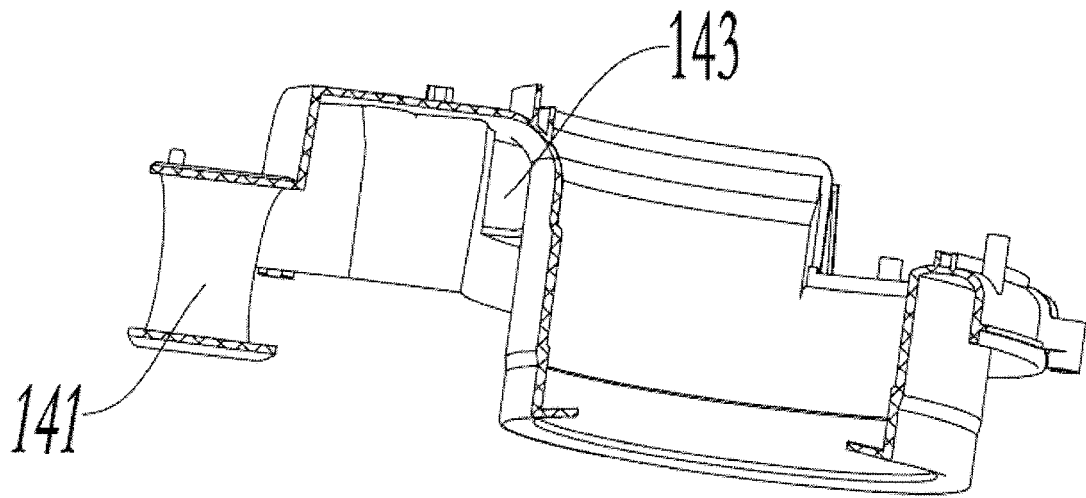


Fig. 10

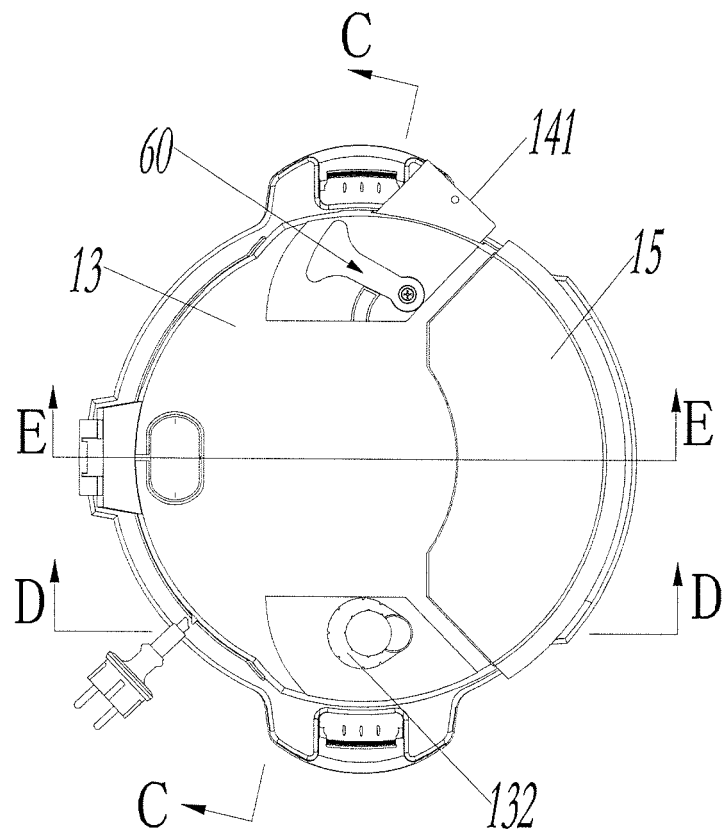


Fig. 11

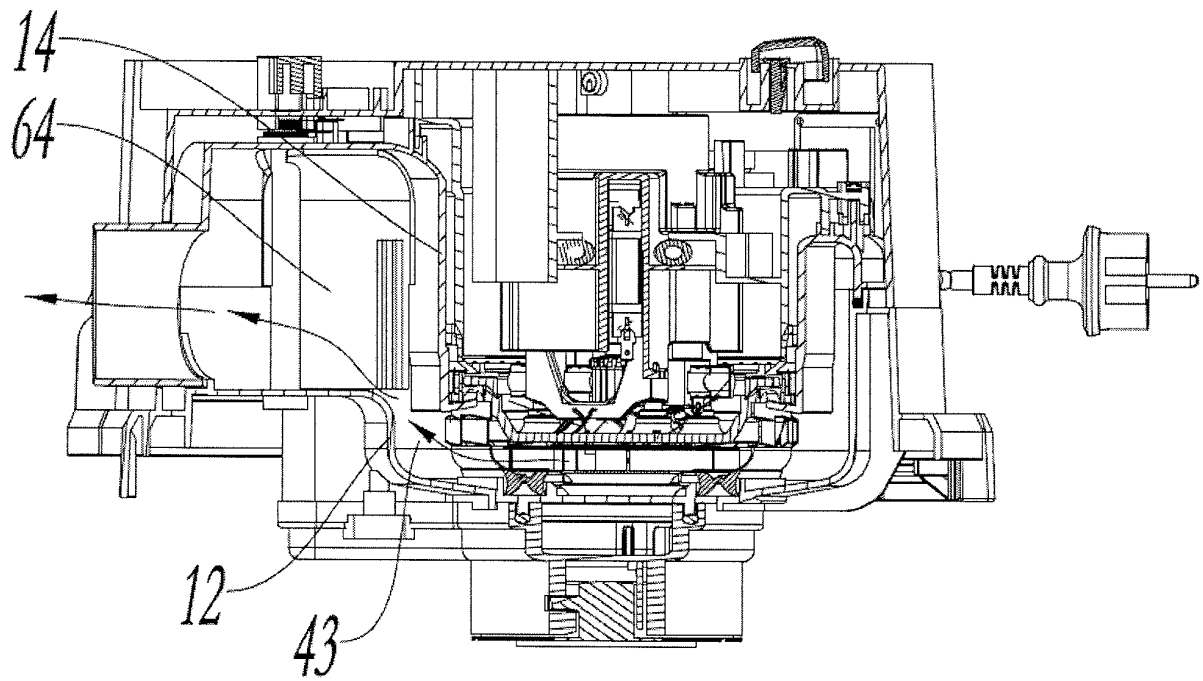


Fig. 12

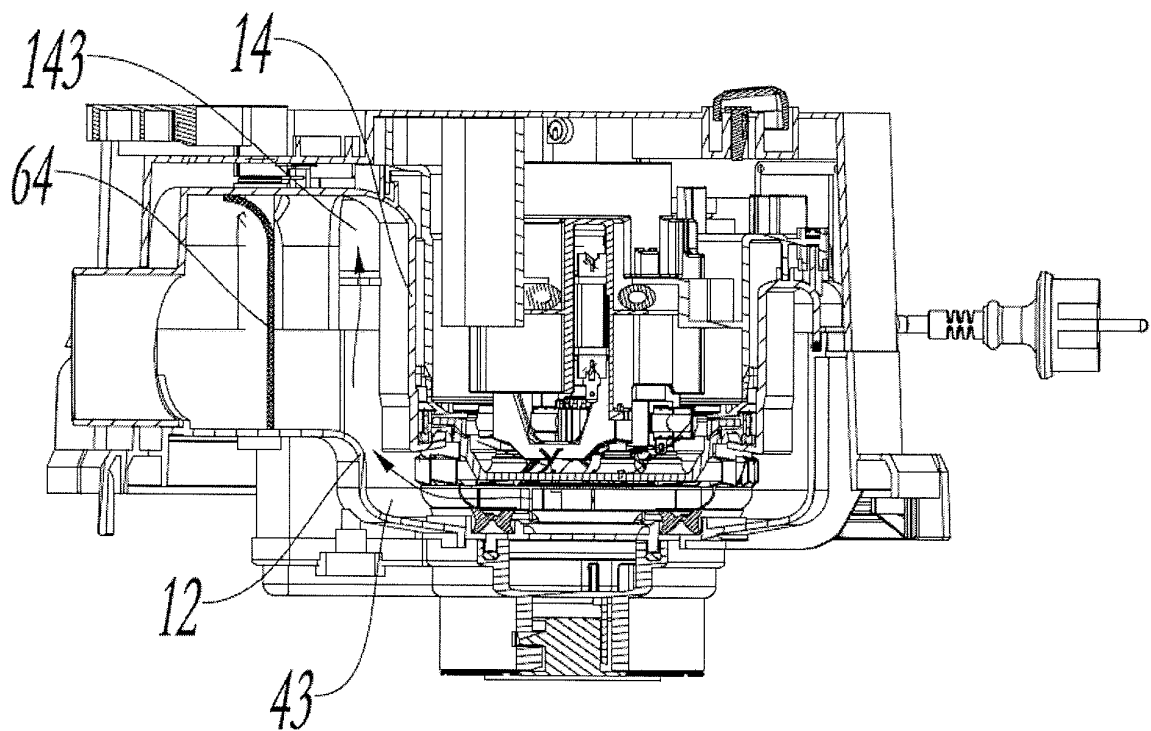


Fig. 13

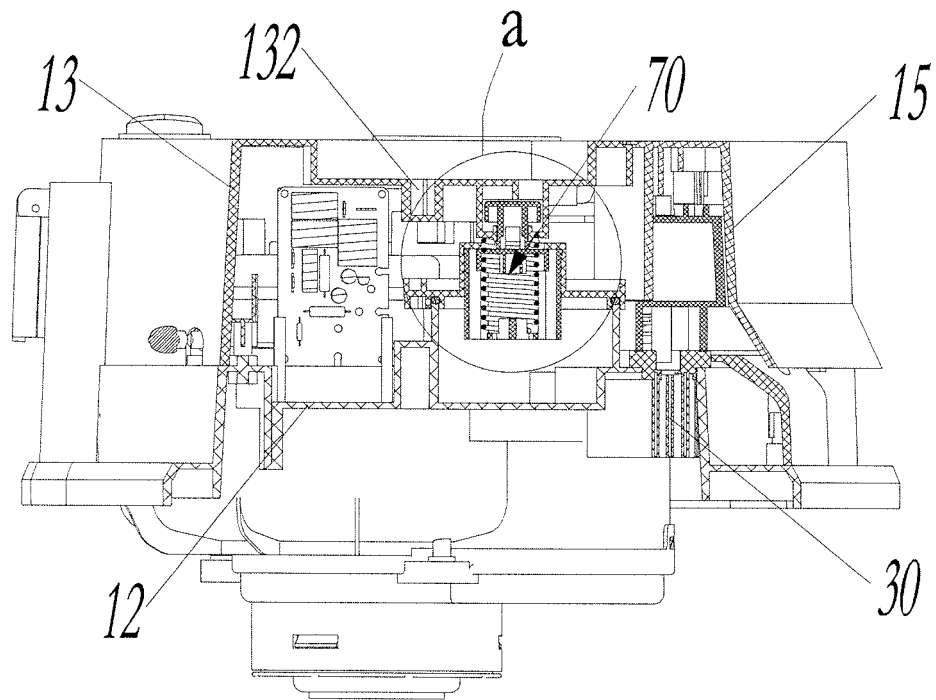


Fig. 14

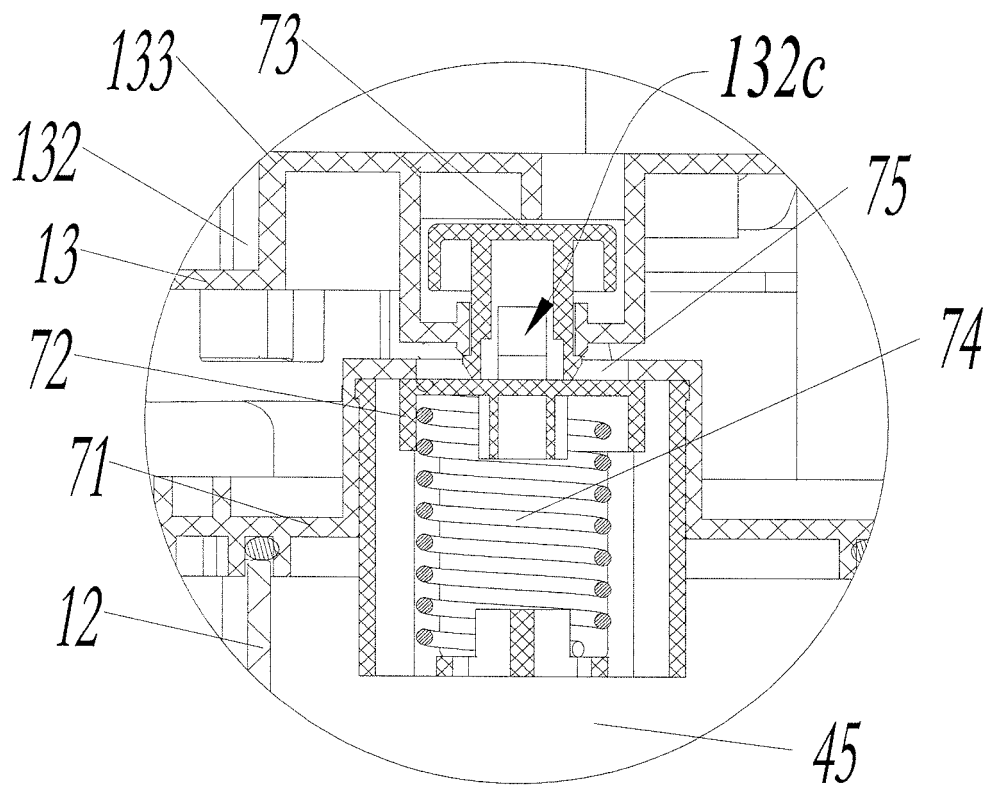


Fig. 15

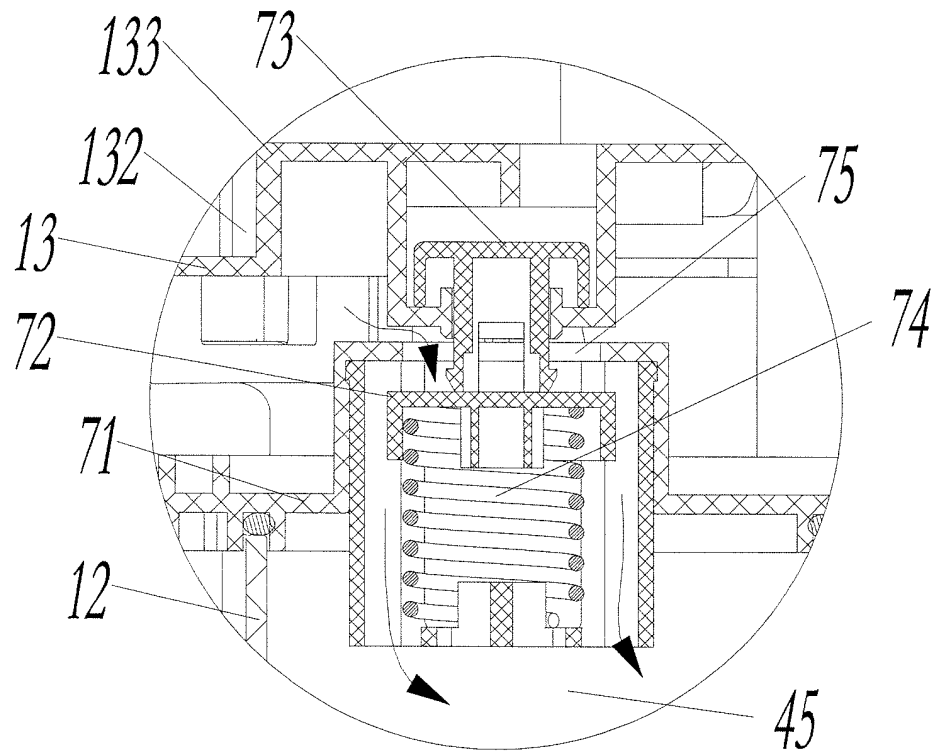


Fig. 16

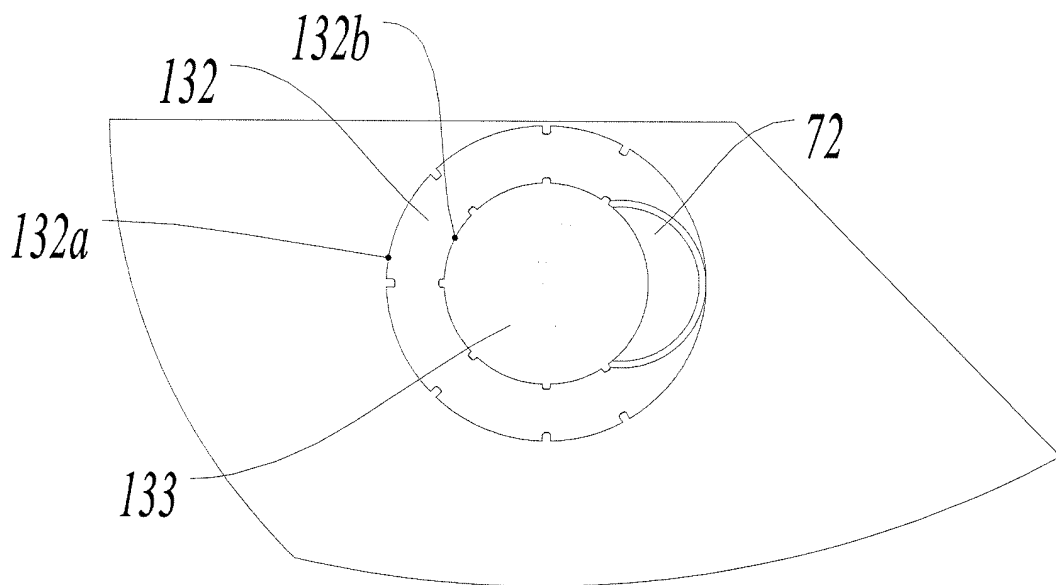


Fig. 17

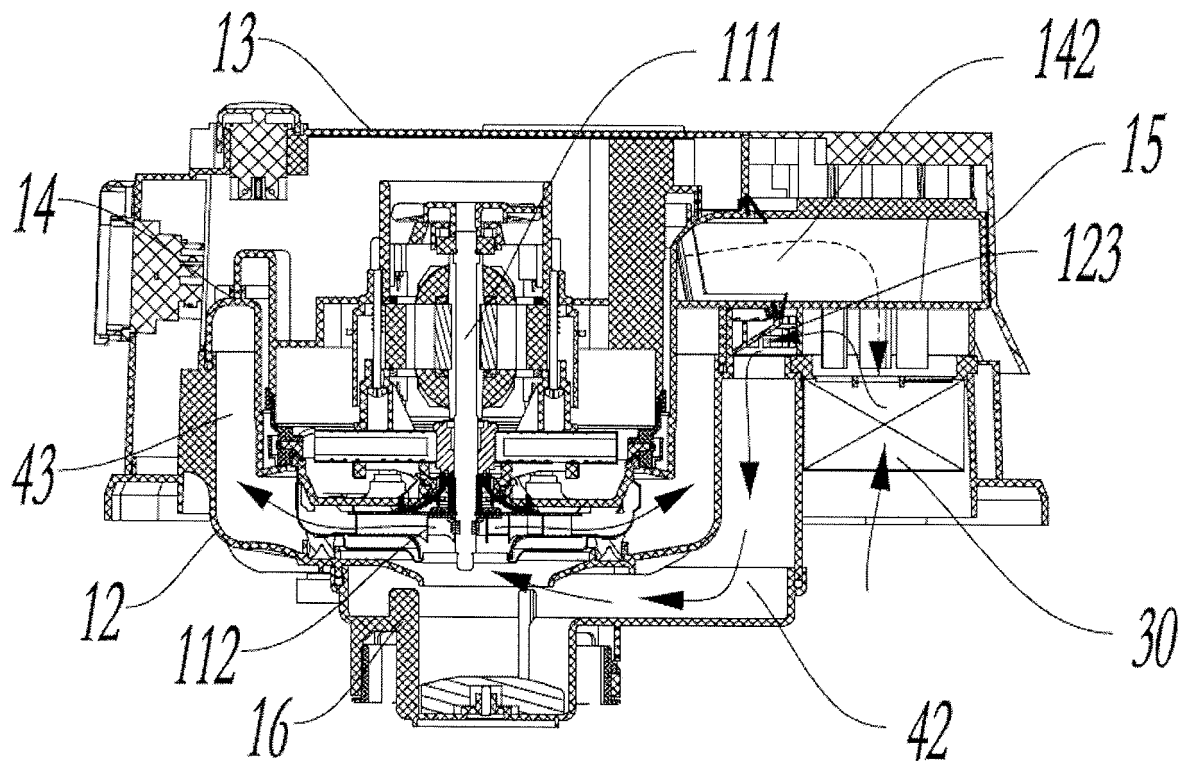


Fig. 18

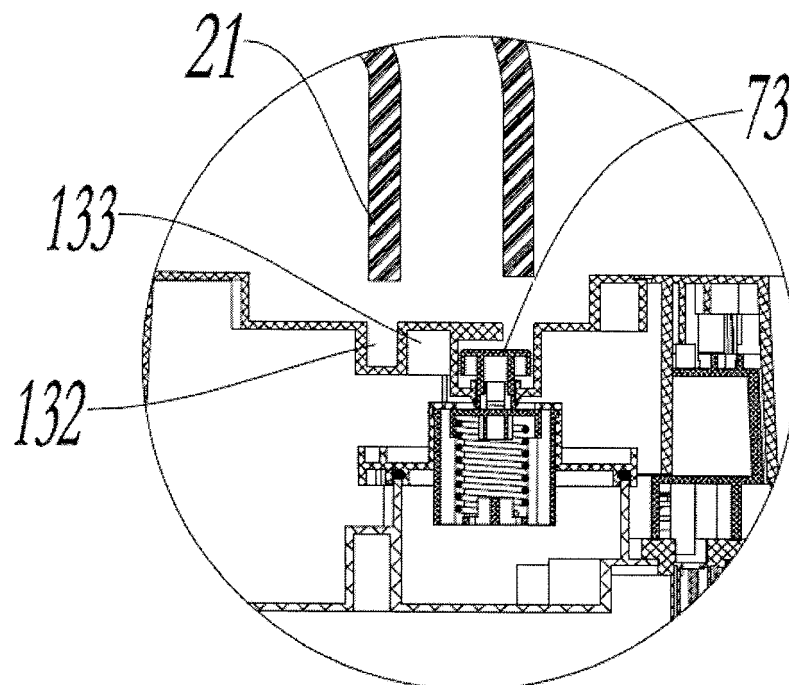


Fig. 19

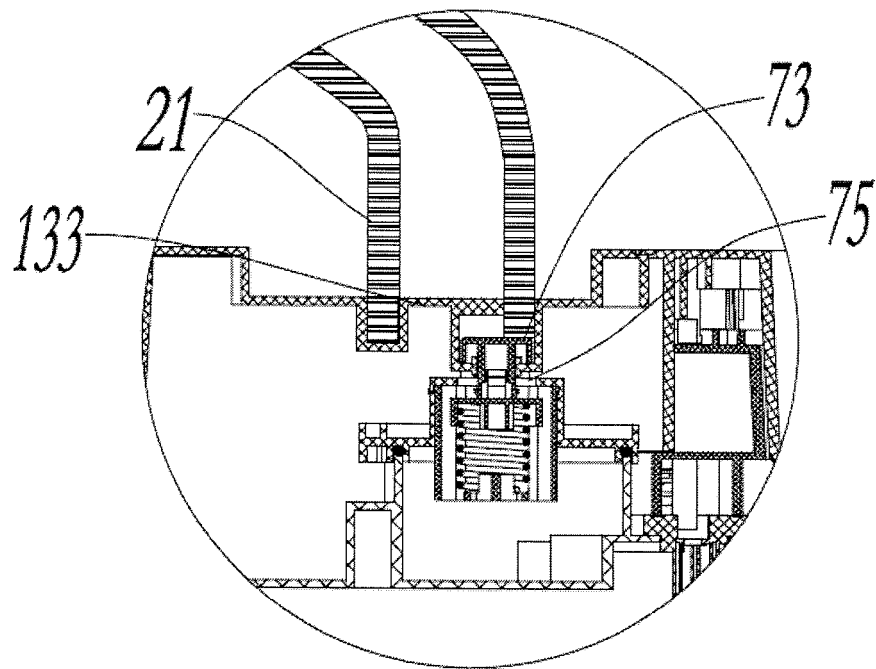


Fig. 20

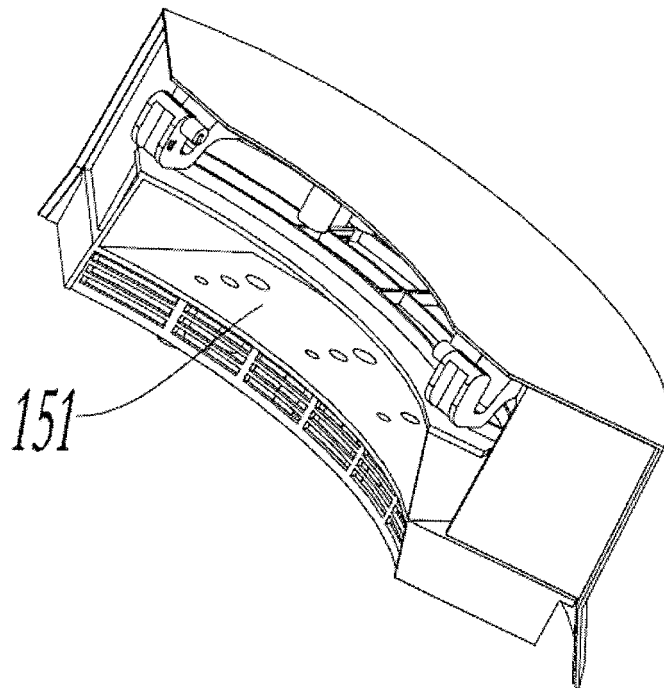


Fig. 21

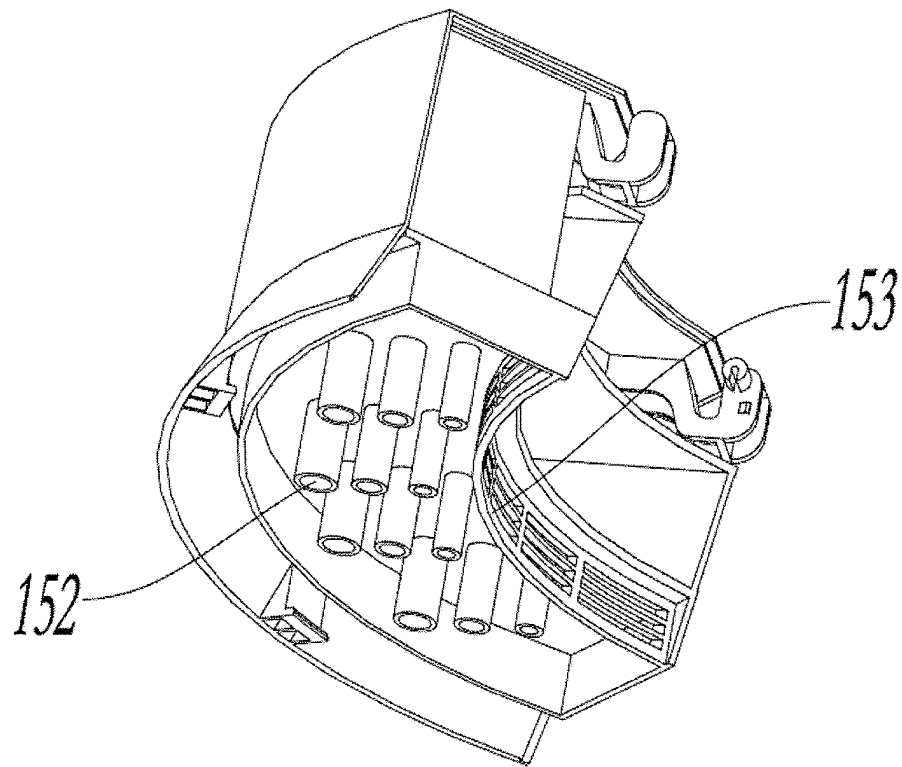


Fig. 22

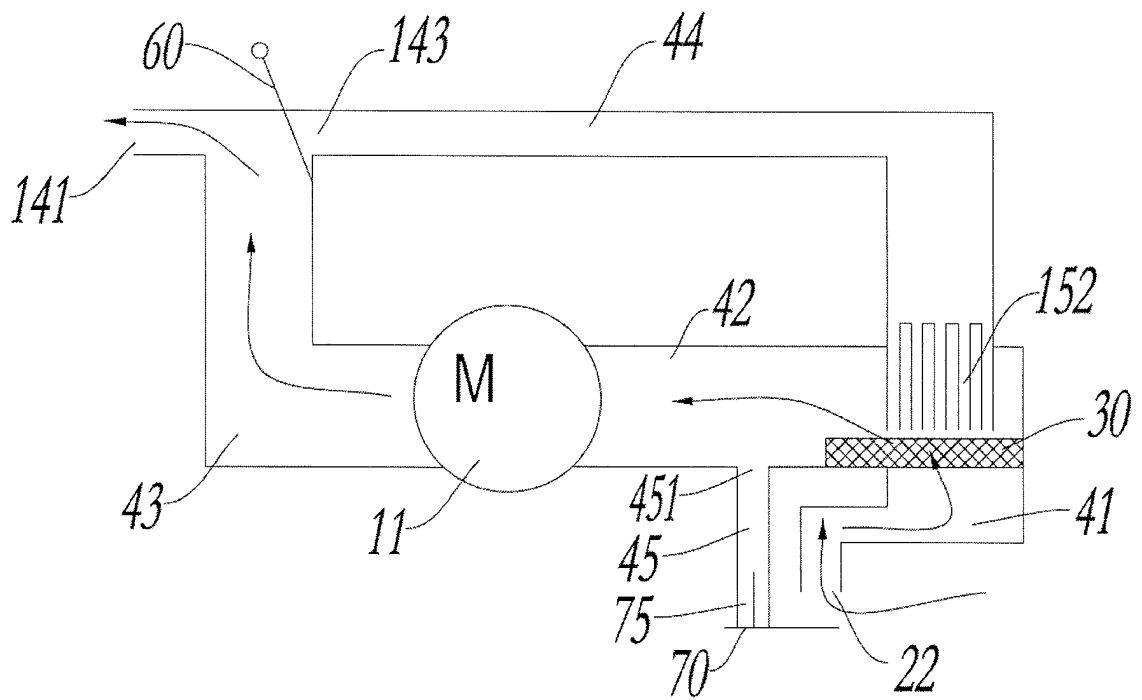


Fig. 23

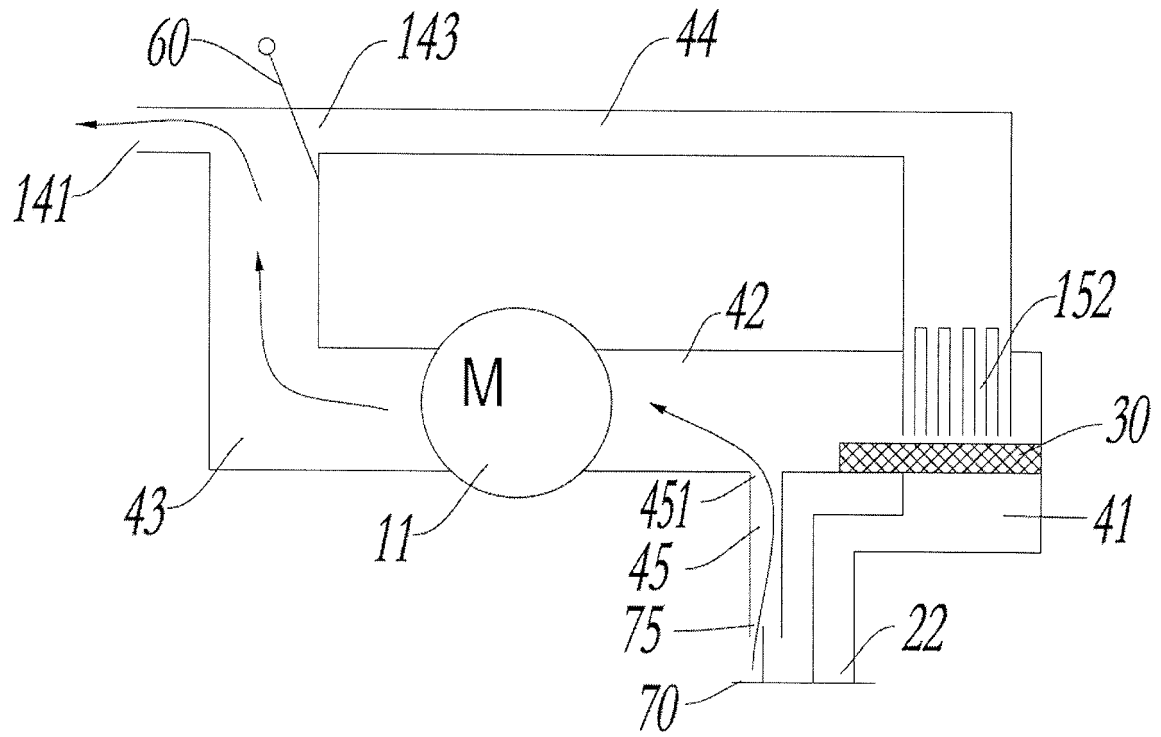


Fig. 24

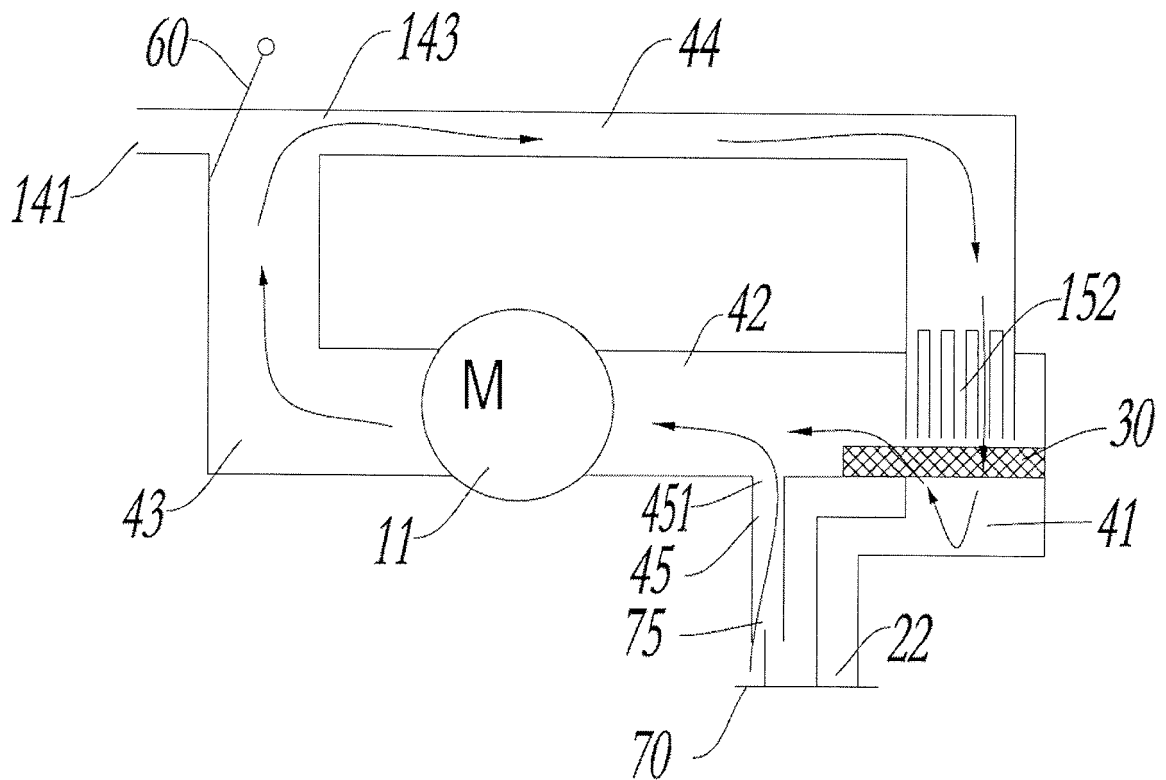


Fig. 25

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2018/075912

A. CLASSIFICATION OF SUBJECT MATTER

A47L 9/20 (2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A47L 9/-; A47L 5/-

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNPAT, CNKI, EPODOC, WPI: 天佑电器, 吸尘器, 过滤, 自清洁, 自清扫, 自洁, 除尘, 吸尘, 软管, 切换, 转换, 阀, 补风, 补气, 外部空气, 打开, 关闭, 封闭, 反向, 吹, 逆向, 逆循环, 逆流, clean+, suction, self+, filter+, hose, shift+, switch+, valve, compensat+, outside, air, exterior, open+, close+, revers+, blow+, counterflow

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 1656872 A2 (ALFRED KARCHER GMBH & CO. KG), 17 May 2006 (17.05.2006), see description, paragraphs [0054]-[0069], and figures 1-2	1-17
A	CN 201492374 U (SKYBEST ELECTRIC APPLIANCE (SUZHOU) CO., LTD.), 02 June 2010 (02.06.2010), see the abstract, description, paragraphs [0019]-[0021], and figures 1-10	1-17
A	CN 203898201 U (SKYBEST ELECTRIC APPLIANCE (SUZHOU) CO., LTD.), 29 October 2014 (29.10.2014), entire document	1-17
A	CN 1461630 A (LG ELECTRONICS (TIANJIN) APPLIANCES CO., LTD.), 17 December 2003 (17.12.2003), entire document	1-17
A	CN 105142481 A (NILFISK ADVANCE AS), 09 December 2015 (09.12.2015), entire document	1-17
A	CN 1791351 A (BSH BOSCH AND SIEMENS HOMEAPPLIANCE GMBH), 21 June 2006 (21.06.2006), entire document	1-17
A	CN 101466296 A (TOSHIBA CORPORATION et al.), 24 June 2009 (24.06.2009), entire document	1-17

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	
"E" earlier application or patent but published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	"&" document member of the same patent family

Date of the actual completion of the international search

24 April 2018

Date of mailing of the international search report

08 May 2018

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Telephone No. 86-(10)-53962374

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2018/075912

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 105361815 A (SKYBEST ELECTRIC APPLIANCE (SUZHOU) CO., LTD.), 02 March 2016 (02.03.2016), entire document	1-17
A	US 2007174993 A1 (DEVER, K.L. et al.), 02 August 2007 (02.08.2007), entire document	1-17
A	EP 2016881 A1 (RIBIMEX ITALIA S. R. L.), 21 January 2009 (21.01.2009), entire document	1-17
A	WO 2016112996 A1 (ALFRED KARCHER GMBH & CO. KG), 21 July 2016 (21.07.2016), entire document	1-17

Form PCT/ISA/210 (continuation of second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
 Information on patent family members

 International application No.
 PCT/CN2018/075912

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