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(54) **CLEANER AND CLEANING METHOD**

STAUBSAUGER UND REINIGUNGSVERFAHREN

ASPIRATEUR ET PROCEDE DE NETTOYAGE

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Description

Technical Field

[0001] The present invention relates to a vacuum cleaner having a sucking means for cleaning by sucking dust on a surface to be cleaned.

Prior Art

[0002] In the prior art, what is often used is an electric vacuum cleaner which has a rotating brush installed in the sucking chamber of the main body of the suction port and made to be driven with a separated motor or an air turbine, in order to increase suction performance in sucking dust especially on a carpet. This kind of vacuum cleaner is aimed for increasing suction performance by combing up dust with the rotating brush and sucking dust on the cleaning area.

[0003] For example, in Japanese Patent Application Laid-Open Number 1-297030, what is disclosed is a technology used in the vacuum cleaner with a rotating turbine driven by suction air flow in which the rotary brush is driven by the rotating turbine. In Japanese Patent Application Laid-Open Number 2-274218, what is disclosed is a technology for the vacuum cleaner in which the rotating brush is driven by the brush motor.

[0004] On the other hand, in Japanese Patent Laid-Open Number 62-139450, what is disclosed is a dust suction apparatus which generates a spiral air flow having its rotating axis so as to extend in the vertical direction to the surface to be cleaned. In this apparatus, a projected part is formed in the suction port and a spiral air flow is generated with this projected part.

WO-8503498 describes a device in which a suction nozzle is provided, as well as a vortex chamber. The vortex chamber is exposed to sub-atmospheric pressure, and a vortex is generated which can remove dust and the like from a surface.

[0005] In US 3238557, a vortex pick-up device is disclosed, wherein the intake nozzle provides relatively high suction by means of high velocity air flow through the nozzle.

[0006] Because it is necessary in the prior art vacuum cleaners using a rotary brush to install a rotary brush, a separated motor or an air turbine for driving the rotary brush inside the suction port itself, there is such a problem that the weight and volume of the suction port become larger, and hence that the operability of the vacuum cleaner become worse. In addition, the rotating noise due to the rotation of the rotary brush and the vibration noise due to the friction between the rotary brush and the floor surface to be cleaned become larger, and this makes a major unsatisfactory factor of the vacuum cleaner.

[0007] In case of the apparatus in which generates a spiral air flow having its rotating axis so as to extend in the vertical direction to the surface to be cleaned, it is required to make the aspect ratio of the cross-section shape of the suction port substantially as close to 1 as possible, or preferably, to make the shape of the cross-section circular. The cross-section shape of the suction port adopted in many conventional-type vacuum cleaners is a oblong rectangle, it is possible to suck dust in the wider area efficiently by moving the suction port relative to the floor surface in the direction perpendicular to the longer axis of the suction port. However, with respect to the shape of the suction port for generating a spiral air flow, it is required to make the cross-section of the suction port larger while the aspect ratio of the rectangle shape of this cross-section of the suction port, in order to suck dust in the wider area efficiently. In the prior art apparatus using spiral air flow, there is such a problem that the weight of the suction port gets larger and the operation of the vacuum cleaner is made to be difficult because the rectangle shape of the suction port is inevitably larger than that of the suction port shaped in a rectangle having the identical aspect ratio. In case of the suction port shaped in a circle, there is such a problem that dust staying on the floor close to the side wall can not efficiently sucked.

Disclosure of the Present Invention

[0008] An object of the present invention is to provide a vacuum cleaner enabling to reduce the mechanical noise from the cleaner, and another object is to provide a vacuum cleaner having a suction port with its size and weight enabled to be smaller.

[0009] In order to attain the above object, the present invention comprises

a main body of suction nozzle having a suction chamber with an open port facing to a surface to be cleaned; a fluid flow path connecting between the suction chamber and an outside part of the main body of suction nozzle; and

a suction means for sucking an air inside the suction chamber through the fluid flow path, wherein the main body of suction nozzle comprises the suction chamber, the suction chamber forming a smooth continuos surface above the open port, an edge of said smooth continuous surface forming an edge of said open port adjacent the surface to be cleaned;

and a first suction nozzle for leading a fluid from outside of the main body of suction nozzle toward the suction chamber, being formed so as to extend only along part of said edge of the port.

[0010] And the present invention comprises a main body of suction nozzle having a suction chamber with an open port facing to a surface to be cleaned; a fluid flow path connecting between the suction chamber and an outside part of the main body of suction nozzle; and a suction means for sucking an air inside the suction chamber through the fluid flow path, wherein the main body of suction nozzle comprises the suction chamber, the chamber forming a smooth continuos surface above

the open port an edge of said smooth continuous surface forming an edge of said open port adjacent the surface to be cleaned; and a suction nozzle for connecting the outside part of the main body of a suction nozzle and an inside of the suction chamber, being formed so as to extend only along a part of said edge of the port.

[0011] And the present invention comprises a main body of suction nozzle having a suction chamber with an open port facing to a surface to be cleaned; a fluid flow path connecting between the suction chamber and an outside part of the main body of suction nozzle; and a suction means for sucking an air inside the suction chamber through the fluid flow path, wherein the main body of suction nozzle comprises the suction chamber, the chamber forming a smooth continuos surface above the open port; and a concave part, extending from an edge of the suction chamber which is formed by an edge of the smooth continuous surface, the concave part being defined in a lower face of the main body of suction nozzle extending in a direction away from said edge toward the fluid intake, and then extending back toward the fluid outlet, the concave part thereby passing over the edge.

[0012] And the present invention comprises a main body of suction nozzle having a suction chamber with an open port facing to a surface to be cleaned; a fluid flow path connecting between the suction chamber and an outside part of the main body of suction nozzle; and a suction means for sucking an air inside the suction chamber through the fluid flow path, wherein the main body of suction nozzle comprises the suction chamber forming a smooth continuos surface above the open port; a shield part for restricting a fluid flowing into the suction chamber through a gap between a lower face of the main body of suction nozzle and the surface to be cleaned; and a suction nozzle for leading a fluid from outside of the main body of suction nozzle toward the suction chamber, being formed so as to extend only along a part of an edge of the port formed by an edge of the smooth continuous surface.

[0013] And the present invention comprises a main body of suction nozzle having a suction chamber with an open port facing to a surface to be cleaned; a fluid flow path connecting between the suction chamber and an outside part of the main body of suction nozzle; and a suction means for sucking an air inside the suction chamber through the fluid flow path, wherein the main body of suction nozzle comprises the suction chamber, the chamber forming a smooth continuos surface above the open port, an edge of said smooth continuous surface forming an edge of said open port adjacent as surface to be cleaned; a suction nozzle for leading a fluid from outside of the main body of suction nozzle toward the fluid path, being formed so as to extend only along part of said edge of the port; and a shield member, being formed at a lower face of the main body of suction nozzle, for restricting a fluid flowing into the suction chamber through a gap between the lower face of the main body of suction nozzle and the surface to be cleaned.

[0014] And the present invention comprises a main body of suction nozzle having a suction chamber with an open port facing to a surface to be cleaned; a fluid flow path connecting between the suction chamber and an outside part of the main body of suction nozzle; and a suction means for sucking an air inside the suction chamber through the fluid flow path, wherein the main body of suction nozzle comprises the suction chamber, the chamber forming smooth continuos surface bridging the open port an edge of said smooth continuous surface forming an edge of said open port adjacent the surface to be cleaned; and a shield member having an open port along an edge in which the continuous surface and the open port intersect with each other around the open port.

[0015] And the present invention comprises a main body of suction nozzle having a suction chamber with an open port facing to a surface to be cleaned; a fluid flow path connecting between the suction chamber and an outside part of the main body of suction nozzle; and a suction means for sucking an air inside the suction chamber through the fluid flow path, wherein the main body of suction nozzle comprises a suction nozzle, being formed to be along only part of an edge of the open port, for leading a straight air flow from an outside of the main body of suction nozzle to the suction chamber; and a suction chamber having an internal face for converting a kinetic energy of the straight air flow to a rotation energy for generating a spiral flow developed in a longitudinal direction of the suction chamber.

[0016] And the present invention comprises a main body of suction nozzle having a suction chamber with an open port facing to a surface to be cleaned; a fluid flow path connecting between the suction chamber and an outside part of the main body of suction nozzle; and a suction means for sucking an air inside the suction chamber through the fluid flow path, wherein the suction chamber is formed so as to have a continuous and smooth internal face above between the open ports; the fluid route connects between a central part of an edge of said open port, which edge is formed by an edge of said smooth continuous surface and an outside of the main body of suction nozzle; a concave part extending from said edge defined in a lower face of the main body of suction nozzle in an direction crossing over the edge; a rubber-made skirt for shielding a gap between the lower face of the main body of suction nozzle and the surface to be cleaned, being formed so as to cover the open port from one step part to another step part defined by the concave part; a roller for make smooth a movement of the main body of suction nozzle is formed is installed in a lower face in a opposite position to the open port of the concave part formed in the lower face of the main body of suction nozzle; the suction means is composed of an extension tube connected to the fluid path and a blower; and a symmetrical and continuous spiral air flow developed from an end side in a direction of the edge of

the open port toward the such an chamber is generated by evacuating an air inside the suction chamber by the blower.

[0017] And the present invention comprises a main body of suction nozzle having a suction chamber with an open port facing to a surface to be cleaned; and a suction means for sucking an air inside the suction chamber,

wherein a spiral air flow is generated in the suction chamber including an edge of the open port along a longitudinal direction of the suction chamber, the air flow developed in the longitudinal direction; the spiral air flow is made to be collided directly with the surface to be cleaned; and a reflected air flow after collision is evacuated thereby.

[0018] The means for generating a spiral air flow is composed of a smooth and continuous surface so configured as to hold an open port formed in the lower face of the main body of suction nozzle against the surface to be cleaned, and a suction nozzle leading a fluid flow on the continuous surface from the outside part of the main body of suction nozzle.

[0019] After the air inside the suction chamber is evacuated by the suction means, the suction nozzle leads the evacuated air into the suction chamber so that the evacuated air may travel in a straightforward way from the outside part of the main body of suction nozzle. The kinetic energy of the air flow is transfered in a straightforward way by the suction nozzle into the rotation energy, whereby the air forms a spiral air flow.

[0020] The suction nozzle is installed so as to extend only along part of the edge of the open port, which edge is formed by an edge of the continuous surface. The direction in which this edge is formed is taken to be in the longitudinal direction of the main body of suction nozzle, the suction chamber or the open port.

[0021] In case that the open port of the fluid path connecting between the suction chamber and the main body of suction nozzle located at the side of the suction chamber is located in the central part of the longitudinal direction, the spiral air flow directs forward to the open port of the fluid path at the center of the suction chamber from the both end sides of the longitudinal direction of the main body of suction nozzle and so on, and makes a couple of symmetrical and continuous spiral air flows. In addition, in case that the open port of the fluid path is located at the both end face of the longitudinal direction of the suction chamber, the spiral air flow directs forward to the both end sides of the longitudinal direction from the center of the suction chamber, and makes a couple of symmetrical and continuous spiral air flow.

[0022] When the suction nozzle is located in the lower face of the main body of suction nozzle, the structure and configuration of the suction nozzle may be determined in response to the position relationship to the surface to be cleaned. For example, a gap defined between the surface to be cleaned and the lower surface of the main body of suction nozzle is so configured as to extend from the front end part or the rear end part of the main body of the suction nozzle and connect to the open port, and this gap can lead the gaseous fluid into the inside of the suction chamber from the outside part of the main body of suction nozzle with its flowing direction being guided. In this configuration, the front end part or the rear end part corresponds to the outer perimeter of the lower surface of the main body of suction nozzle so configured as to extend along the longitudinal direction of the main body.

[0023] In the above case, it is required that the air flow led into the suction chamber is guided from the tangential direction of the generated spiral air flow to the direction of the spiral flow, and that the external air flowing other than through the suction nozzle is shielded. In order to meet this requirement, in configuring the suction nozzle in responsive to the relation between the lower surface of the main body of suction nozzle and the surface to be cleaned, the structure of the lower surface of the main body of suctio nozzle at the opposite side over the open port and at the side parts of the open port (both end parts of the main body in the longitudinal direction) is so defined as to prevent the air outside the main body of suction nozzle from flowing into the suction chamber.

[0024] In addition, it is allowed to install a shielding member for preventing the air from flowing into the suction chamber at the opposite side over the open port and at the side parts , that is, both end parts of the main body in the longitudinal direction.

[0025] It is also allowed to configure the suction nozzle by installing a concave part extending along the longitudinal direction of the main body in the lower surface part of the main body of suction nozzle where a suction nozzle is defined, so that the briding part from the front end part or the rear end part of the main body of suction nozzle to the open port may be established.

[0026] The spiral air flow makes a fluid path from the continuous surface to the surface to be cleaned, and this air flow plays an role as rotary brushes which have ever been conventionally installed in the main body of suction nozzle in the prior art vacuum cleaners. Thus, the spiral air flow operates as if the air flow hits the surface of the floor to be cleaned and dust can be removed from the floor surface.

[0027] Though the continuous surface surely forms a surface extending along the longitudinal direction of the suction chamber, the shape of this continuous surface is not necessarily cylindrical shell, but allowed to be a quadrilateral column. In addition, as the suction nozzle is so directed as to lead the air fluid from outside along the continuous surface, a spiral air flow can be generated effectively.

[0028] And furthermore, in the present invention, by installing a suction power control means for controlling the suction power of the suction means, it is possible to control the magnitude or power of the spiral air flow. In this control, with suction power instruction means for directing the designated suction power to the suction pow-

er control means by operating the in-hand operation part, the operability of the vacuum cleaner can be increased. In this case, it is allowed to transfer the instruction signals through the wired signal lines connected between the suction power control means and the suction power instruction means, or without wiring cables, the instruction signals can be transmitted. As for the no-wiring data transmission, infrared rays, ultrasonic waves or electronic radio waves can be used.

[0029] The class of fluid described in above is assumed to be gaseous air in case of applying the vacuum cleaner into the home use. However, depending on the usage condition, it may be possible to handle another kind of gaseous fluid or liquid. It is also allowed for the fluid to be handled to contain air, gas or liquid, and their mixture containing dust and any kind of wasted materials and impurities.

Brief Description of the Drawings

[0030] FIG. 1 is a perspective drafting of the suction nozzle of the first embodiment of the present invention.

[0031] FIG. 2 is an external view of the vacuum cleaner of the present invention.

[0032] FIG. 3 is a cross-sectional view of the main body of suction nozzle of the first embodiment of the present invention.

[0033] FIG. 4 is a perspective view from the top of the main body of suction nozzle of the first embodiment of the present invention.

[0034] FIG. 5 is a cross-sectional view of the main body of suction nozzle of the second embodiment of the present invention.

[0035] FIG. 6 is a cross-sectional view of the main body of suction nozzle of the third embodiment of the present invention.

[0036] FIG. 7 is a cross-sectional view of the main body of suction nozzle of the fourth embodiment of the present invention.

[0037] FIG. 8 is a perspective view from the top of the main body of suction nozzle of the second embodiment of the present invention.

[0038] FIG. 9 is a perspective view from the top of the second main body of suction nozzle of the second embodiment of the present invention.

[0039] FIG. 10 is a cross-sectional view of the main body of suction nozzle showing one embodiment of the present invention.

Preferred Embodiment of the Present Invention

[Embodiment 1]

[0040] In the followings, the first embodiment of the present invention is described in detail with drawings.

[0041] FIG. 1 shows a perspective view of the nozzle body. Inside the nozzle body 101 place on the floor surface (a surface to be cleaned) 102 , a spiral air flow 103 is established by the suction operation of the suction means (not shown). Component 104 is a central axis of the spiral air flow 103, component 105 is a suction chamber, and the arrow 106 represents the rotation direction of the spiral air flow 103.

[0042] FIG. 2 shows an external view of the vacuum cleaner of this embodiment.

[0043] A hose 202 is connected to the body of the vacuum cleaner, and the extension tube 204 and the body of the nozzle 101 are connected to the hose 202. In the middle way of the hose, a switch operation part 203 is installed.

[0044] FIG. 3 is a III-III direction cross-sectional view of the body of the nozzle 101 shown in FIG. 1.

[0045] An air gap between the front end part of the body of the nozzle 101 and the floor 301 is formed so that a suction nozzle may be established. A continuous and smooth surface 108 is formed in the suction chamber, and this surface 306 extends until the back end side of the main body of the nozzle 101. As shown in FIG. 3, the suction chamber has an open port facing against the floor 301. In addition, the arrows 304 and 305 represent the direction of air flow.

[0046] The main body of the nozzle 101 and the extension tube 204 are connected by the joint 109, and the extension tube 204 is so formed as to move in the direction shown by the arrow A in relative to the main body of the nozzle 101. And furthermore, †in the neighboring area of the open port facing downward defined by the suction chamber below where the suction nozzle 302 of the body of the nozzle 101 is not formed, a skirt 307 is installed in order to restrict the inlet flow of air from the rear end of the body of the nozzle 101, and a roller 308 is installed at the rear end of the bottom face of the body of the nozzle 101 in order to make the movement of the body of the nozzle 101 easier. It is allowed to compose the skirt 307 with rubber or other elastic materials.

[0047] In FIG. 4, a perspective view from the top of the main body of the nozzle 101 is shown.

[0048] In FIG. 4, at the both end faces of the suction chamber in its longitudinal direction, open ports 401 and 402 of the fluid path 107, and the fluid path 107 extending from the open ports 401 and 402 has a junction point at the rear end of the main body of the nozzle 101 which continues to the outside of the main body of the nozzle 101. In FIG. 4, the arrows 403 and 404 represent the direction of the air flow, and the parts 405 and 406 represent spiral air flow generated inside the suction chamber.

[0049] Next, what is described is the operation of the first embodiment of the present invention.

[0050] When the operator of the vacuum cleaner operates the switch operation part 203 located at the grip part of the hose, the electric blower in the main body of the vacuum cleaner 201 is operated in the operation mode in responsive to the designated switch operations.

[0051] The evacuation force developed by the electric blower reaches the main body of the nozzle 101 through

the hose 202 and the extension tube 204. As shown in FIG. 3, as the main body of nozzle 101 has an air gap 302 used as a suction nozzle in a forward direction, the inlet air is always evacuated in the tangent direction on the hypothetical cylinder 303 as shown with the arrow 304.

[0052] The evacuated air is accelerated with the rotational angular velocity of the blower, and rotates in high speed in the direction shown with the arrow 305, and thus, blows off the dust staying on the floor 301. At the same time, as shown in FIG. 4, as the inlet air is so evacuated from the open ports 401 and 402 on the fluid path 107, a couple velocity vectors 403 and 404 defined from the center of the longitudinal extension of the suction chamber to the individual open ports 401 and 402 are generated, and thus, the evacuated air flow and dust are caught by the spiral air flows 405 and 406 which have a common central axis almost parallel to the floor surface 301, and finally, the evacuated air flow and dust are sucked through the open ports 401 and 402 into the main body of the vacuum cleaner 201.

[0053] A couple of open ports 401 and 402 of the fluid path 107 are installed, and spiral air flows in the suction chamber are extracted at the both end parts. However, it may be allowed to use only one of the open ports 401 and 402 for evacuating the air from one side of the suction chamber. In this case, it is required to keep out the air flow from one of a couple of both end sides of the suction chamber in which an open port is not installed.

[0054] In this aspect of the invention the suction nozzle is formed only in the central area of the front end of the suction chamber in order to increase the air flow speed.

[0055] In one embodiment, the suction nozzle is so formed as the component 501 shown in FIG. 5, and the rotation direction of the spiral air flow may be reversed in comparison with the former case shown in FIG. 3. In another embodiment, the suction nozzle is so formed as the component 601 in FIG. 6 where the inlet air port is directed upward, or a couple of suction nozzle are formed in two different ways, upward and downward as the components 701 and 702 shown in FIG. 7. In those cases, the suction nozzles 50, 601, 701 and 702 are be formed at the partial area of the front on a of the suction chamber. What are shown in FIGS. 5, 6 and 7 have a similar cross-sectional view to that in FIG. 3, where the fluid path 107 and the open port for the extension tube and so on are not shown.

[0056] As described above, according to these embodiments, it will be appreciated that a spiral air flow which has a central axis almost parallel to the surface to be cleaned can be generated inside the nozzle, and that dust laying on the floor surface to be cleaned can be removed and sucked with high-speed spiral air blow. Therefore, a light-weight and silent suction nozzle for the vacuum cleaner which has a suction performance equal to or higher than that of the prior art can be provided even without rotary brushes.

[0057] In addition, by installing a means for transferring signals from the switch operation part 203 to the main body of the vacuum cleaner with infrared rays, ultrasonic waves or electronic radio waves in stead of using wired signal lines, there is no wiring cable in the hose 202 and the extension tube 204, which brings another effect such that the weight of the extension tube and the hose can be reduced and that the operability of the vacuum cleaner can be increased.

[0058] And furthermore, what can be seen as another advantageous aspect includes that, as the structure of the hose can be relatively simplified because there is no need for connecting electrically between the hose and its end couplers, and that the flexible part of the hose can be replaced without specific tools and devices.

[0059] The present invention may also be applied to the vacuum cleaner now described.

[0060] FIG. 8 shows a perspective top view of the nozzle.

[0061] In FIG. 8, the fluid path 107 is connected to the central part of the suction chamber extending in its longitudinal direction installed in the main body of the nozzle 801. In this configuration, partitions are placed in order to form the open ports 802 and 803 to be connected to the fluid path 107 at the center of'the shorter extension in relative to the longer extension of the suction chamber. And furthermore, a suction nozzle 302 is established below the front end part of the main body of the nozzle 101. In addition, the arrows 804 and 805 represent the direction of the air flow, the symbols 806 and 807 represent spiral air flows, and the components 808 and 809 are side walls for shielding the air flowing.

[0062] Next, what is described is the operation of such a vacuum cleaner.

[0063] When the operator of the vacuum cleaner operates the switch operation part 203 located at the grip part of the hose, the electric blower in the main body of the vacuum cleaner 201 is operated in the operation mode in responsive to the designated switch operations.

[0064] The evacuation force developed by the electric blower reaches the main body of the nozzle 801 through the hose 202 and the extension tube 204. As the evacuated air from the main body of the nozzle 801 is shielded from outside by the side walls 808 and 809 of the suction chamber, the air outside the suction chamber can not flow into the suction chamber from the axial direction of the hypothetical cylinder but the inlet air is always evacuated in the tangent direction on the hypothetical cylinder. Therefore, in the similar manner to the first embodiment, the evacuated air is accelerated with the rotational angular velocity of the blower, and rotates in high speed in the direction shown with the arrow 305, and thus, blows off the dust staying on the floor.

[0065] At the same time, as the inlet air is so evacuated from the open ports 801 and 802, a couple velocity vectors 804 and 805 defined in the axial direction are generated, and thus, the evacuated air flow and dust are caught by the spiral air flows 806 and 807, and fi-

nally, the evacuated air flow and dust are sucked through the open ports 802 and 803 into the main body of the vacuum cleaner 201.

[0066] The connection between the suction chamber and the fluid path 107 shown in FIG. 8 may be altered in another way shown in FIG. 9. In FIG. 9, a separation shield plate 902 is placed at the center of the longitudinal extension of the suction chamber in order to separate the evacuation chamber into a couple of individual sub-chambers. The open port of the fluid path 107 is formed at the part where the separation shield plate 902 is placed so as to evacuate the air in the individual separated evacuation chambers. With this configuration, a couple of spiral air flows 903 and 906 can be generated. It is also enabled to generate a couple of spiral air flows 903 and 906 without the separation shield plate 902, in which the power of the spiral air flow becomes smaller.

[0067] As described above, according to this embodiment, it will be appreciated that a spiral air flow which has a central axis almost parallel to the surface to be cleaned can be generated inside the nozzle, and that dust laying on the floor surface to be cleaned can be removed and sucked with high-speed spiral air blow. Therefore, a light-weight and silent suction nozzle for the vacuum cleaner which has a suction performance equal to or higher than that of the prior art can be provided even without rotary brushes.

[0068] In the embodiment shown in FIGS. 8 and 9, a couple of continuous spiral air flow which develops from the end part of the suction chamber in the longitudinal direction to the open port of the fluid path located in the center of the suction chamber are generated in the whole area of the longitudinal direction of the suction chamber. However, according to the invention the suction nozzle may be formed along only part of the longitudinal direction, as explained above.

[0069] As the connection between the suction chamber and the extension tube is established at the central part of the suction chamber, the length of the fluid path can be shortened, and therefore, the pressure loss can be reduced to be smaller. In addition, as the main body of the suction nozzle can be small, there may be also such an advantageous effect that the operability is increased.

[0070] As shown in FIG. 10, it is also allowed to make the main body of the suction nozzle 101 an empty structure, and to form the continuous surface 306 of the suction chamber 101A and the fluid path 101B with the inner wall of the empty structure. In addition, it maybe possible to form the suction chamber and the fluid path with another structural member other than the main body of the suction nozzle 101.

[0071] In the present invention, a rotary brush can be used together with the spiral air flow itself in the main body of the suction nozzle generating the spiral air flow.

[0072] It will be appreciated that the vacuum cleaner of the present invention can generate a spiral air flow inside the suction chamber of the main body of the suction nozzle in the longitudinal direction, and that dust laying on the floor surface to be cleaned can be removed and sucked with high-speed spiral air blow. Therefore, a light-weight and silent suction nozzle for the vacuum cleaner can be provided without installing rotary brushes.

Claims

1. A vacuum cleaner comprising:

a vacuum cleaner main body (201);
a suction nozzle main body (101) having a suction chamber (105) formed within the body, the suction chamber (105) having an open port facing a surface to be cleaned (301), the suction chamber forming a smooth continuous surface above the open port, an edge of said smooth continuous surface forming an edge of said open port adjacent the surface to be cleaned;
at least one connecting member (109, 204, 202) for connecting the suction nozzle main body (101) to the vacuum cleaner main body (201);
a fluid outlet (107) through which the fluid passes from the suction nozzle main body (101) to the connecting member (109, 204, 202);
a first suction nozzle (302) for leading a fluid from outside of said suction nozzle main body (101) towards the suction chamber (105);
a fluid flow path passing from the first suction nozzle (302) through the suction chamber (105) and the fluid outlet (107) to the at least one connecting member (109, 204, 202); and
suction means for sucking air along the fluid flow path;

characterised in that:

the first suction nozzle (302) extends only along a part of said edge of the port.

2. A vacuum cleaner according to claim 1, which further comprises a second suction nozzle (501,601,701, 702) for leading a fluid toward said fluid flow path from a direction different from the direction from which said first suction nozzle (302) leads the fluid.

3. A vacuum cleaner according to claim 1 or claim 2, wherein a said suction nozzle (302,501,601,701,702) is defined by the juxtaposition of a lower face of said suction nozzle main body (101)to the surface to be cleaned.

4. A vacuum cleaner according to any of the preceding claims, wherein said first suction nozzle (302), or

said second suction nozzle (501,601,701,702) is formed with a concave part extending from an edge of said open port of the suction chamber (105) which edge is formed by an edge of said smooth continuous surface, said concave part being defined in a lower face of said suction nozzle main body (101) and extending in a direction away from said edge toward the fluid inlet and then back toward the fluid outlet, the concave part thereby passing over said edge.

5. A vacuum cleaner according to any of the preceding claims further having a shield part(307) for restricting a fluid flowing into the suction chamber (105) through a gap between a lower face of the main body of the suction nozzle (101) and the surface to be cleaned (301).

6. A vacuum cleaner according to claim 5, wherein the first suction nozzle (302) is positioned so that the fluid flow path leads into the suction chamber (105) about the shield port (307).

7. A vacuum cleaner according to any of the preceding claims, wherein the fluid flow path is positioned approximately centrally along the edge of the open port of the suction chamber (105) and a continuous spiral air flow develops toward the fluid outlet (107) from an end of the suction chamber (105).

8. A vacuum cleaner according to any of the preceding claims, wherein the fluid flow path is branched, and symmetrical and continuous spiral air flows develop toward the fluid path from a central part of the suction chamber (105).

9. A vacuum cleaner according to any of the preceding claims, wherein the suction nozzle is arranged to lead a straight air flow from outside of said suction nozzle main body (101) towards the suction chamber (105); and

the suction chamber (105) has an internal face for converting a kinetic energy of the straight air flow to a rotation energy for generating a spiral flow developed in a longitudinal direction of the suction chamber.

10. A vacuum cleaner according to any of the preceding claims, further comprising;

an evacuation power control means(203)for controlling a suction power of the suction means.

11. A vacuum cleaner according to any one of the preceding claims, wherein an evacuation power instruction means(203) for directing the suction power without direct connection to the evacuation power control means is formed at an in-hand operation part.

12. A vacuum cleaner according to any one of the preceding claims, wherein a rubber-made skirt (307) is provided for shielding a gap between the lower face of the main body of suction nozzle (101) and the surface to be cleaned (301);

a roller (308) is provided for enabling a smooth movement of the main body of suction nozzle(101), the roller being installed in a lower face of the main body of the suction nozzle;

the connecting member is composed of an extension tube (204) connected to a blower; and

a symmetrical and continuous spiral air flow developed from an end side of said edge of the open port of the suction chamber (105) toward the fluid flow path, said continuous spiral air flow being generated by evacuating air from inside the suction chamber (105) by the blower.

13. A vacuum cleaner as in any of the preceding claims, wherein a spiral air flow is generated in the suction chamber (105) including an edge of the open port along a longitudinal direction of the suction chamber, the air flow developed in the longitudinal direction;

the spiral air flow is made to be collided directly with the surface (301) to be cleaned; and

a reflected air flow after collision is evacuated thereby.

14. A vacuum cleaner according to any one of the preceding claims, wherein said first suction nozzle (302) extends on either side of the edge of the open port and the fluid flow path connecting the suction chamber (105) and the suction nozzle main body (101).

Patentansprüche

1. Staubsauger mit:

einem Staubsauger-Hauptgehäuse (201);
einem Saugdüsen-Hauptgehäuse (101) mit einer in dem Gehäuse ausgebildeten Saugkammer (105), die eine der zu reinigenden Fläche (301) zugewandte Öffnung aufweist, und oberhalb der Öffnung eine glatte durchgängige Fläche bildet, wobei ein Rand der glatten durchgängigen Fläche, angrenzend an die zu reinigenden Fläche, einen Rand des Öffnunges bildet;
mindestens einer Verbindungseinheit (109, 204, 202) zum Verbinden des Saugdüsen-Hauptgehäuses (101) mit dem Staubsauger-Hauptgehäuse (201);
einem Fluidauslass (107), durch den ein Fluid von dem Saugdüsen-Hauptgehäuse (101) zu der Verbindungseinheit (103, 204, 202) ge-

langt,

einer ersten Saugdüse (302), um Fluid von außerhalb des Saugdüsen-Hauptgehäuses (101) in Richtung der Saugkammer (105) zu leiten;

einem Fluid-Strömungsweg, der von der ersten Saugdüse (302) durch die Saugkammer (105) und den Fluidauslass (107) zu der mindestens einen Verbindungseinheit (109, 204, 202) führt; und

eine Saugvorrichtung, um Luft entlang des Fluid-Strömungswegs anzusaugen;

dadurch gekennzeichnet, daß

die erste Saugdüse (302) sich nur entlang eines Teils des Öffnungsrandes erstreckt.

2. Staubsauger nach Anspruch 1, mit weiterhin einer zweiten Saugdüse (501, 601, 701, 702) zum Leiten von Fluid zu dem Fluid-Strömungsweg entlang einer anderen Richtung als die, in welche die erste Saugdüse das Fluid leitet.

3. Staubsauger nach Anspruch 1 oder 2, wobei eine Saugdüse (302, 501, 601, 701, 702) durch Anlegen einer unteren Stirnfläche des Saugdüsen-Hauptgehäuses (101) an die zu reinigenden Fläche gebildet wird.

4. Staubsauger nach einem der vorhergehenden Ansprüche, wobei die erste Saugdüse (302), oder die zweite Saugdüse (501, 601, 701, 702) mit einem konkaven Anteil ausgebildet sind, der von einem durch einen Rand der glatten durchgängigen Oberfläche gebildeten Rand der Öffnung der Saugkammer (105) ausgeht, in einer unteren Stirnfläche des Saugdüsen-Hauptgehäuses (101) ausgebildet ist, sich von dem Rand weg hin zu einem Fluideinlaß und dann zurück in Richtung des Fluidauslasses erstreckt, und dabei über den Rand reicht.

5. Staubsauger nach einem der vorhergehenden Ansprüche mit weiterhin einer Abdeckung (307), um ein Fluid, das durch einen Spalt zwischen einer unteren Stirnfläche des Saugdüsen-Hauptgehäuses (101) und der zu reinigenden Fläche (301) in die Saugkammer (105) strömt, einzugrenzen.

6. Staubsauger nach Anspruch 5, wobei die erste Saugdüse (302) so angeordnet ist, daß der Fluid-Strömungsweg über die Abdeckung (307) in die Saugkammer (105) führt.

7. Staubsauger nach einem der vorhergehenden Ansprüche, wobei der Fluid-Strömungsweg ungefähr mittig entlang dem Rand der Öffnung der Saugkammer (105) angeordnet ist und sich ein kontinuierlicher Spiralluftstrom von einem Ende der Saugkammer (105) zu dem Fluidauslass (107) ausbildet.

8. Staubsauger nach einem der vorhergehenden Ansprüche, wobei der Fluid-Strömungsweg verzweigt ist, und sich symmetrische und kontinuierliche Spiralluftströme von einem mittleren Teil der Saugkammer (105) zum Fluidweg ausbilden.

9. Staubsauger nach einem der vorhergehenden Ansprüche, wobei die Saugdüse so angeordnet ist, daß ein gerader Luftstrom von außerhalb des Saugdüsen-Hauptgehäuses (101) in Richtung der Saugkammer (105) geleitet wird; und

die Saugkammer (105) eine die kinetische Energie des geraden Luftstroms in Rotationsenergie umwandelnde Innenfläche aufweist, zum Erzeugen eines in longitudinale Richtung der Saugkammer ausgebildeten Spiralstroms.

10. Staubsauger nach einem der vorhergehenden Ansprüche mit weiterhin einer Evakuierkraft-Steuervorrichtung (203) zum Steuern einer Saugkraft der Saugvorrichtung.

11. Staubsauger nach einem der vorhergehenden Ansprüche, wobei eine Evakuierkraft-Anweisungsvorrichtung (203) zum Steuern der Saugkraft ohne direkte Verbindung zu der Evakuierkraft-Steuervorrichtung an einer Stelle angeordnet ist, die bei Bedienung des Staubsaugers in der Hand liegt.

12. Staubsauger nach einem der vorhergehenden Ansprüche, wobei eine aus Gummi gefertigte Schürze (307) bereitgestellt ist, um den Spalt zwischen der unteren Stirnfläche des Saugdüsen-Hauptgehäuses (101) und der zu reinigenden Fläche (301) abzuschirmen;

eine Rollvorrichtung (308) bereitgestellt ist, um eine glatte Bewegung des Saugdüsen-Hauptgehäuses (101) zu ermöglichen, wobei die Rollvorrichtung an einer unteren Stirnfläche des Saugdüsen-Hauptgehäuses angebracht ist;

die Verbindungseinheit aus einer an einem Gebläse angeschlossenen, rohrförmigen Verlängerungsvorrichtung (204), besteht, und

ein symmetrischer und kontinuierlicher Spiralluftstrom von einer Seite des Rands der Öffnung der Saugkammer (105) entlang des Fluid-Strömungswegs ausgebildet ist, wobei der kontinuierliche Spiralluftstrom dadurch erzeugt wird, daß Luft aus dem Innenraum der Saugkammer (105) durch das Gebläse gesaugt wird.

13. Staubsauger nach einem der vorhergehenden Ansprüche, wobei ein Spiralluftstrom in longitudinaler Richtung in der, entlang der longitudinalen Richtung, einen Rand der Öffnung umfassenden Saugkammer (105) erzeugt wird;

der Spiralluftstrom so ausgebildet ist, daß er direkt auf die zu reinigende Fläche (301) trifft; und

nach dem Auftreffen ein reflektierter Luftstrom abgesaugt wird.

14. Staubsauger nach einem der vorhergehenden Ansprüche, wobei die erste Saugdüse (302) auf jeder der Seiten der Öffnung und des die Saugkammer (105) und das Saugdüsen-Hauptgehäuse (101) verbindenden Fluid-Strömungswegs, verläuft.

Revendications

1. Aspirateur comprenant :

un corps principal d'aspirateur (201) ;
un corps principal de suceur (101) comportant une chambre d'aspiration (105) formée à l'intérieur du corps, la chambre d'aspiration (105) comportant un orifice ouvert regardant vers une surface devant être nettoyée (301), la chambre d'aspiration formant une surface lisse continue au-dessus de l'orifice ouvert, un bord de ladite surface lisse continue formant un bord dudit orifice ouvert voisin de la surface devant être nettoyée ;
au moins un élément de raccordement (109, 204, 202) pour raccorder le corps principal de suceur (101) au corps principal d'aspirateur (201) ;
un orifice de sortie de fluide (107) à travers lequel le fluide passe du corps principal de suceur (101) à l'élément de raccordement (109, 204, 202) ;
une première buse d'aspiration (302) pour conduire un fluide de l'extérieur dudit corps principal de suceur (101) vers la chambre d'aspiration (105) ;
un trajet d'écoulement de fluide passant de la première suceur (302), par l'intermédiaire de la chambre d'aspiration (105) et de l'orifice de sortie de fluide (107), vers le ou les éléments de raccordement (109, 204, 202) ; et
des moyens d'aspiration pour aspirer de l'air le long du trajet d'écoulement de fluide ;

caractérisé en ce que :

la première suceur (302) ne s'étend que le long d'une partie dudit bord de l'orifice.

2. Aspirateur selon la revendication 1, qui comprend de plus une deuxième suceur (501, 601, 701, 702) pour conduire un fluide vers ledit trajet d'écoulement de fluide à partir d'une direction différente de la direction à partir de laquelle ladite première buse aspiration (302) conduit le fluide.

3. Aspirateur selon la revendication 1 ou la revendication 2, dans lequel l'une desdites buses d'aspiration (302, 501, 601, 701, 702) est définie par la juxtaposition d'une face inférieure dudit corps principal de suceur (101) avec la surface devant être nettoyée.

4. Aspirateur selon l'une quelconque des revendications précédentes, dans lequel ladite première suceur (302), ou ladite deuxième suceur (501, 601, 701, 702) est formée avec une partie concave s'étendant à partir d'un bord dudit orifice ouvert de la chambre d'aspiration (105), ce bord étant formé par un bord de ladite surface lisse continue, ladite partie concave étant définie dans une face inférieure dudit corps principal de suceur (101) et s'étendant dans une direction s'éloignant dudit bord vers l'orifice d'entrée de fluide, puis revenant vers l'orifice de sortie de fluide, la partie concave passant par conséquent au-dessus dudit bord.

5. Aspirateur selon l'une quelconque des revendications précédentes, comportant de plus une partie formant bouclier (307) pour maintenir un fluide s'écoulant à l'intérieur de la chambre d'aspiration (105) à travers un espace entre une face inférieure du corps principal de suceur (101) et la surface devant être nettoyée (301).

6. Aspirateur selon la revendication 5, dans lequel la première suceur (302) est positionnée de telle sorte que le trajet d'écoulement de fluide conduise à l'intérieur de la chambre d'aspiration (105) autour de la partie formant bouclier (307).

7. Aspirateur selon l'une quelconque des revendications précédentes, dans lequel le trajet d'écoulement de fluide est positionné de façon approximativement centrale le long du bord de l'orifice ouvert de la chambre d'aspiration (105), et un écoulement d'air spiral continu se développe vers l'orifice de sortie de fluide (107) à partir d'une extrémité de la chambre d'aspiration (105).

8. Aspirateur selon l'une quelconque des revendications précédentes, dans lequel le trajet d'écoulement de fluide est ramifié, et des écoulements d'air spiraux symétriques et continus se développent vers le trajet de fluide à partir d'une partie centrale de la chambre d'aspiration (105).

9. Aspirateur selon l'une quelconque des revendications précédentes, dans lequel la suceur est configurée de façon à conduire un écoulement d'air droit depuis l'extérieur dudit corps principal de suceur (101) vers la chambre d'aspiration (105) ; et

la chambre d'aspiration (105) comporte une face interne pour convertir une énergie cinétique de l'écoulement d'air droit en une énergie de rotation pour générer un écoulement spiral développé dans

une direction longitudinale de la chambre d'aspiration.

10. Aspirateur selon l'une quelconque des revendications précédentes, comprenant de plus :

des moyens de commande de puissance d'évacuation (203) pour commander une puissance d'aspiration des moyens d'aspiration.

11. Aspirateur selon l'une quelconque des revendications précédentes, dans lequel des moyens d'instruction de puissance d'évacuation (203) pour diriger la puissance d'aspiration sans connexion directe avec les moyens de commande de puissance d'évacuation sont formés dans une partie d'actionnement tenue en main.

12. Aspirateur selon l'une quelconque des revendications précédentes, dans lequel une jupe réalisée en caoutchouc (307) est présente pour protéger un espace entre la face inférieure du corps principal de la suceur (101) et la surface devant être nettoyée (301) ;

un rouleau (308) est présent pour autoriser un mouvement doux du corps principal de suceur (101), le rouleau étant installé dans une face inférieure du corps principal de la suceur ;

l'élément de raccordement se compose d'un tube d'extension (204) raccordé à une soufflante ; et

un écoulement d'air spiral symétrique et continu est développé depuis un côté d'extrémité dudit bord de l'orifice ouvert de la chambre d'aspiration (105) vers le trajet d'écoulement de fluide, ledit écoulement d'air spiral continu étant généré en évacuant de l'air depuis l'intérieur de la chambre d'aspiration (105) à l'aide de la soufflante.

13. Aspirateur selon l'une quelconque des revendications précédentes, dans lequel un écoulement d'air spiral est généré dans la chambre d'aspiration (105) comprenant un bord de l'orifice ouvert le long d'une direction longitudinale de la chambre d'aspiration, l'écoulement d'air étant développé dans la direction longitudinale ;

l'écoulement d'air spiral est réalisé de façon à rentrer directement en impact avec la surface (301) devant être nettoyée ; et

un écoulement d'air réfléchi après l'impact est évacué en conséquence.

14. Aspirateur selon l'une quelconque des revendications précédentes, dans lequel ladite première suceur (302) s'étend de chaque côté du bord de l'orifice ouvert et le trajet d'écoulement de fluide relie la chambre d'aspiration (105) et le corps principal de suceur (101).

FIG.1

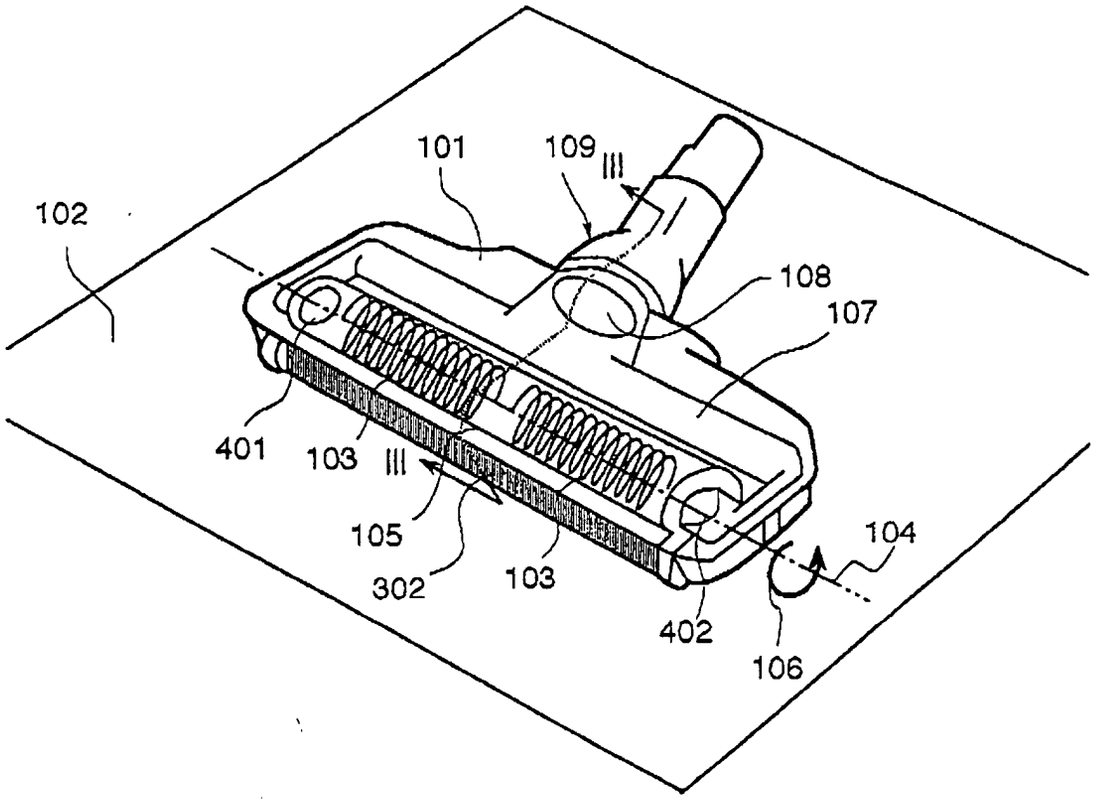

101
109
III
102
108
107
401
103
III
105
104
302
103
402
106

FIG.2

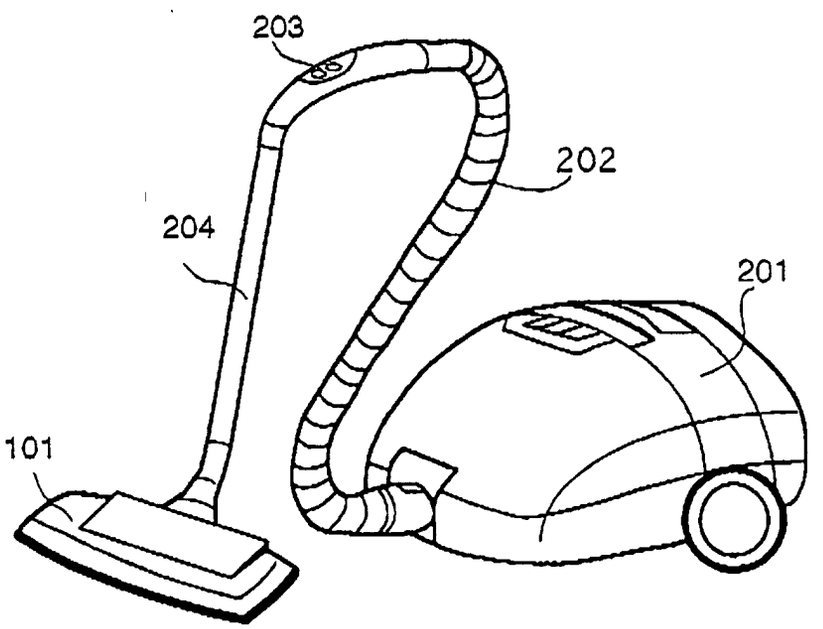

203
202
204
201
101

FIG.3

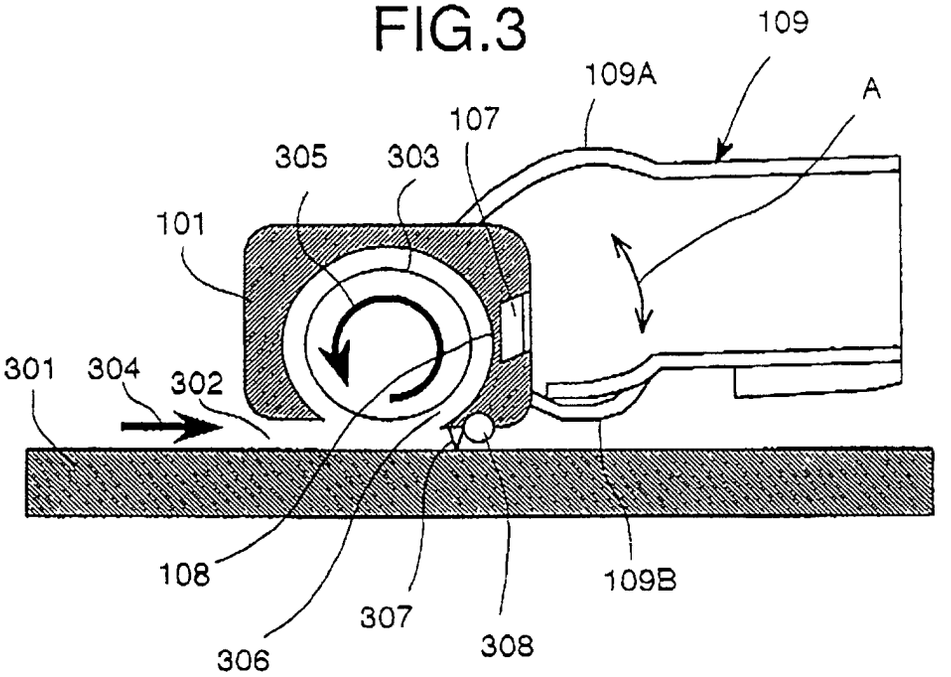

109
109A
A
107
305
303
101
301
304
302
108
306
307
308
109B

FIG.4

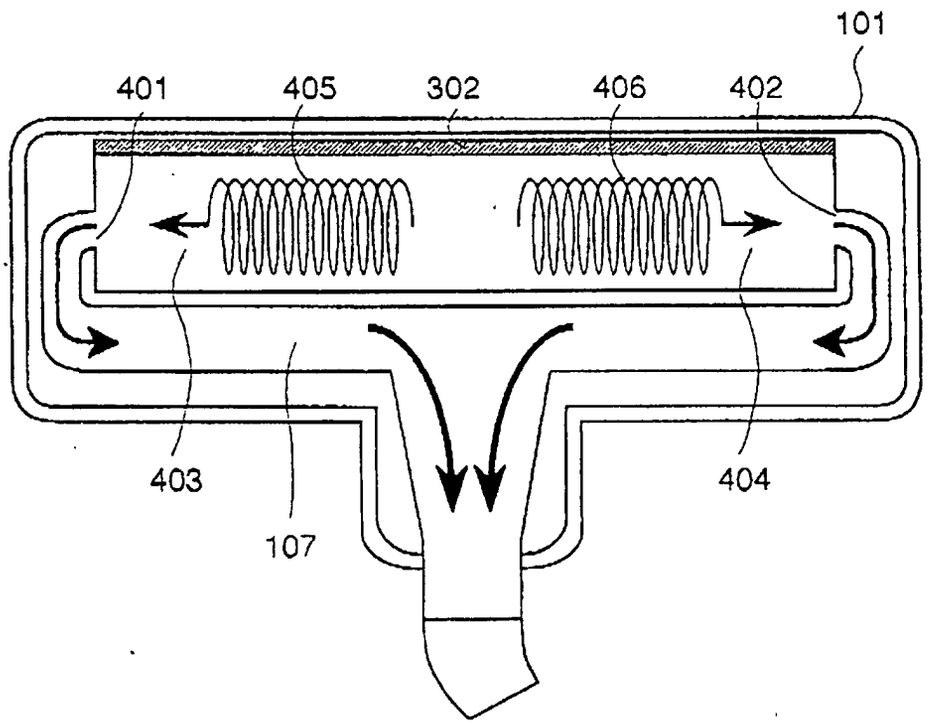

101
401
405
302
406
402
403
107
404

FIG.5

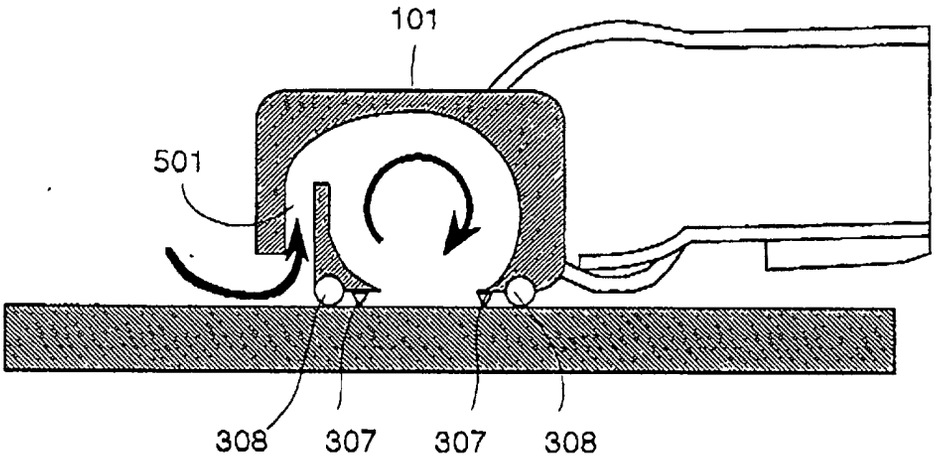


FIG.6

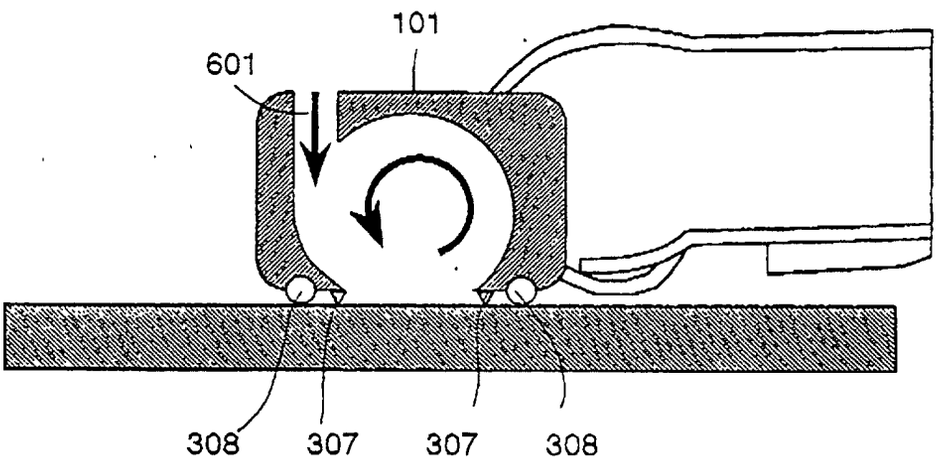


FIG.7

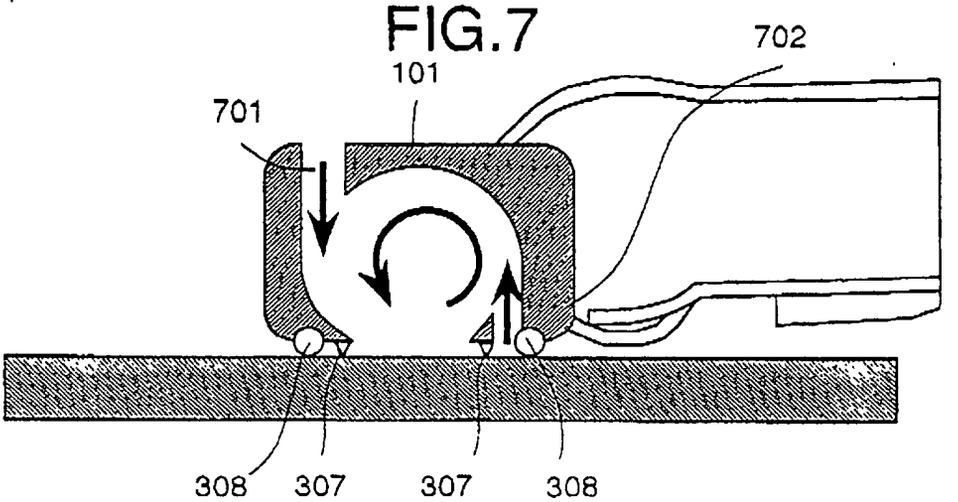


FIG.8

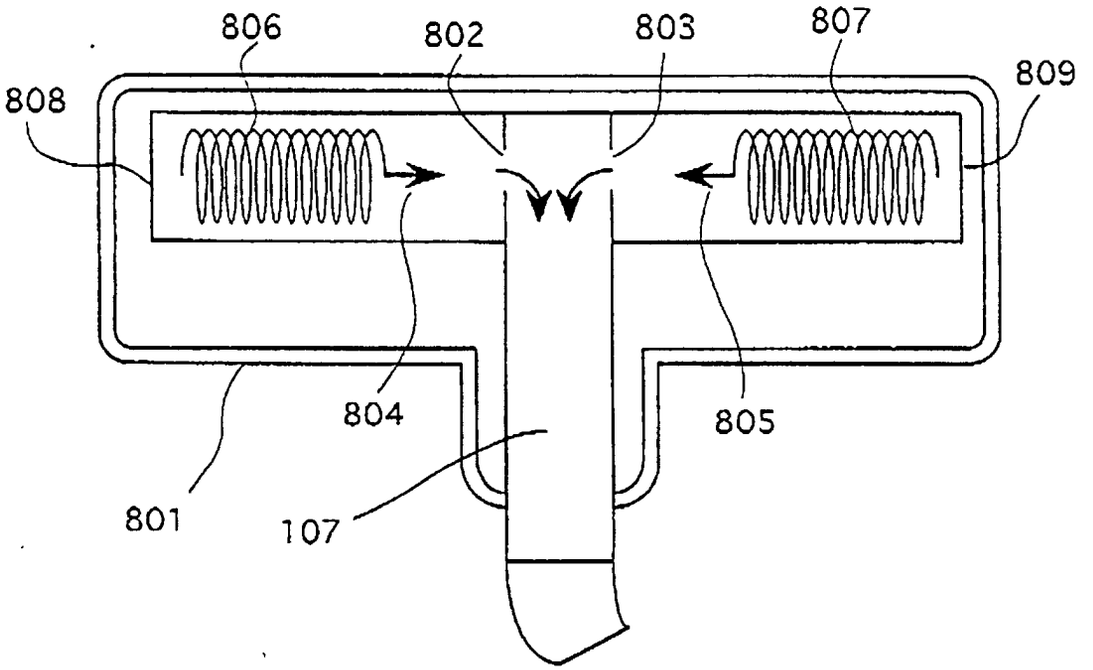

806
802
803
807
809
808
804
805
801
107

FIG.9

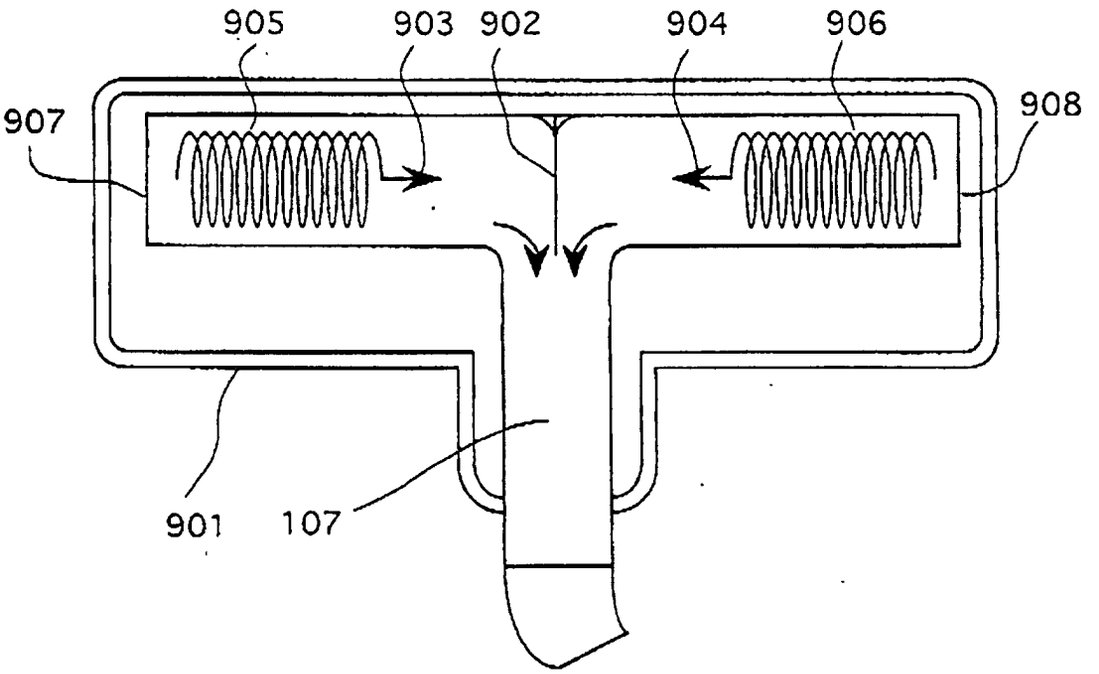

905
903
902
904
906
907
908
901
107

FIG.10

