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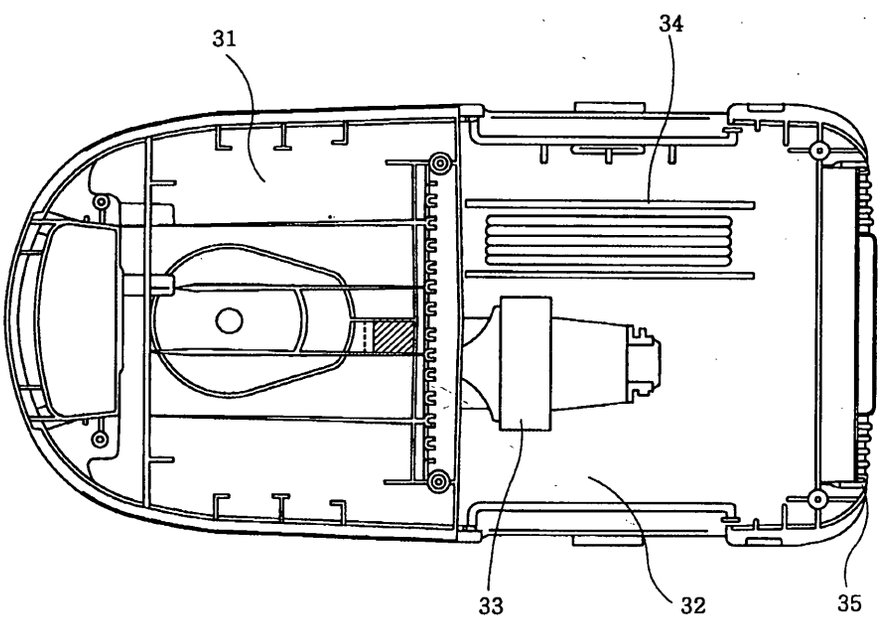
(54) Vacuum cleaner

(57) An electric blower employed in a vacuum cleaner for creating a suction air stream in order to collect dust particles reduces level of noise heard by the operator, by reducing flow resistance in the vacuum cleaner, facilitated by the limiting the volume thereof to about 20% of that of the main body of the vacuum cleaner. Moreover, by limiting the volume of the blower, dust storage capacity can be expanded without having to significantly change the dimensions of the main body used by a convention vacuum cleaner. Thus providing greater comfort and convenience to the operator.

FIG. 1



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Description

[0001] The present invention relates to a vacuum cleaner; and, more particularly, to a household vacuum cleaner with enhanced airflow and reduced noise.

[0002] Conventional vacuum cleaners in general are as disclosed in Japanese Utility Model Laid-Open Publication No. 1988-64339 as illustrated in Figs. 25 and 26.

[0003] Referring to Figs. 25 and 26, there is provided base 1 of a main body of a vacuum cleaner. Included in a front region thereof is dust chamber 2 having an open top, and separated by partition 3 is housing chamber 4 in a rear region thereof incorporating a cord retracting device (not shown) and electric blower 5 for generation of suction air stream for the intake of dust. Moreover, seamlessly formed in the frontal upper end of base 1 is handle 6. Furthermore, in order to facilitate transportability of the vacuum cleaner, there are provided swivel caster 8 on the bottom surface thereof and a pair of wheels 7 in a rear portion of respective lateral faces thereof.

[0004] As shown in Fig. 25, upper unit 10 encloses the open top of housing chamber 4 incorporating electric blower 5, in which a rear portion of upper unit 10 is latched onto latch 9 provided in base 1, and a frontal portion thereof is screwed onto base 1 via vis.

[0005] The exposed open top of dust chamber 2 is enclosed by lid 11, rotatably installed via boss 12 attached to upper unit 10. Under such configuration, base 1 is adjoined with upper unit 10 at conjugating member 13.

[0006] Conventionally, electric blower 5 employed in such vacuum cleaner occupied a large portion of space in housing chamber 4, thus often cited as a limiting factor in designing vacuum cleaners.

[0007] For instance, such conventional vacuum cleaner suffers from poor airflow from electric blower 5 in housing chamber 4, as a result of the cord retracting device placed adjacent to electric blower 5 therein which interrupts the airflow. Accordingly, the flow rate is deteriorated, resulting in a poor suction air stream and incurring of noise. Previous efforts to improve airflow therein have been unsuccessful, due to a considerable volume of electric blower 5.

[0008] Moreover, other attempts such as expanding dust collection capacity have also been encountered by the design limitations of size/volume, i.e., such expansion was not feasible without having to enlarge the overall size/volume of the vacuum cleaner.

[0009] Furthermore, electric blower 5 of considerable weight depending on its location significantly affects the centroid of the vacuum cleaner, thereby further imposing design limitations.

[0010] It is, therefore, an object of the present invention to provide a vacuum cleaner employing therein a compact lightweight electric blower, capable of reducing noise, expanding capacity of dust chamber, and facilitating transporting thereof, while maintaining the overall size/volume of a conventional vacuum cleaner to be substantially unchanged, thereby providing greater convenience to the operator.

[0011] In accordance with a preferred embodiment of the present invention, there is provided a vacuum cleaner, including: a main body having an electric blower for generating suction air stream and a dust chamber for storing collected dust particles therein; and a suction nozzle communicated with the dust chamber for sucking in dir-laden air, wherein the electric blower is not greater than about 20% of the main body by volume.

[0012] In accordance with another preferred embodiment of the present invention, there is provided a vacuum cleaner, including: a main body having a dust chamber for collecting dust therein and a housing chamber for hosting an electric blower for generating suction air stream and a power supplying member for supplying power thereto; and a suction nozzle communicated with the dust chamber for sucking in dirt-laden air, wherein the electric blower is not greater than about 30% of the dust chamber and that of the housing chamber by volume.

[0013] In accordance with still another preferred embodiment of the present invention, there is provided a vacuum cleaner, including: a main body having a housing chamber containing therein an electric blower for generating suction air stream and a power supply member for providing power to the electric blower, a dust chamber for collecting dust therein, and an attachment storage compartment for storing therein a suction nozzle to be used in sucking in dir-laden air, wherein at least one of ratios of a width and a length of the electric blower to a width and a length of the attachment storage compartment, respectively, is not greater than about 30%.

[0014] The above and other objects and features of the present invention will become apparent from the following description of preferred embodiments given in conjunction with the accompanying drawings, in which:

Fig. 1 is a plan view of a base of a main body of a vacuum cleaner in accordance with a first preferred embodiment of the present invention;

Fig. 2 describes a partially cutaway side elevational view of the vacuum cleaner;

Fig. 3 shows a perspective view of the exterior of the vacuum cleaner;

Fig. 4 offers noise characteristics of the vacuum cleaner;

Fig. 5 is a plan view of a modification of the first preferred vacuum cleaner of the present invention;

Fig. 6 provides a plan view of another modification of the first preferred vacuum cleaner of the present invention;

Fig. 7 presents a plan view of still another modification of the first preferred vacuum cleaner of the present invention;

Fig. 8 depicts a side elevational view of still another modification of the first preferred vacuum cleaner of the present invention;

Fig. 9 represents a partially cutaway side elevational view of still another modification of the first preferred vacuum cleaner of the present invention;
Fig. 10 sets forth a partially cutaway side elevational view of still another modification of the first preferred vacuum cleaner;
Fig. 11 describes a partially cutaway side elevational view of still another modification of the first preferred vacuum cleaner;
Fig. 12 illustrates a plan view of a vacuum cleaner in accordance with a second preferred embodiment of the present invention, wherein a lid enclosing an attachment storage compartment is removed;
Fig. 13 offers a plan view of a vacuum cleaner after removing a lid removed in a modification of the second preferred embodiment;
Fig. 14 provides a plan view of a vacuum cleaner after removing a lid in still another modification of the second preferred embodiment;
Fig. 15 presents a side elevational view of a vacuum cleaner in accordance with a third preferred embodiment of the present invention;
Fig. 16 sets forth a plan view of a base of a vacuum cleaner of a modification of the third preferred embodiment;
Fig. 17 depicts a side elevational view of another modification of the third preferred vacuum cleaner;
Fig. 18 describes a side elevational view of still another modification of the third preferred vacuum cleaner;
Fig. 19 shows a side elevational view of still another modification of the third preferred vacuum cleaner;
Fig. 20 is a partially cutaway side elevational view of a vacuum cleaner in accordance with a fourth preferred embodiment of the present invention;
Fig. 21 represents a partially cutaway side elevational view of a vacuum cleaner in accordance with a fifth preferred embodiment of the present invention;
Fig. 22 sets forth a partially cutaway side elevational view of a vacuum cleaner in accordance with a sixth preferred embodiment of the present invention;
Fig. 23 illustrates a partially cutaway side elevational view of a vacuum cleaner in accordance with a seventh preferred embodiment of the present invention;
Fig. 24 provides a perspective view of an alternative upright vacuum cleaner in accordance with the present invention;
Fig. 25 offers a partially cutaway side elevational view of a conventional vacuum cleaner; and
Fig. 26 depicts a perspective view of a base of the conventional vacuum cleaner.

[0015] The preferred embodiments of the present invention will now be described with reference to the accompanying drawings. The basic layout of the present invention closely resembles that of the conventional art. Thus, an elaboration of substantially identical parts will be omitted.

[0016] The first preferred embodiment of the present invention will now be explained. Fig. 1 represents a plan view of a base of a main body of a vacuum cleaner; Fig. 2 illustrates a partially cutaway side elevational view of the main body; Fig. 3 depicts a perspective view of the exterior of the main body; and Fig. 4 presents noise characteristics of the vacuum cleaner.

[0017] Referring to Fig. 3, main body 21 of the vacuum cleaner (hereinafter referred to as main body) includes base 22, upper portion 23, and cover 24 enclosing upper portion 23. Cover 24 incorporates an attachment storage compartment (not shown), which is covered by lid 25 provided thereon. Further provided is aperture 26 to be connected with a hose (not shown) coupled to a suction nozzle (not shown) for sucking dust via an extension tube (not shown). Moreover, placed on lateral faces of main body 21 is a pair of wheels 27. Finally enclosing an adjoining portion of base 22 and upper portion 23 is bumper 29.

[0018] As shown in Figs. 1 and 2, base 22 is provided with dust chamber 31 and housing chamber 32 divided by partition 30. Incorporated in housing chamber 32 is electric blower 33, placed on a mounting plate (not shown) for generation of suction air stream, that is equal to or less than about 20% of main body 21 by volume, and cord retracting device 34 serving as a power supplying member. Cord retracting device 34 can be replaced by a rechargeable battery pack. Furthermore, located in a rear portion of base 22 is exhaust 35 for releasing therethrough the suction air stream created by electric blower 33.

[0019] Hereinafter, operation of the vacuum cleaner described will now be explained in detail. Upon power up, electric blower 33 engages in a rotational motion thereby generating the suction air stream. So created suction air stream uplifts the dirt particles through the suction nozzle and transports the dirt-laden air via the extension tube, the hose and aperture 26, finally reaching a dust bag (not shown) provided in dust chamber 31. As a result, the dirt particles are collected and trapped therein. The dirt-laden air subsequently free of dirt particles passes through dust chamber 31 and gets sucked into electric blower 33 in housing chamber 32, and finally being released through exhaust 35. Vacuum cleaning is carried out by continuously performing the above process.

[0020] In a conventional vacuum cleaner, the suction air stream generated by the electric blower passes through a narrow path to be released through the exhaust, incurring turbulent airflow pattern and flow resistance, which directly accounts for the generation of noise.

[0021] It is the main object of the present invention to provide noise reduction by employing compact electric blower 33 adopting a high efficiency inverter motor. Such compact electric blower 33 frees up additional

space in housing chamber 32, thereby reducing occurrences of turbulent airflow and flow resistance, enabling noise reduction.

[0022] Specifically, electric blower 33 employed in the present invention is not greater than about 20% of the interior of main body 21 by volume. Therefore, by utilizing thus obtained freed up space in main body 21, dust chamber 31 as well as the exhaust area can be expanded to hold bigger capacity, while maintaining the dimensions of main body 21 identical to those of a conventional vacuum cleaner. Such augmentation of the exhaust area reduces formation of turbulent airflow, thereby enabling noise reduction and providing greater convenience to the operator.

[0023] By utilizing the aforementioned design criteria of the present invention, i.e., the electric blower being not greater than about 20% of the interior of the main body by volume, even with electric blower 33 of high power output having a maximum power output of over 1400 W, the space provided between electric blower 33 and the walls of main body 21 serving as buffer is sufficient to insulate the walls of main body 21 from the heat dissipated by electric blower 33, thereby preventing thermal deformations in the walls of main body 21.

[0024] Referring to Fig. 4, there is provided a noise characteristics view showing a relationship between a ratio of the volume of electric blower 33 to the volume of housing chamber 32 and noise level associated therewith. In order to gauge the noise level (A level), a microphone was placed 1 m above and 1 m away from the center of main body 21. In general, a normal person can tolerate noise level up to about 50 dBA without experiencing much discomfort. In Fig. 4, the ratio (v1/V1) of the volume of electric blower 33 (v1) to the volume of housing chamber 32 (V1) to obtain such noise level is about 35%. Accordingly, the ratio can practically be set to be not greater than about 35%. However, taking into account actual variations, the preferable ratio is not greater than about 30%.

[0025] As described, by restricting the ratio (v1/V2) of the volume of electric blower 33 (v1) to the volume of housing chamber 32 (V1) not to exceed about 30%, the air stream generated by electrical blower 33 can be exhausted through exhaust 35 in laminar flow rather than turbulent flow. Moreover, under such ratio, the flow resistance is significantly reduced while being exhausted, thereby improving the suction power of electric blower 33.

[0026] In accordance with the preferred embodiment of the present invention as described above, significant noise reductions can be achieved. Moreover, by freeing up the area adjacent to electric blower 33, the airflow is improved therein, which . in turn improves the cooling efficiency of electric blower 33. Consequently, electrical blower 33 can be efficiently cooled to suppress the rise in temperature thereof, improving the reliability of the vacuum cleaner.

[0027] Fig. 5 is a plan view of a vacuum cleaner of a modification of the first preferred embodiment, wherein the ratio (v2/V2) of the volume of electric blower 33 (v2) to the volume of dust chamber 31 (V2) is not to exceed about 30%. Carrying out the previously described noise measurement under such condition, noise level was reduced below 50 dBA, which can be attributed to a formation of laminar flow pattern in the suction air stream.

[0028] As described, if electric blower 33 is designed not to exceed about 30% of housing chamber 32 or dust chamber 31 by volume, it can be seen that the noise generation is suppressed due to formation of laminar flow pattern in the suction air stream.

[0029] So far it has been described that noise reduction can be achieved by restricting the volume of electric blower 33 relative to that of dust chamber 31 or housing chamber 32. Hereinbelow further reduction of noise level will be illustrated by specifying configuration/dimensions of electric blower 33 with respect to that of housing chamber 32 with reference to accompanying drawings.

[0030] Fig. 6 is a plan view of the vacuum cleaner of another modification of the first preferred embodiment, in which W1 and L1 denote the width and the length of housing chamber 32, respectively, whereas w1 and 11 denote the width and the length of electric blower 33, respectively. When previously described noise measurement was carried out, while restricting the ratio of w1 to W1 to not exceed about 30%, the noise level reached far below 50 dBA, which can be attributed to the formation of laminar flow pattern in the suction air stream facilitated by the reduction in the flow resistance of the airflow from electric blower 33, experienced at cord retracting device 34 and walls of housing chamber 32. The 30% ratio takes into account discrepancies due to actual variations.

[0031] The same results were obtained when the ratio of the (l1/L2) of the length of electric blower 33 (l1) to the length of housing chamber 32 (L1) was chosen not to exceed about 30%, which can be attributed to suppressing formation of the turbulent flow in the suction air stream, facilitated by the lengthening of the distance between electric blower 33 and exhaust 35 in housing chamber 32.

[0032] Further, substantially the same results were obtained when both ratios, i.e., w1/W1 and l1/L1, were restricted not to exceed about 30%.

[0033] In addition to the aforementioned correlation between the configuration/dimensions of housing chamber 32 and electric blower 33 described in conjunction with Fig. 6, there further exists a correlation between the configuration/dimensions of dust chamber 31 and electric blower 33, which will be covered hereinafter in reference with accompanying drawings.

[0034] Fig. 7 is a plan view of the vacuum cleaner of still another modification of the first preferred embodiment, wherein W2 and L2 are the width and the length of dust chamber 31, respectively. In this modification, the width w2 of electric blower 33 is configured not to exceed about 50% of the width W2 of dust chamber 31.

Employing the aforementioned noise level measurement under such conditions reduced the noise level significantly below 50 dBA. On the other hand, the ratio over about 50% is considered undesirable, for such ratio widens the inlet of electric blower 33 aiding formation of turbulent airflow pattern in suction air stream in dust chamber 31, thereby suppressing formation of laminar flow, hence increasing level of noise produced thereby.

[0035] In addition, the same results were obtained when the length 12 of electric blower 33 was designed not to exceed about 50% of the length L2 of dust chamber 31, which provides greater spacing between electric blower 33 and exhaust 35 in housing chamber 32, thereby suppressing formation of turbulent flow pattern in the suction air stream, significantly reducing the noise level.

[0036] Moreover, substantially the same results were obtained when both the length 12 and the width w2 of electric blower 33 were set not to exceed about 50% of the length L2 and the width W2 of dust chamber 31, respectively.

[0037] Fig. 8 is a side elevational view of the vacuum cleaner of still another modification of the first preferred embodiment, wherein the height h of electric blower 33 mounted in base 22 was designed not to exceed 50% of the height H of housing chamber 32. Accordingly, greater spacing is provided between electric blower 33 and the upper surface of upper portion 23. Therefore, the high frequency pitch produced by electric blower 33 is effectively prevented from transmitting through the upper surface of upper portion 23, enabling noise reduction. Further, such arrangement forces the centroid to be at a lower part of the vacuum cleaner, thereby making the structure more robust against external shocks and impacts.

[0038] Fig. 9 is a partially cutaway side elevational view of a vacuum cleaner of still another modification of the first preferred embodiment, in which electric blower 33 is disposed on the bottom portion of base 22. Under such arrangement, the high frequency pitch is effectively prevented from transmitting through the upper portion of main body 21, thereby enabling noise reduction.

[0039] Fig. 10 is a partially cutaway side elevational view of a vacuum cleaner of still another modification of the first preferred embodiment, in which electric blower 33 is disposed above base 22 through the use of a mounting plate. Under such arrangement the suction air stream flows from upper portion 23 of main body 21 to base 22, which in turn reduces the flow rate. Consequently, the rate of exhaust airflow from main body 21 to the ambient air is reduced, which also reduces dispersing of the dust particles during the exhaust process.

[0040] Fig. 11 is a partially cutaway side elevational view of a vacuum cleaner of still another modification of the first preferred embodiment, in which electric blower 33 is disposed around the middle of the upper surface of upper portion 23 and the bottom surface of base 22. Under such arrangement, flow resistance along the walls of housing chamber 32 is reduced, and a reduced amount of vibration of electric blower 33 is distributed or transmitted through base 22 and upper portion 23, which in turn lessens the overall vibration of main body 21.

[0041] A second preferred embodiment of the present invention will now be described in detail, in which a compact lightweight electric blower is used to effectively utilize thus obtained additional space for the attachment storage compartment. The basic configuration of the second preferred embodiment closely resembles that of the first preferred embodiment. Therefore, like parts in the first and the second embodiments will be designated by like numerals and a detailed description thereof will be omitted; and instead distinctive parts will be focused and elaborated.

[0042] Fig. 12 is a plan view of a main body after removing the lid covering the attachment storage compartment. There is provided attachment storage compartment 36 in upper portion 23 of the main body. Attachment storage compartment 36 holds attachments, such as crevice nozzle 37 for cleaning cracks and brush nozzle 38 for cleaning shelves. Under the configuration of the present embodiment, the width w3 of electric blower 33 is designed not to exceed about 30% of the width W3 of attachment storage compartment 36. Accordingly, such configuration of attachment storage compartment 36 placed in upper portion 23 of the main body facilitates accessing of the attachments associated therewith, since crevice nozzle 37 and brush nozzle 38 can be sufficiently spaced apart. Furthermore, electric blower 33 can be disposed in a portion in base 22 directly corresponding to the portion between crevice nozzle 37 and brush nozzle 38, thus providing sufficient spacing between electric blower 33 and upper portion 23 of the main body. In particular, it is preferable to form the portion in upper portion 23 corresponding to electric blower 33 to be upwardly protruded. Such configuration reduces flow resistance of the suction air stream in that region thereby suppressing an increase in the noise level.

[0043] Fig. 13 is a plan view of a main body after removing the lid covering the attachment storage compartment in a modification of the second preferred embodiment, in which, there is provided attachment storage compartment 36 in upper portion 23 for holding attachments, such as, crevice nozzle 37 and brush nozzle 38. In this example, the length 13 of electric blower 33 is configured not to exceed about 30% of the length L3 of attachment storage compartment 36. Accordingly, attachment storage compartment 36 disposed in upper portion 23 of the main body facilitates accessing of the attachments, since crevice nozzle 37 and brush nozzle 38 associated therewith have sufficient spacing therebetween. Furthermore, by placing crevice nozzle 37 and brush nozzle 38 close to one end of attachment storage compartment 36 (i.e. at the rear end thereof), a substantial region thereof can be unoccupied by the nozzles 37 and 38. And then by disposing electric blower 33 in a

portion of a base 22 that corresponds to the unoccupied region in attachment storage compartment 36, an ample spacing between electric blower 33 and upper portion 23 can be attained. In particular, it is preferable to form the portion in upper portion 23 that corresponds to electric blower 33 disposed in base 22 to be upwardly protruded, so as to reduce the flow resistance of the suction air flow in that portion, as well as the noise level associated therewith under such configuration.

[0044] Fig. 14 is a plan view of a main body after removing a lid, exposing the attachment storage compartment 36 of still another modification of the preferred embodiment. There is provided attachment storage compartment 36 in upper portion 23 of the main body for housing the attachments, such as crevice nozzle 37, brush nozzle 38, and floor nozzle 39. In such configuration, the width w4 and the length 14 of electric blower 33 are not configured to exceed about 30% of the width W4 and the length L4 of attachment storage compartment 36, respectively. By such, attachment storage compartment 36 can be enlarged, to enable crevice nozzle 37, brush nozzle 38, and floor nozzle 39 to be held therein, adding greater convenience.

[0045] Furthermore, by designing electric blower 33 not to exceed about 30% of attachment storage compartment 36 by volume, the noise associated with the exhaust airflow is reduced, while being able to enlarge attachment storage compartment 36, so that crevice nozzle 37, brush nozzle 38, and floor nozzle 39 can be placed therein, adding greater convenience.

[0046] Moreover, by mounting electric blower 33 in the bottom region of base 22, the centroid of the main body in effect is near the bottom, thereby making the main body more dynamically stable. Furthermore, since electric blower 33 is placed away from the upper surface of upper portion 23 in such configuration, the noise can be diminished while passing through the enlarged distance therebetweeen and further reduced while being transmitted through the upper surface of upper portion 23 and lid 25 serving as buffer, accordingly the high frequency pitch may be filtered therethrough, reducing the noise heard by the operator.

[0047] A third preferred embodiment of the present invention, employing a compact lightweight electric blower at various locations in a vacuum cleaner so as to add convenience to an operator, will now be explained in detail. The basic configuration of the present embodiment is substantially identical to that of the first preferred embodiment. Thus only the distinctive parts will be explained, and like parts will be assigned like reference numerals, omitting detailed explanations thereof.

[0048] Fig. 15 is a side elevational view of a main body of a vacuum cleaner in accordance with the third embodiment. There is provided a pair of wheels 40 on the lateral faces of the main body. In the present embodiment, electric blower 33 is preferably installed near the center O of wheels 40, i.e. the axis of rotation thereof. Thus, since electric blower 33 of a considerable weight is placed so that the center thereof sustantially coincides with that of wheels 40, the centroid of main body 21 nearly coincides with the axis of rotation. Accordingly, such configuration of the main body facilitates operator's maneuverability of the vacuum cleaner.

[0049] Fig. 16 is a plan view of a base of a modification of the third preferred vacuum cleaner, in which the centroid O of electric blower 33 and cord retractable device 34 is aligned with the central axis TT of main body 21. By aligning the centroid to the central axis of main body 21 as such, linear maneuverability of the main body is enhanced.

[0050] Furthermore, if cord retractable device 34 is placed to the rear of electric blower 33, while a handle is located in the front region of main body 21, cord retractable device 34 and electric blower 33 are both aligned with the central axis of main body 21, respectively, thereby providing stability when carrying main body 21 and facilitating the transportability thereof as well. In addition, such configuration further yields improved exhaust airflow from electric blower 33 to cord retractable device 34, thereby effectively cooling the electric power cord wound in cord retractable device 34.

[0051] Moreover, cord retractable device 34, if disposed under electric blower 33, offers such benefits as, increased stability as a result of lowered center of mass and reduction in rattling of wheels 40 against the floor surface due to cord retractable device 34 serving to absorb vibration generated by electric blower 33, thereby reducing the vibration transmitted to wheels 40.

[0052] Fig. 17 is a side elevational view of another modification of the preferred vacuum cleaner of the present invention, in which handle 41 is formed in the upper front end of main body 21, and electric blower 33 is disposed in an upper portion of housing chamber 32. In such particular configuration, the centroid G of main body 21 is above line SS extending from an edge of handle 41 to center O of wheel 40. Accordingly, under such configuration, when main body 21 is pulled by handle 41, the centroid shifts downwards and gets closer to the operator, thereby eliminating instability while holding handle 41 and maneuvering main body 21.

[0053] In a similar fashion, if handle 41 is installed at the front portion of base 22 of main body 21 and electric blower 33 is provided at the bottom region of housing chamber 32, the centroid gets closer to the operator when main body 21 is pulled by handle 41, thereby eliminating instability in holding handle 41 and maneuvering main body 21, and consequently facilitating the transportability thereof.

[0054] Fig. 18 is a side elevational view of still another modification of the preferred embodiment, in which handle 42 is pivotally installed at upper portion 23 of the main body, and disposed below the axis of rotation thereof is electric blower 33. In such configuration, the centroid of main body 21 is located below handle 42 while being carried by handle 42, since electric blower 33 with a considerable mass is located directly below

handle 42. Accordingly, movement of the centroid of main body 21 is minimized, while being carried by handle 42, thus eliminating instability in the hand and further facilitating the transportability of main body 21.

[0055] Fig. 19 is a side elevational view of still another modification of the preferred vacuum cleaner, in which fixed handle 43 is provided at upper portion 23 and electric blower 33 is installed in the proximity thereof. Similar to the aforementioned example, the centroid of main body 21 is placed close to handle 43, hence eliminating instability in the hand of the operator as a result of the minimized movement of the centroid while transporting main body 21.

[0056] As illustrated in the first to third preferred embodiment, the configurations of vacuum cleaners employing the compact lightweight electric blower are tailored to the specification of a design in reducing noise, expanding dust chamber, and enhancing maneuverability and operability of the vacuum cleaner. In such exemplary cases, it is preferable that the electric blower is configured not to exceed about 20% of the main body by volume. That is because the ratio (v2/V2) of the volume (v2) of the electric blower 33 to the volume (V2) of the dust chamber 31 and the ratio (v1/V1) of the volume (v1) of electric blower 33 to the volume (V1) of housing chamber 32 are preferably not to exceed about 30% as described above. Exceeding such ratio will result in an insufficient amount of space in the main body required to obtain the desired aforementioned results with given dimensions/configurations of the conventional main body 21.

[0057] Moreover, if electric blower 33 is designed not to exceed about 25% of main body 21 by weight, the vibration generated by electric blower 33 is less experienced by main body 21, resulting in a reduced amount of vibration of main body 21. Accordingly, the outer walls of main body 21 can be designed thinner, thereby reducing the overall weight thereof.

[0058] Furthermore, electric blower 33 with power output of greater than 1400 W under aforementioned specification (i.e., not greater than 25% of the main body by weight) has low heat capacity, hence heat transfer taking place between electric blower 33 and the outer walls of main body 21 tends to be insufficient to cause thermal deformation in the outer walls.

[0059] A fourth preferred embodiment of the present invention will now be described with reference to Fig. 20. An explanation of parts that are identical or similar to those in the previous embodiments will be omitted, and like reference numerals and names will be used therefor.

[0060] The fourth preferred embodiment shown in Fig. 20 is provided with exhaust 44 in the rear portion of main body 21 for exhausting air stream generated by electric blower 33 to the outside; filter 45 disposed in front of exhaust 44 for collecting dust particles, such as carbon particles, entrained in the air stream generated by electric blower 33; and partition 46 for supporting filter 45 and being provided with opening 47 placed in front of filter 45 communicated therewith. Further provided is shielding wall 48 disposed between electric blower 33 and partition 46 so that electric blower 33 is not directly facing opening 47.

[0061] Under such arrangement, the air stream generated by electric blower 33 encounters shielding wall 48 and is redirected and detoured toward opening 47 formed in partition 46 and is passed therethrough. Thereafter, the air stream is passed through filter 45, at which time dust particles, such as carbon particles are trapped therein, consequently only the "clean" air stream exiting through exhaust 44 and finally released to the surrounding. Likewise, the noise generated by electric blower 33, which travels along with the air stream to the rear of main body 21, is prevented from directly escaping through opening 47 as a result of the direct pathway to opening 47 being blocked by shielding wall 48, greatly contributing to the reduction of noise. Such usage of shielding wall 48 would be highly effective in case of using such high rotational speed electric blower 33 in the first to the third preferred embodiment.

[0062] In the present preferred embodiment, shielding wall 48 is placed in front of partition 46. By the same token, however, similar results can be achieved as long as shielding wall 48 is provided to block the direct pathway of the air stream to exhaust 44 even in a case where partition 46 does not exist and filter 45 is supported by means other than partition 46.

[0063] A fifth preferred embodiment of the present invention will now be described with reference to Fig. 21. An explanation of parts that are identical or similar to those in the previous embodiments will be omitted, and the like reference numerals and names will be used therefor.

[0064] The present embodiment comprehends the provision of motor cover 48, formed into upper and lower sections 48a, 48b, each having a substantially semi-circular cross sectional shape, enclosing electric blower 33; packing 51 for hermetically sealing the front ends of motor cover 48 to partition 30; aperture 52, disposed at the bottom region of lower motor cover 48b, enabling opening 47 to be air-communicated with the interior of the motor cover. In particular, a rear region of electric blower 33 is connected to a rear portion of motor cover 48 via vibration-proof material 49, whereas a front region of electric blower 33 is attached to partition 30 via vibration-proof material 50.

[0065] Under such configuration, the air stream generated by electric blower 33 flows in the direction indicated by arrow A. Specifically, the air stream first flows through aperture 52 toward the bottom and is redirected in the direction normal to the initial direction toward opening 47, and finally exits through exhaust 44 to the surrounding. Meanwhile, noise also generated by electric blower 33, which travels through aperture 52 along with the air stream, is attenuated when redirected and also as a result of elongated travel path. Accordingly,

the level of noise escaping through exhaust 44 can be significantly reduced. Such benefits can be evident from a vacuum cleaner employing high rotational speed electric blower 33 yielding high level of noise, such as those used in the first to the third preferred embodiments.

[0066] A sixth preferred embodiment of the present invention will now be described with reference to Fig. 22. An explanation of parts that are identical or similar to those in the previous embodiments will be omitted, and like reference numerals and names will be used therefor.

[0067] The present embodiment is characterized by the provision of motor cover 48 defined by upper motor cover 48a and lower motor cover 48b each having a double layered wall structure, in which inner wall 53 of lower motor cover 48b incorporates first aperture 52 to be communicated with electric blower 33 and outer wall 54 of upper motor cover 48a incorporates second aperture 55 to be communicated with first aperture 52, such that two apertures 52, 55 are in non-facing positions.

[0068] Under such configuration, the noise generated by electric blower 33 is transmitted along with the air stream through first aperture 52 located at one side of motor cover and is detoured toward second aperture 55 residing at the opposite side of motor cover 48. And then the noise and the he air stream exit through second aperture 55 to travel toward opening 47, thereby considerably lowering the level of noise. Such benefits can be highly advantageous when a vacuum cleaner is equipped with such blower as high rotational speed electric blower 33 producing high level of noise used in the first to the third preferred embodiments.

[0069] A seventh preferred embodiment of the present invention will now be described with reference to Fig. 23. An explanation of parts that are identical or similar to those of the previous embodiments will be omitted, and like reference numerals and names will be used therefor.

[0070] The present embodiment is provided with motor cover 56 constituted by upper motor cover 56a and lower motor cover 56b each being of an approximate semi-circular cross sectional shape, first cavity 57 and second cavity 58 are provided. Specifically, seamlessly formed semi-circular walls 59, 60, 61, respectively having cutaway portions 59a, 60a, 61a, define upper motor cover 56a. In a similar fashion, seamlessly formed semi-circular walls 62, 63, 64, respectively having cutaway portions 62a, 63a, 64a, define lower motor cover 56b.

[0071] Moreover, when upper motor cover 56a and lower motor cover 56b are assembled together to form motor cover 56, two exhaust openings are formed, one by cutaway portions 60a and 63a and the other by cutaway portions 61a and 64a.

[0072] Under such configuration, the noise generated by electric blower 33 follows the air stream through the narrowly formed cutaway portions 59a, 62a and into first cavity 57 where the cross sectional area is expanded, and then through the narrow cutaway portions 60a, 63a. Thereafter the air stream flows into second cavity 58, where the cross sectional area is again expanded, and sequentially through the narrow cutaway portions 61a, 64a. Finally the air stream is exited through opening 47 to the surrounding of main body 21. Such narrowing and widening of the cross sectional area of the travel path of the air stream functions as a muffler in diminishing the noise level. Such configuration may be extremely beneficial when using a high rotational speed electric blower outputting high level of noise as in the first through third preferred embodiments.

[0073] Though the first to seventh preferred embodiments have been described with reference to a canister type vacuum cleaner, the present invention should not be construed as being limited thereto. As shown in Fig. 24, an upright vacuum cleaner can be employed and can still benefit from the present invention. In referring to Fig. 24, there is provided main body 67 having dust chamber 73, which is enclosed by cover 72. Included at upper portion of main body 67 are handle 66 having grip 65 in the upper distal end thereof. Electric blower 71 is also disposed at the bottom region of main body 67. Furthermore, suction head 70 is pivotally attached to the bottom of main body 67.

[0074] While the invention has been shown and described with respect to the preferred embodiment, it will be understood to those skilled in the art that various changes and modifications may be made without departing from the scope of the invention as defined in the following claims.

Claims

1. A vacuum cleaner, comprising:

a main body including an electric blower for generating suction air stream and a dust chamber for storing collected dust particles therein; and

a suction nozzle communicated with the dust chamber for sucking in dir-laden air,

wherein the electric blower is not greater than about 20% of the main body by volume.

2. A vacuum cleaner, comprising:

a main body including a dust chamber for collecting dust therein and a housing chamber for hosting an electric blower for generating suction air stream and a power supplying member for supplying power thereto; and

a suction nozzle communicated with the dust chamber for sucking in dirt-laden air,

wherein the electric blower is not greater than about 30% of the dust chamber and that of the hous-

ing chamber by volume.

3. The vacuum cleaner of claim 2, wherein at least one of ratios of a width and a length of the electric blower to a width and a length of the housing chamber, respectively, is not greater than about 30%.

4. The vacuum cleaner of claim 1 or 2, wherein at least one of ratios of a width and a length of the electric blower to a width and a length of the dust chamber, respectively, is not greater than about 50%.

5. The vacuum cleaner of claim 2, wherein a ratio of a height of the electric blower to a height of the housing chamber is not greater than about 50%.

6. The vacuum cleaner of claim 2, wherein the main body is provided with a base and an upper portion, the base having a front region where the dust chamber resides and a rear region where the housing chamber for hosting therein the electric blower and the power supplying member is located, the upper portion covering the top of the housing chamber, and

wherein the electric blower is supported by the base on a bottom portion thereof.

7. The vacuum cleaner of claim 2, wherein the main body is provided with a base and an upper portion, the base having a front region where the dust chamber resides and a rear region where the housing chamber for hosting therein the electric blower and the power supplying member is located, the upper portion covering the top of the housing chamber, and

wherein the electric blower is supported by the base at an upper portion thereof.

8. The vacuum cleaner of claim 2, wherein the main body is provided with a base and an upper portion, the base having a front region where the dust chamber resides and a rear region where the housing chamber for hosting therein the electric blower and the power supplying member is located, the upper portion covering the top of the housing chamber, and

wherein the electric blower is supported by the base at a center portion between a ceiling of the upper portion and a bottom surface of the base.

9. The vacuum cleaner of claim 2, wherein the main body further includes an attachment storage compartment for storing therein the suction nozzle, and

wherein the electric blower is not greater than about 30% of the attachment storage compartment by volume.

10. The vacuum cleaner of claim 9, wherein the main body is provided with a base and an upper portion, the base having a front region where the dust chamber resides and a rear region where the housing chamber for hosting therein the electric blower and the power supplying member is located, the upper portion having therein the attachment storage compartment and covering the top of the housing chamber, and

wherein the electric blower is supported by the base at a lower portion thereof.

11. The vacuum cleaner of claim 2, wherein the main body is provided with a base and an upper portion, the base having a front region where the dust chamber resides and a rear region where the housing chamber for hosting therein the electric blower and the power supplying member is located, and the upper portion covering the top of the housing chamber, and

wherein a pair of wheels is provided to lateral sides of the main body and the electric blower supported by the base is at a lower portion thereof near the axis of rotation of the pair of wheels.

12. The vacuum cleaner of claim 2, wherein the main body is provided with a base and an upper portion, the base having a front region where the dust chamber resides and a rear region where the housing chamber for hosting therein the electric blower and the power supplying member is located, and the upper portion covering the top of the housing chamber, and

wherein a handle is provided at a front upper portion of the main body, and the electric blower is located at an upper portion of the housing chamber.

13. The vacuum cleaner of claim 2, wherein the main body is provided with a base and an upper portion, the base having a front region where the dust chamber resides and a rear region where the housing chamber for hosting therein the electric blower and the power supplying member is located, and the upper portion covering the top of the housing chamber, and

wherein a handle is provided at a lower upper portion of the main body, and the electric blower is positioned at a lower portion of the housing chamber.

14. The vacuum cleaner of claim 2, wherein the main body is provided with a base and an upper portion, the base having a front region where the dust chamber resides and a rear region where the housing chamber for hosting therein the electric blower and the power supplying member is located, and the upper portion covering the top of the housing chamber, and

wherein a handle is pivotally provided at an

upper portion of the main body and the electric blower is placed below the axis of rotation of the handle.

15. The vacuum cleaner of claim 2, wherein the main body is provided with a base and an upper portion, the base having a front region where the dust chamber resides and a rear region where the housing chamber for hosting therein the electric blower and the power supplying member is located, and the upper portion covering the top of the housing chamber, and

wherein a handle is provided on the upper portion, and the electric blower is placed near the handle.

16. The vacuum cleaner of claim 1 or 2, further comprising:

an exhaust, provided at a rear portion of the main body for releasing therethrough the suction air stream generated by the electric blower; and

a shielding wall disposed between the electric blower and the exhaust, the shielding wall blocking the direct pathway of the suction air stream from the electric blower to the exhaust.

17. The vacuum cleaner of claim 1 or 2, further comprising:

an exhaust, provided at a rear portion of the main body for releasing therethrough the suction air stream generated by the electric blower; and

a motor cover for enclosing the electric blower, the motor cover having an aperture at a bottom surface portion thereof for the interior of the motor cover to be communicated with the exhaust.

18. The vacuum cleaner of claim 1 or 2, further comprising:

an exhaust, provided at a rear portion of the main body for releasing therethrough the suction air stream generated by the electric blower; and

a double layered motor cover having an inner wall and an outer wall for enclosing the electric blower, the inner wall is provided a first aperture formed therein for 'releasing the suction air stream generated by the electric blower, and the outer wall having a second aperture formed therein, the first and the second aperture being located at two opposite sides of the motor cover, respectively.

19. The vacuum cleaner of claim 1 or 2, further comprising:

an exhaust, provided at a rear portion of the main body, for releasing therethrough the suction air stream generated by the electric blower; and

a motor cover for enclosing the electric blower, the motor cover being provided with a plurality of cavities formed in a rear portion thereof and walls enclosing the cavities being provided with opening allowing the electric blower to be air-communicated with the exhaust.

20. A vacuum cleaner, comprising:

a main body including a housing chamber having therein an electric blower for generating suction air stream and a power supply member for providing power to the electric blower, a dust chamber for collecting dust therein, and an attachment storage compartment for storing therein a suction nozzle to be used in sucking in dir-laden air,

wherein at least one of ratios of a width and a length of the electric blower to a width and a length of the attachment storage compartment, respectively, is not greater than about 30%.

FIG. 1

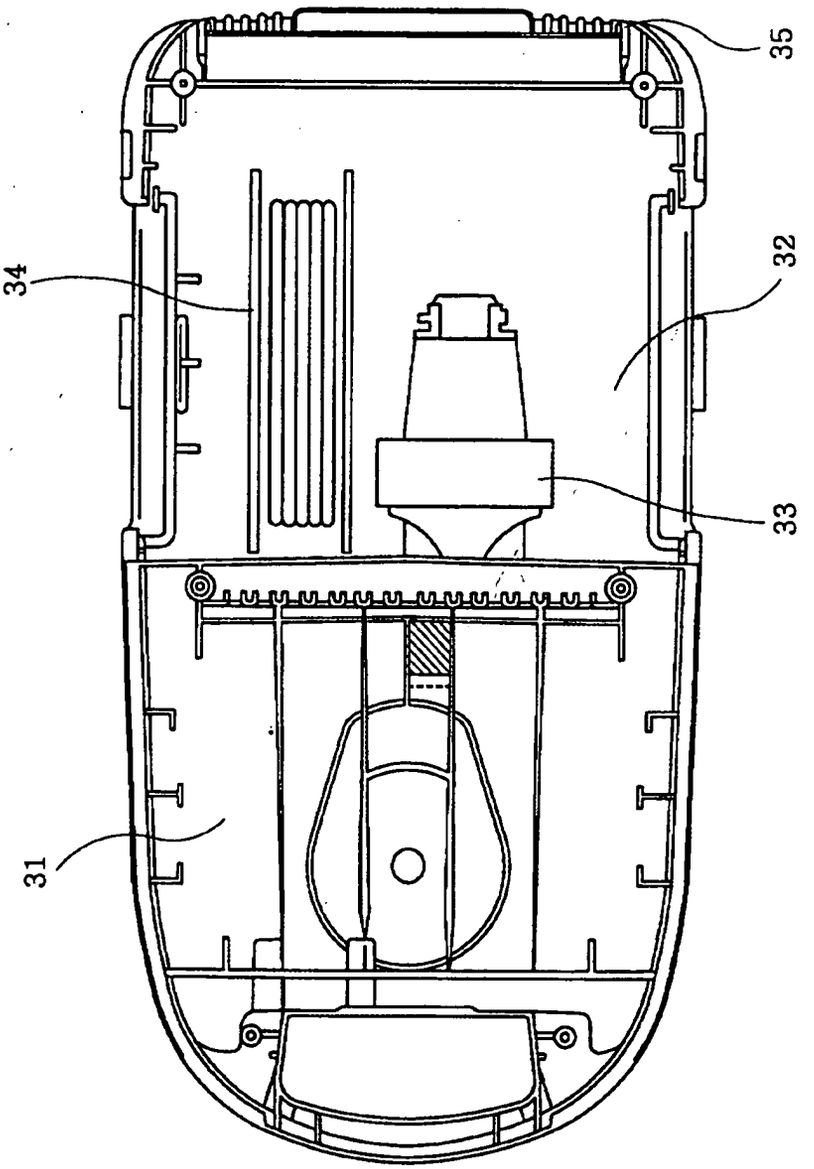


FIG.2

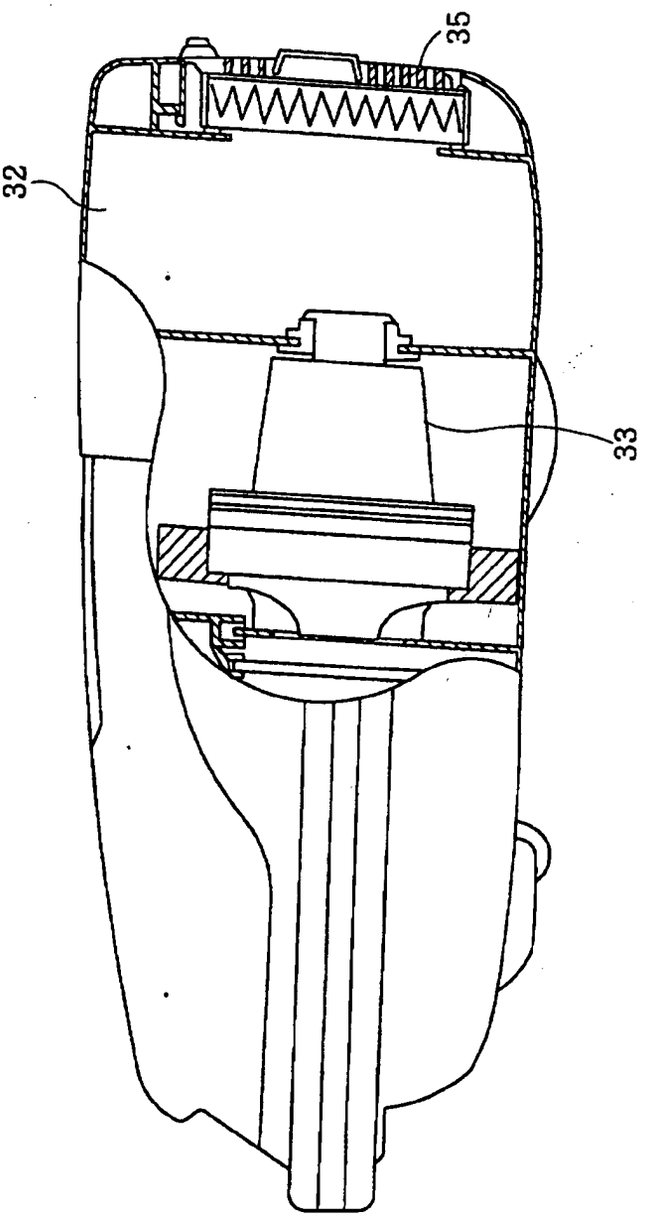


FIG.3

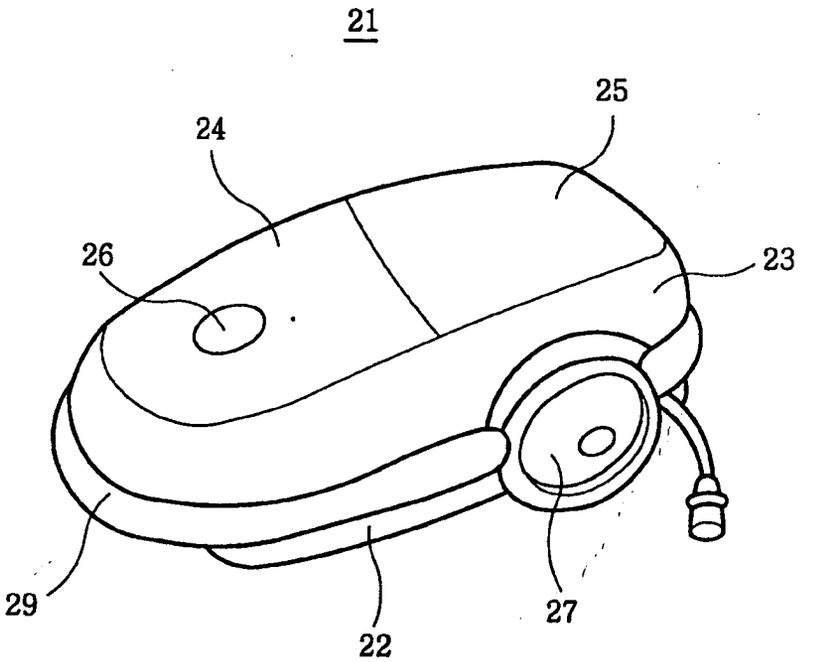


FIG. 4

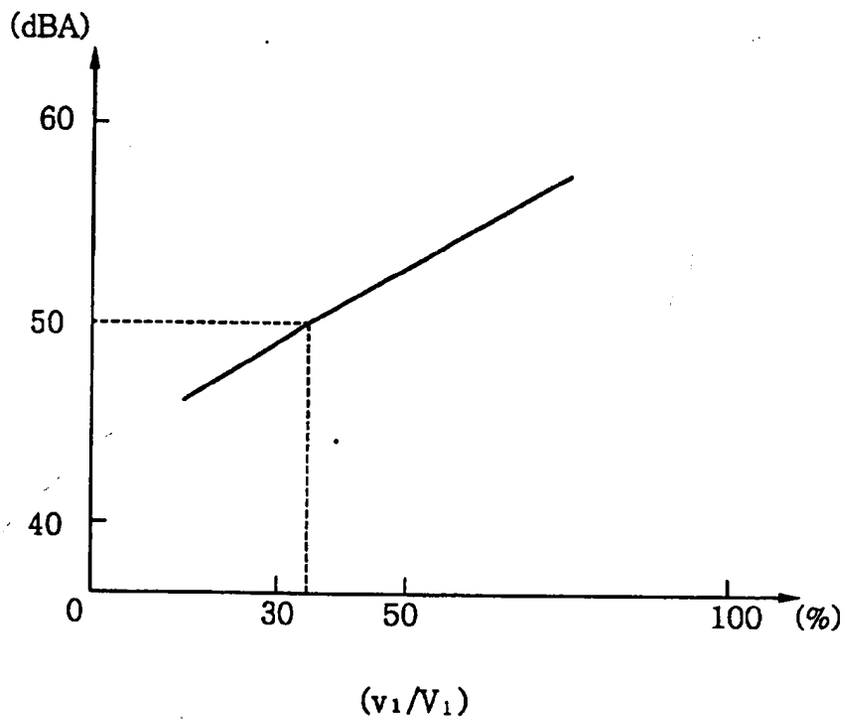


FIG.5

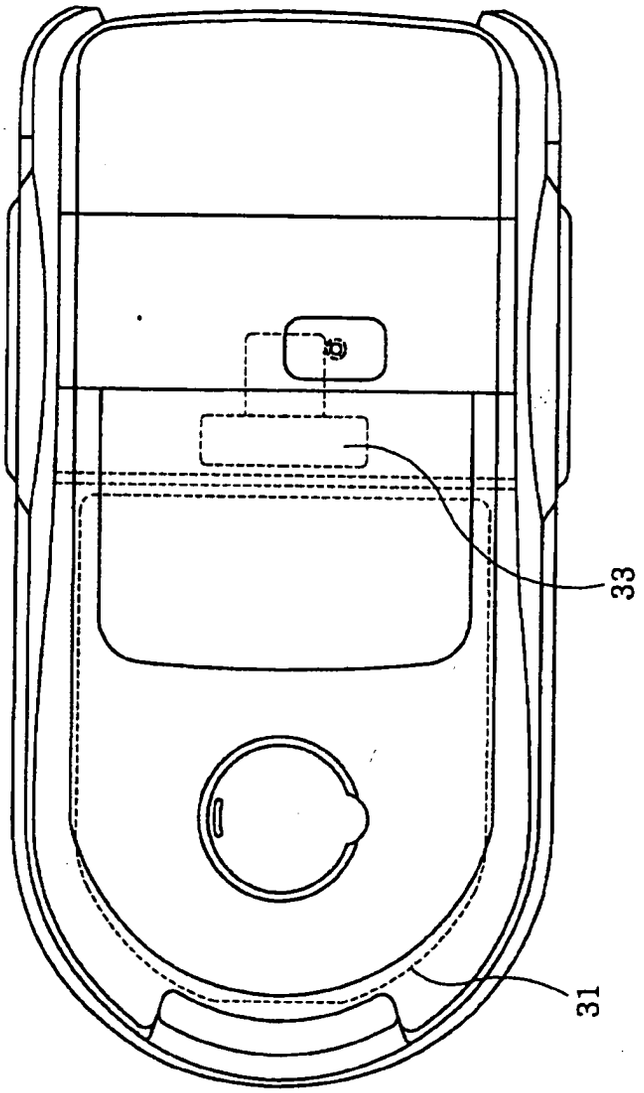


FIG.6

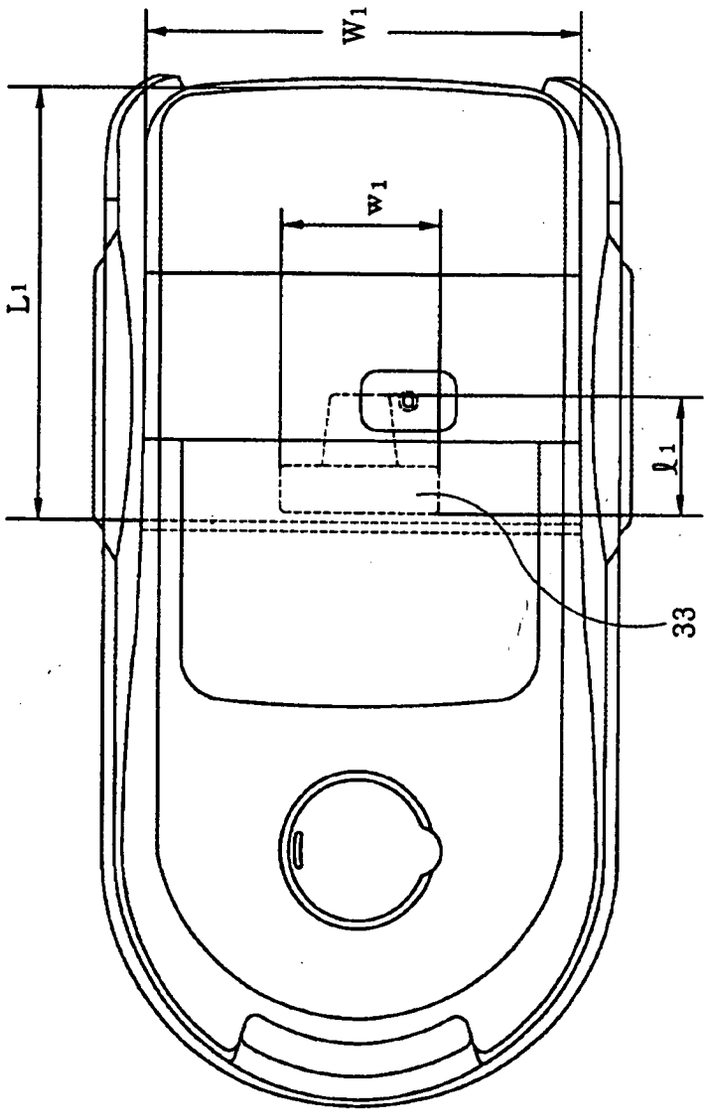


FIG. 7

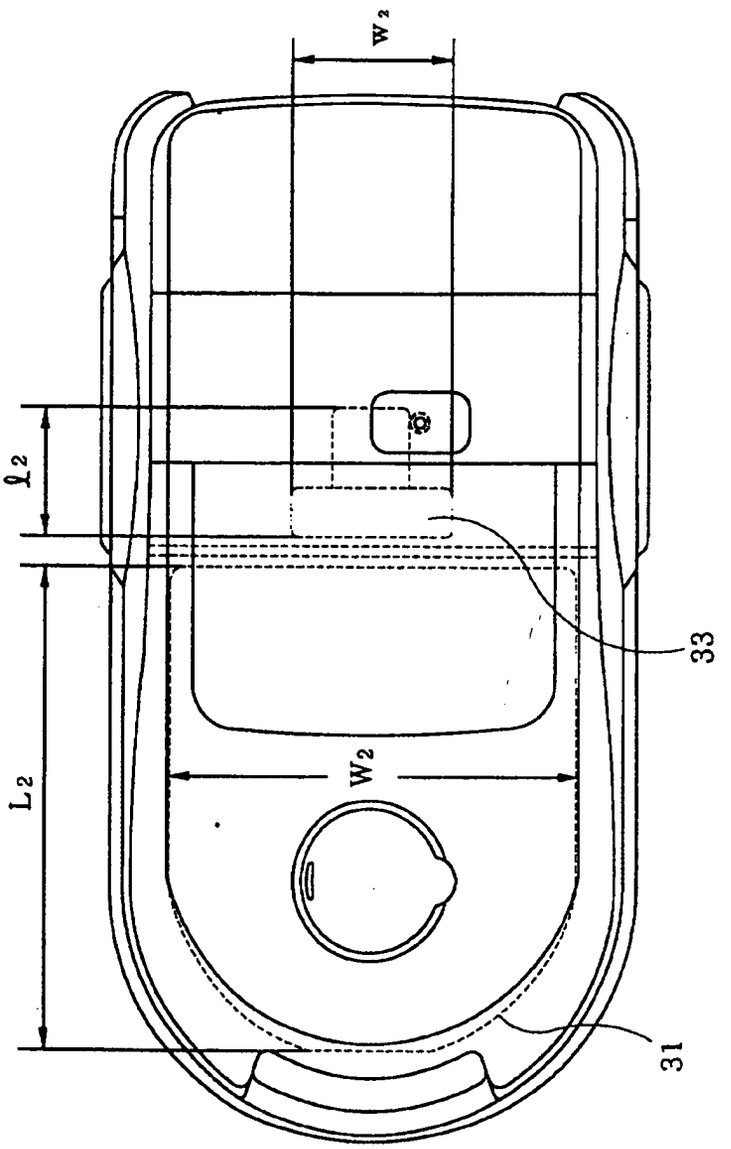


FIG.8

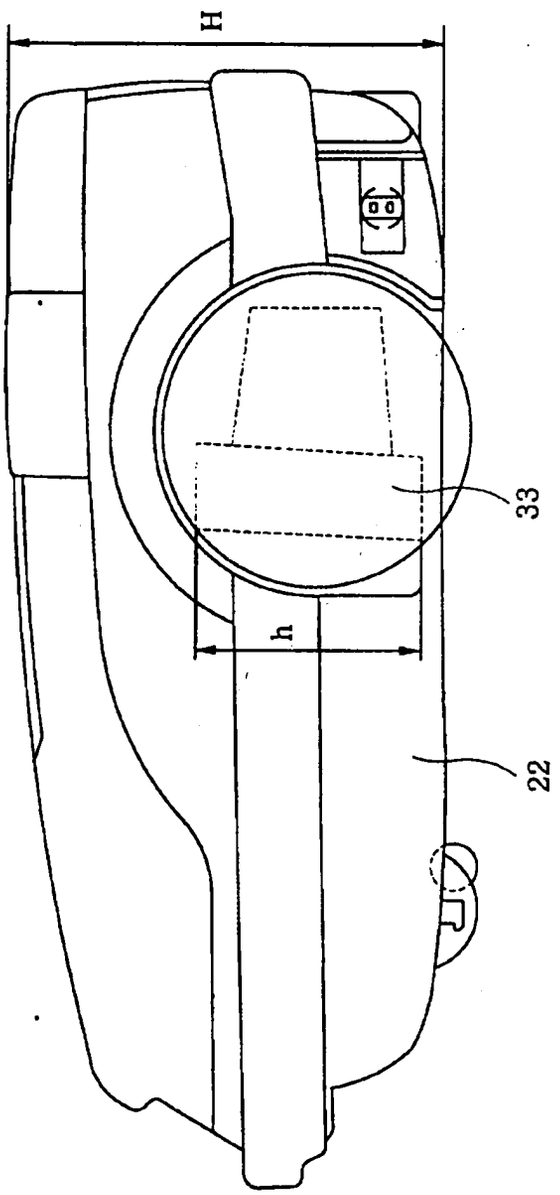


FIG.9

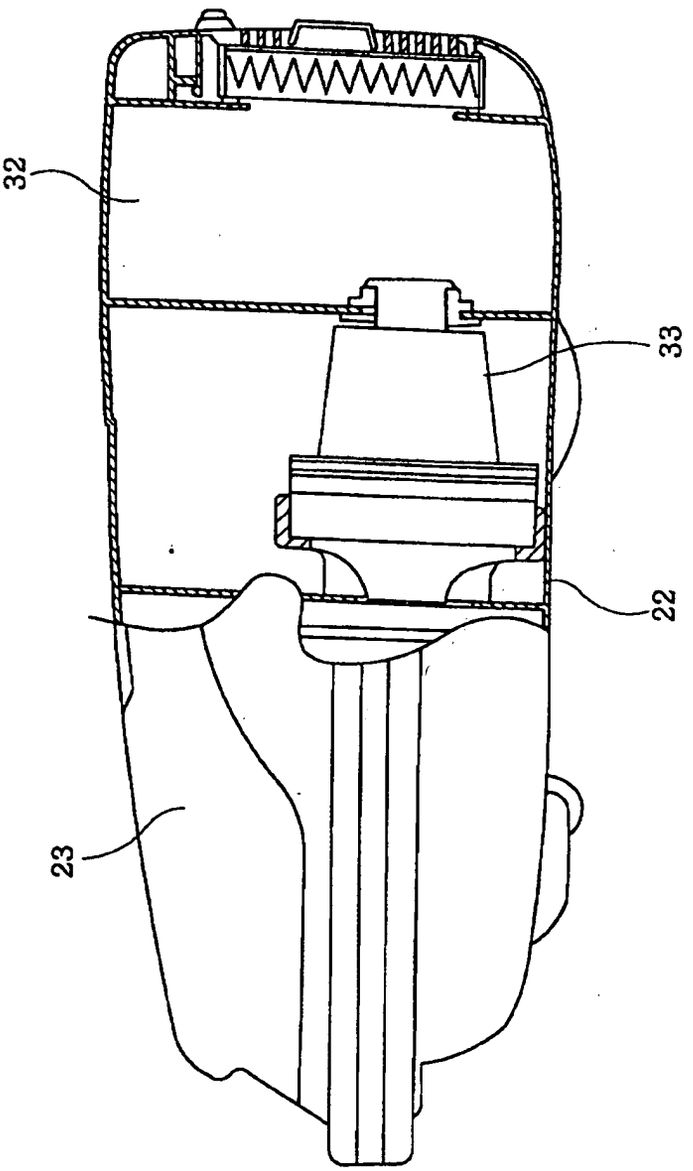


FIG. 10

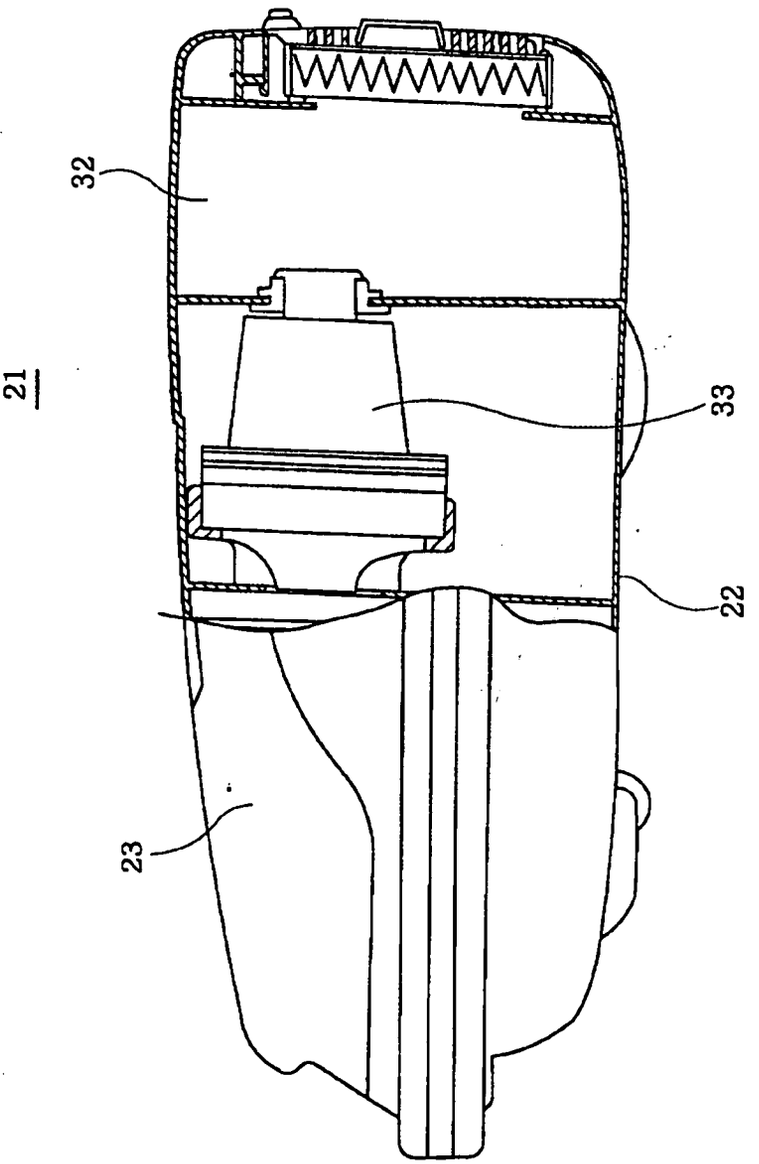


FIG. 11

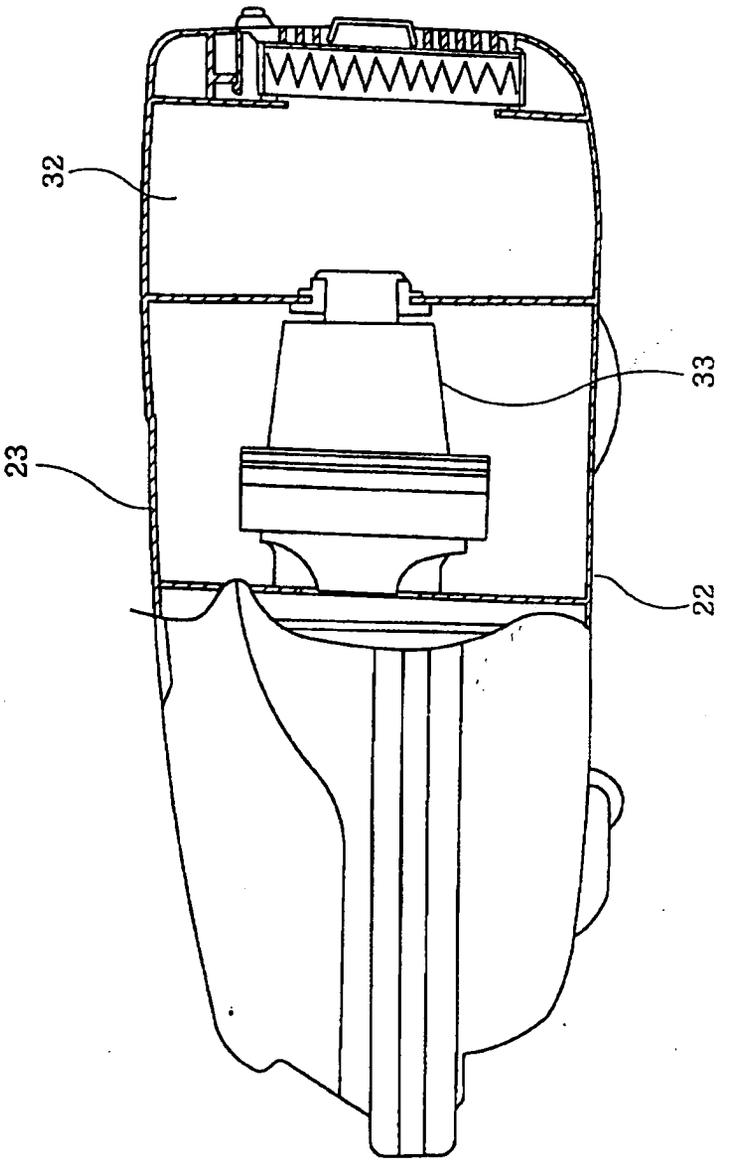


FIG. 12

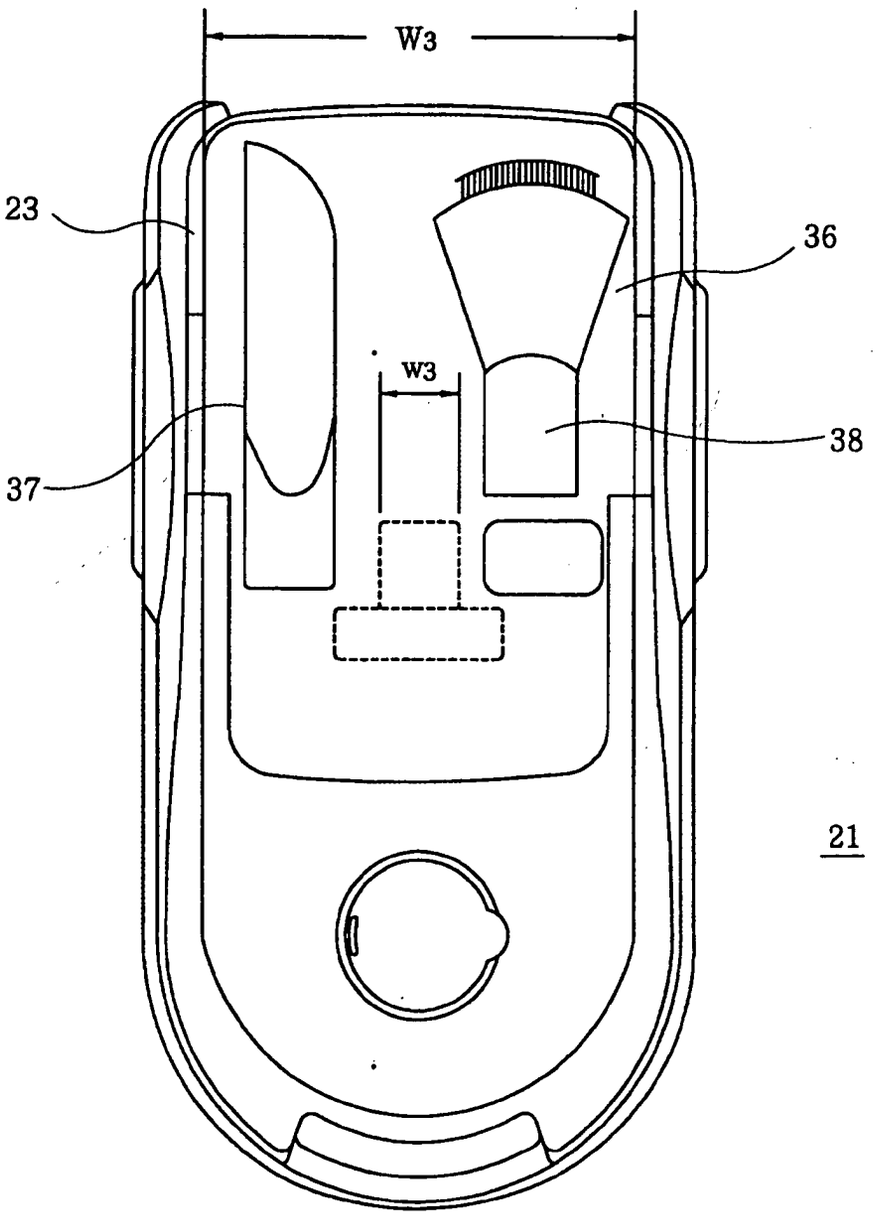


FIG. 13

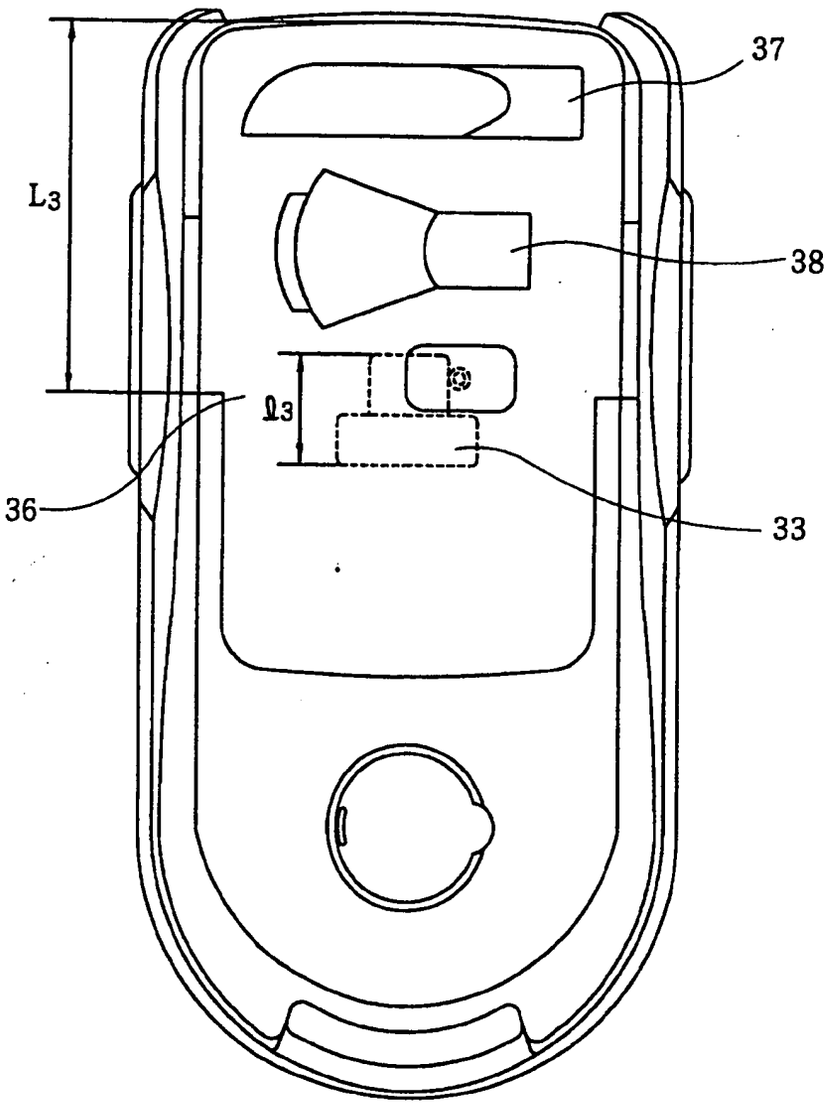


FIG. 14

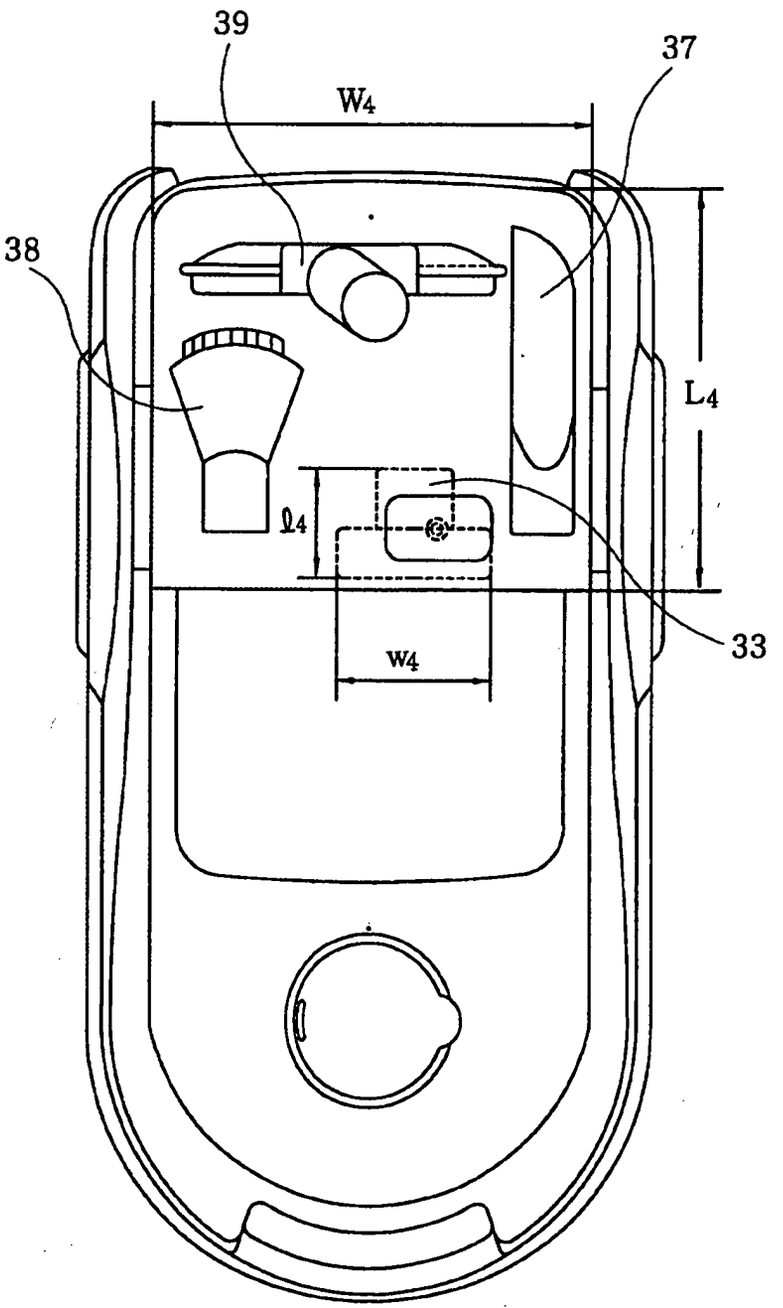


FIG. 15

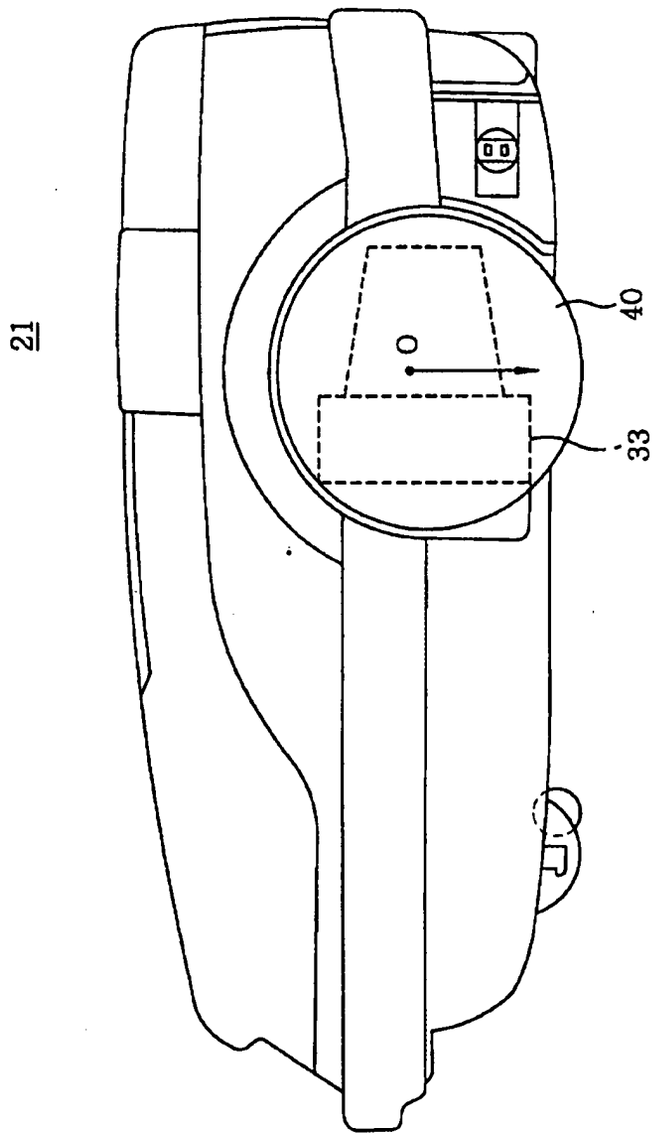


FIG. 16

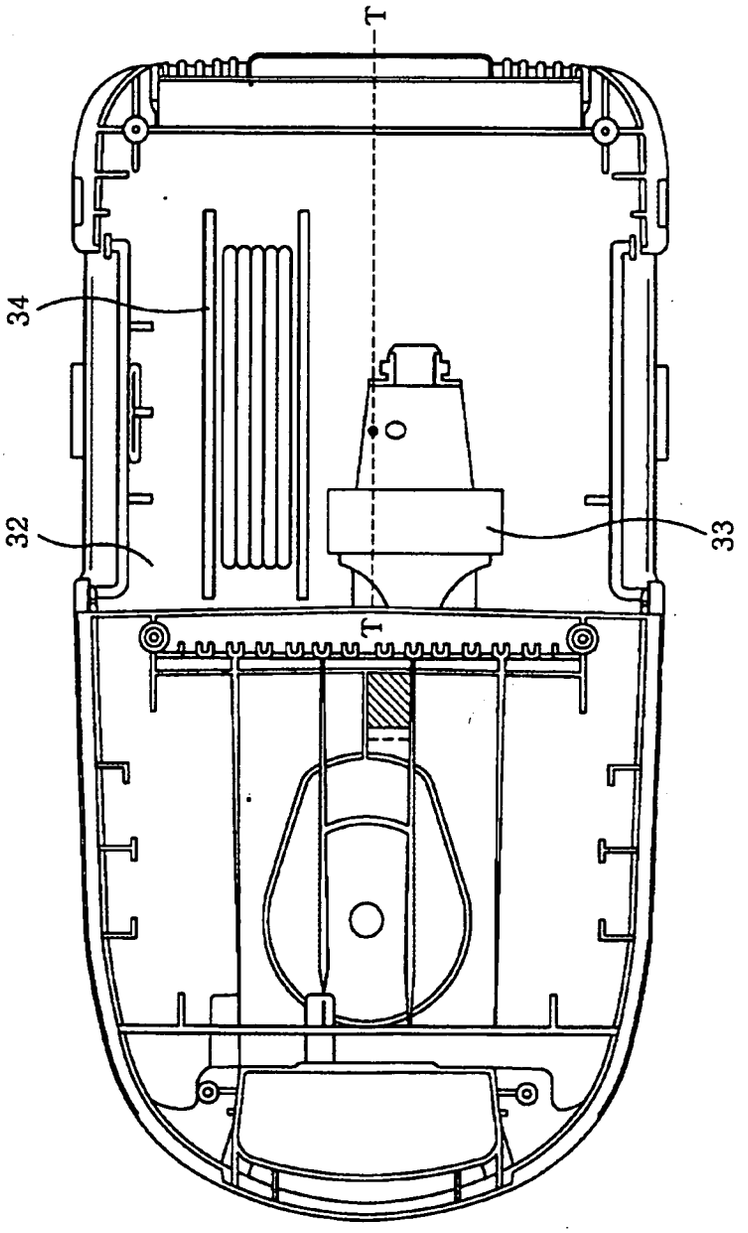


FIG. 17

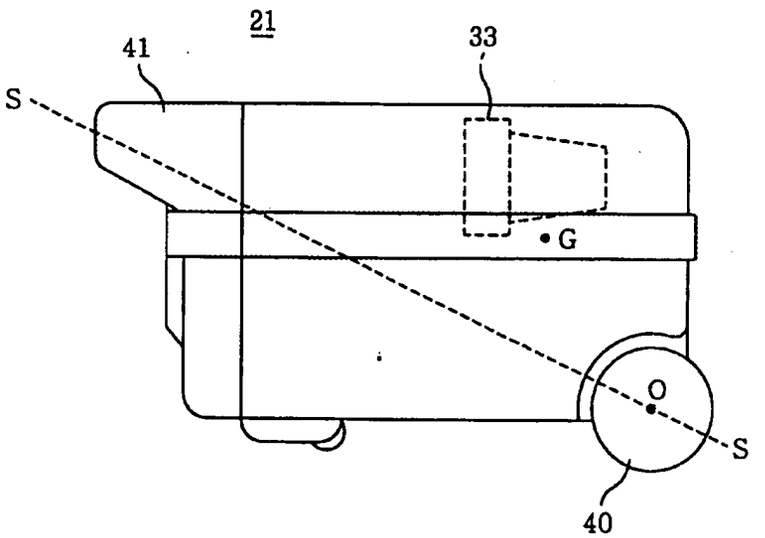


FIG. 18

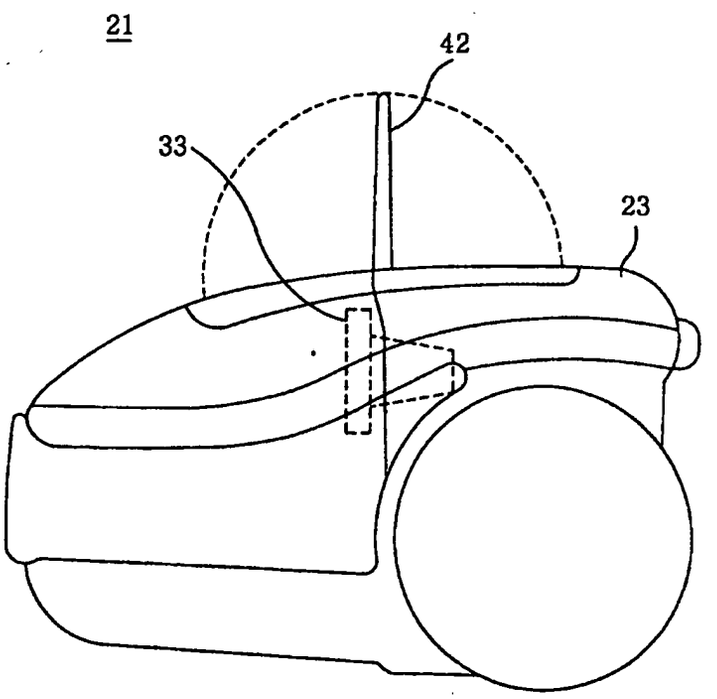


FIG. 19

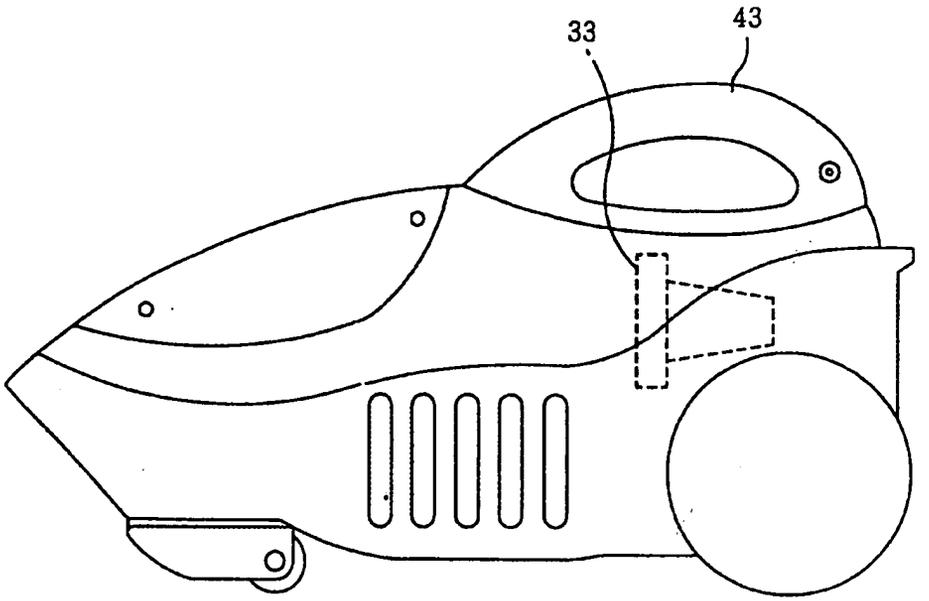


FIG.20

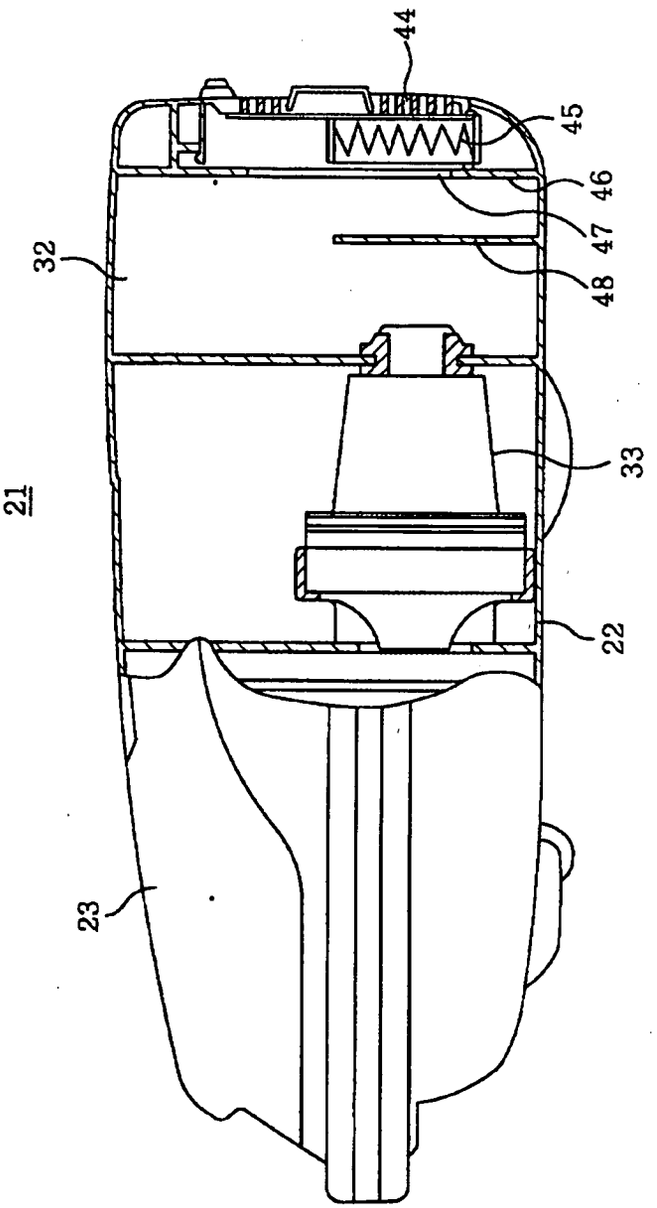


FIG.21

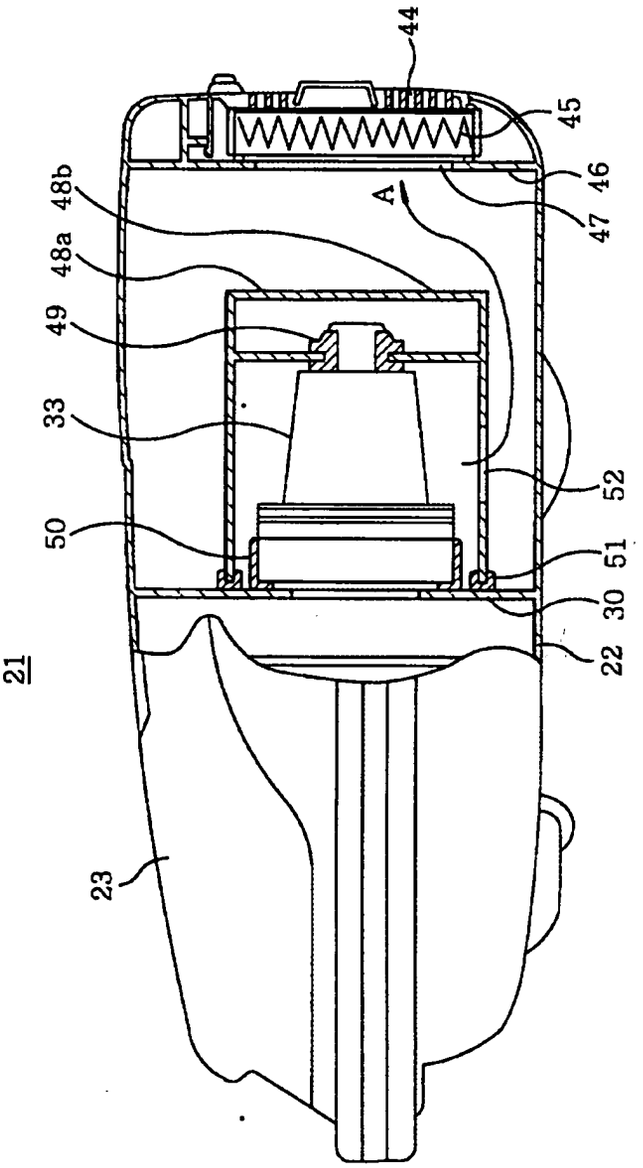


FIG.22

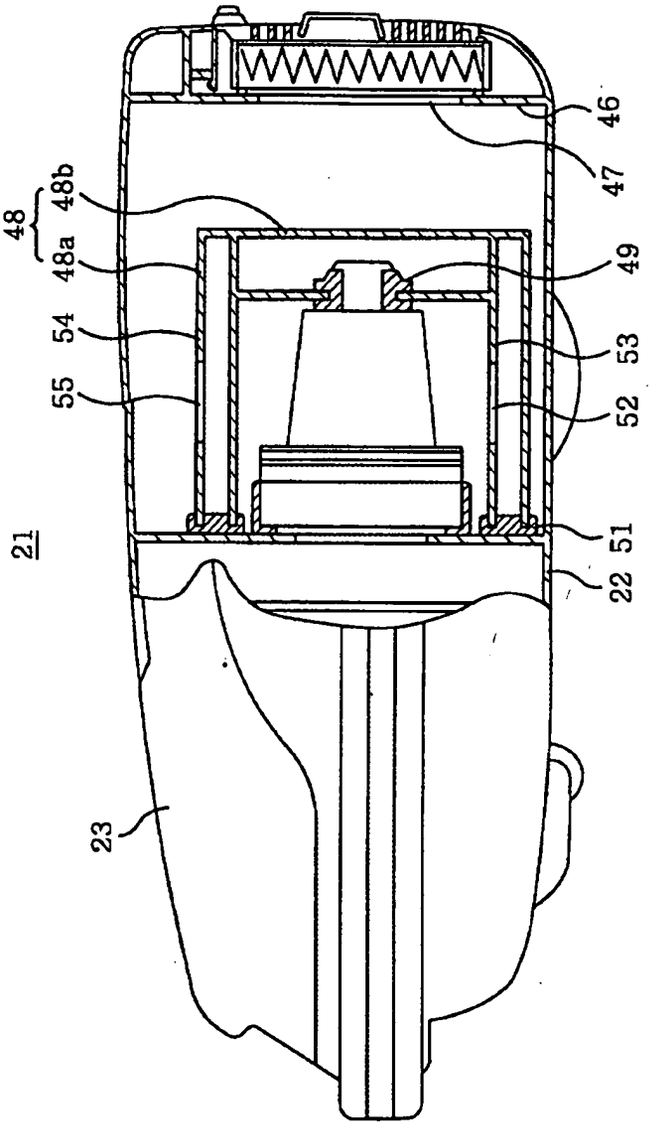
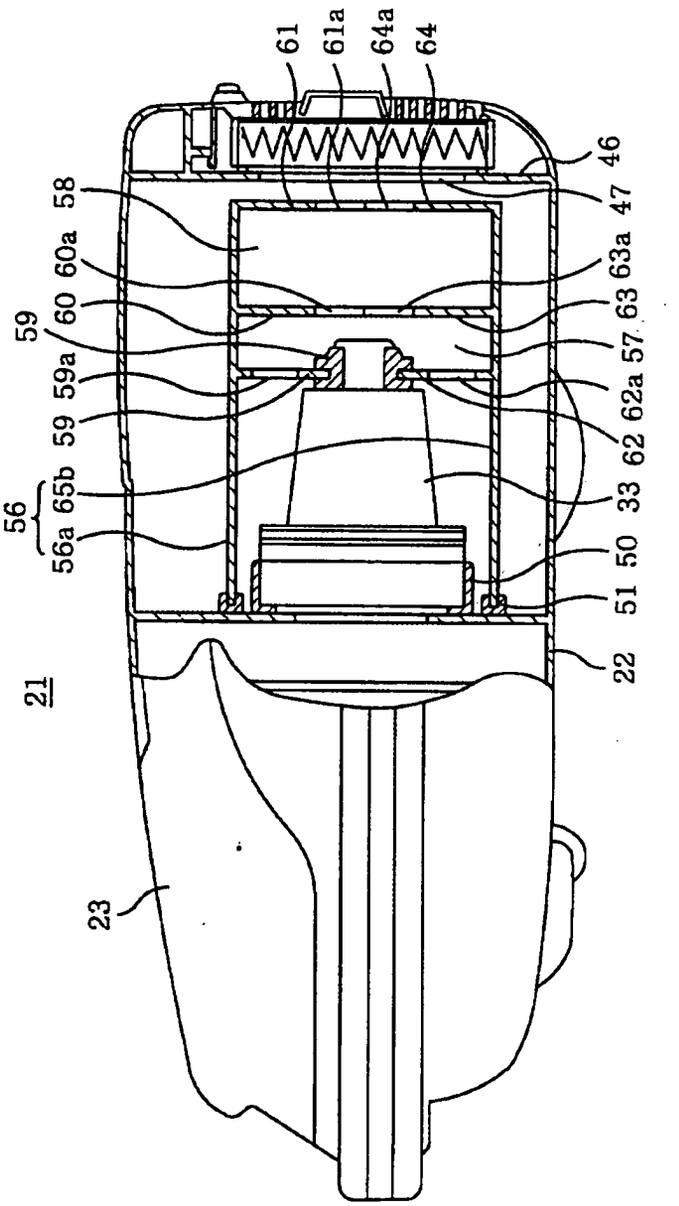


FIG.23


61
61a
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60a
63a
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62a
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33
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56a
50
51
22
21
23

FIG.24

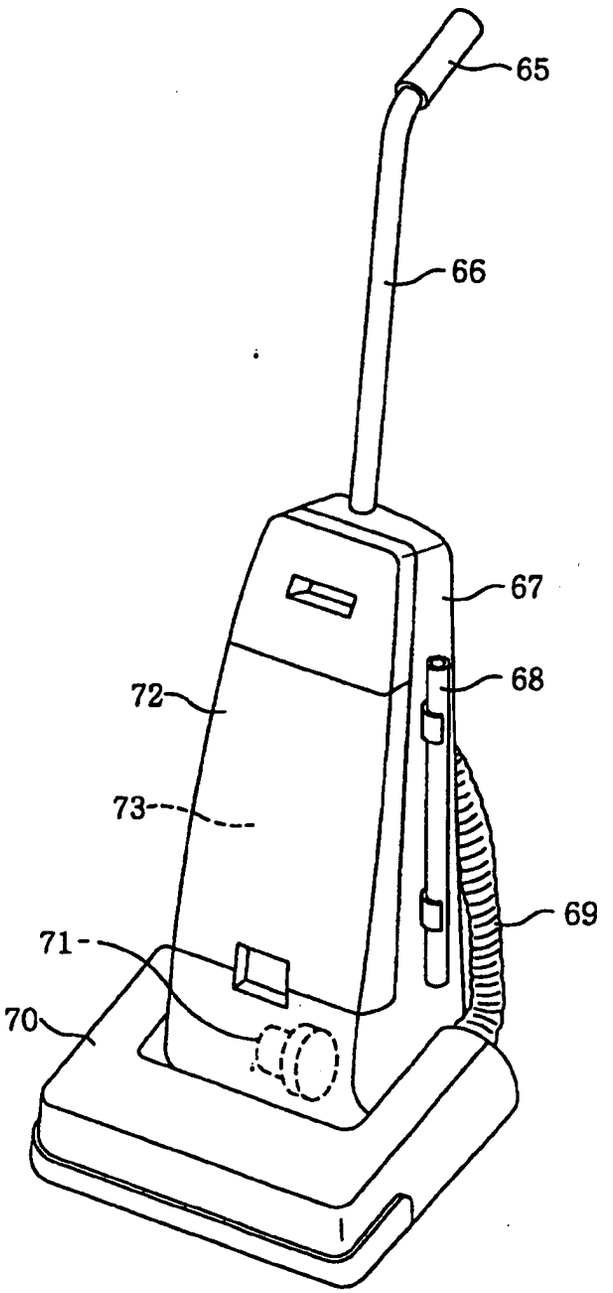

FIG.25

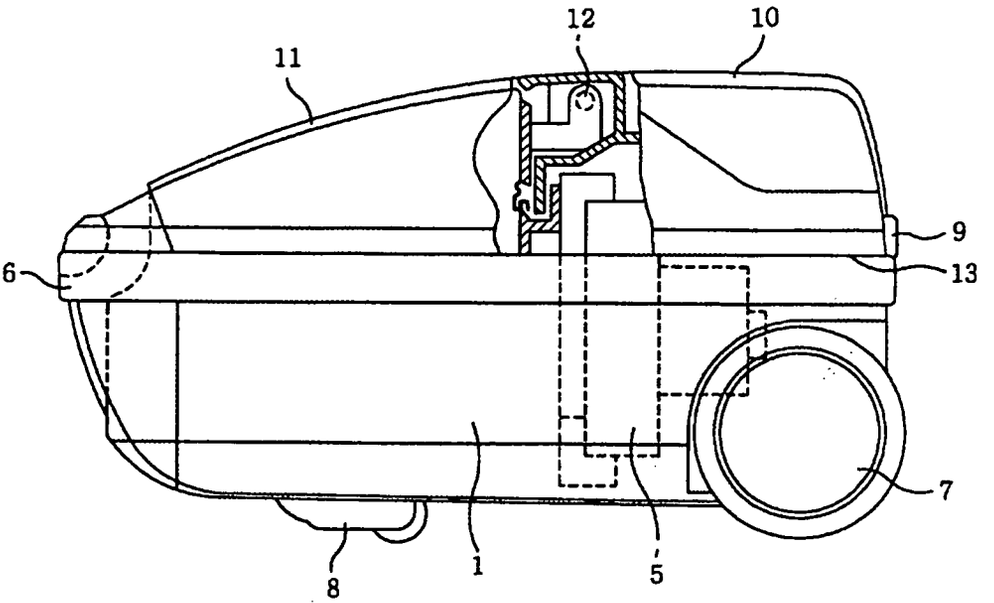

FIG.26