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(54) ELECTRIC VACUUM CLEANER

(57) A dust collecting device includes a first centrifugally separating part 41 for centrifugally separating dust and second centrifugally separating parts which communicate with the first centrifugally separating part 41 and centrifugally separate dust finer than that separated by the first centrifugally separating part 41. The first centrifugally separating part 41 has a case body 51 capable of housing dust and a cylindrical turning part 52 which is arranged in the case body 51 and turns air containing dust between the turning part and the case body 51. The turning part 52 includes, at its circumference, circumferential openings 65 communicating with the second centrifugally separating parts and, at its end, an end opening 74 communicating with the second centrifugally separating parts. The first centrifugally separating part 41 has a compression filter 54 provided on the end opening 74.

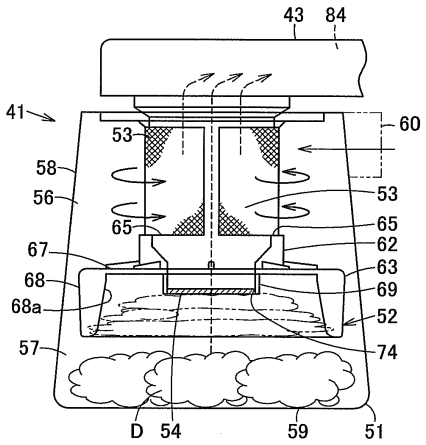

FIG. 1

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Description

TECHNICAL FIELD

[0001] The present invention relates to an electric vacuum cleaner including a dust collecting part for centrifugally separating and trapping dust.

BACKGROUND ART

[0002] Conventionally, for example, an electric vacuum cleaner is used which includes a dust collecting part (dust collecting device) forcentrifugallyseparating (cyclone-separating) and trapping dust. In the dust collecting part of such an electric vacuum cleaner, a turning part (shade part) is, concentrically with a cylindrical case body, arranged in the case body, and a centrifugally separating part is provided which vertically has: a separating part for turning air containing dust between the case body and the turning part, the air being vacuumed by driving of an electric blower, to centrifugally separate the dust; and a dust collecting chamber for trapping the dust separated by the separating part.

[0003] With some of the dust collecting parts of such electric vacuum cleaners, it is known that centrifugally separating parts are arranged in series at multiple stages, for example, two stages, a first centrifugally separating part positioned at the extreme upstream centrifugally separates coarse dust in the air containing dust, for example, fiber dust, and a second centrifugally separating part positioned downstream in relation to the first centrifugally separating part centrifugally separates fine dust which has passed through the first centrifugally separating part.

[0004] In the case of connecting the centrifugally separating parts at multiple stages, since no influence of a vortex flow of the separating part is received, coarse dust trapped by the dust collecting chamber of the first centrifugally separating part is not compressed, and thus the dust collecting chamber is required to have a large volume in order to trap a sufficient amount of dust or a mechanical compressor for compressing coarse duct is required.

CITATION LIST

Patent Literature

[0005] Patent Document 1: Japanese Laid-Open Patent Publication No. 2007-222614

SUMMARY OF INVENTION

Technical Problem

[0006] It is an object of the present invention to provide an electric vacuum cleaner capable of suppressing upsizing and a complicated constitution of a dust collecting part and further, of trapping a large amount of dust.

Solution to Problem

[0007] An electric vacuum cleaner according to an embodiment has: a cleaner main body housing an electric blower; and a dust collecting part communicating with a suction side of the electric blower. The dust collecting part includes a first centrifugally separating part for centrifugally separating dust and second centrifugally separating parts which communicate with the first centrifugally separating part and centrifugally separate dust finer than dust separated by the first centrifugally separating part. The first centrifugally separating part has a case body capable of housing dust and a cylindrical turning part which is arranged in the case body to turn air containing dust between the turning part and the case body. The turning part includes, at its circumference, circumferential openings communicating with the second centrifugally separating parts and, at its end, an end opening communicating with the second centrifugally separating parts. The first centrifugally separating part further has a compressing filter provided on the end opening.

BRIEF DESCRIPTION OF DRAWINGS

[0008]

Fig. 1 is a vertical cross sectional view schematically showing a first centrifugally separating part of an electric vacuum cleaner according to an embodiment.

Fig. 2 is a perspective cross sectional view schematically showing a dust collecting part of the same electric vacuum cleaner.

Fig. 3 is a horizontal cross sectional view schematically showing some of the second centrifugally separating parts of the same electric vacuum cleaner.

Fig. 4 is a side view for explaining the internal structure of the same electric vacuum cleaner.

Fig. 5 is a perspective view showing the same electric vacuum cleaner.

EMBODIMENT

[0009] Hereinafter, a constitution of an embodiment will be described with reference to Figs. 1 to 5.

[0010] In Figs. 4 and 5, the reference numeral 11 denotes a so-called canister type electric vacuum cleaner. The electric vacuum cleaner 11 has a tube part 12 as a sucked air passage body (air passage forming body) and a cleaner main body 13 detachably connected to the tube part 12.

[0011] The tube part 12 includes: a connection tube part 15 to be connected to the cleaner main body 13; a flexible hose body 16 communicating with a front end side of the connection tube part 15; a hand operation part 17 provided on a front end side of the hose body 16; an

extension tube 18 detachably connected to a front end side of the hand operation part 17; and a floor brush 19 as a suction port body selectively detachable from the front end side of the extension tube 18 or the front end side of the hose body 16.

[0012] A loop-shaped grip part 21 is projected to the hose body 16 side from the hand operation part 17 and a plurality of set buttons 22 for operation are provided on an upper part of the grip part 21.

[0013] The cleaner main body 13 includes a main body case 25 having traveling wheels 23 at its both sides and a turn wheel 24 at its lower part, the wheels 23 having large diameters, and a dust collecting device 26 as a dust collecting part can be detachable from an upper part of the main body case 25. The cleaner main body 13 can travel (move) along a floor surface to be cleaned at least in the back and forth direction by the traveling wheels 23 and the turn wheel 24.

[0014] The main body case 25 is formed of, for example, synthetic resin and has a main body part 32 housing an electric blower 31 and a projecting part 33 projected on a front part of the main body part 32.

[0015] The electric blower 31 is arranged in the main body part 32 and controlled, in accordance with operation of the set buttons 22, by a control unit (not shown) housed in the main body part 32. Additionally, both ends of the electric blower 31 in its axial direction are elastically supported via elastic members 35 and 36 made of, for example, rubber.

[0016] The main body part 32 supports a lower part of a rear side of the dust collecting device 26 and houses the electric blower 31, the control unit and further a cord reel device (not shown) which serves as a power supply part for supplying power to the electric blower 31 and around which a power cord 37 is wound. Additionally, at a rear end of the main body part 32, there are formed: an exhaust hole (not shown) for exhausting air from the electric blower 31 to the outside of the main body case 25; and a cord leading-out port (not shown) from which a tip end side of the power cord 37 is led out. Further, the traveling wheels 23 are positioned at both sides of the main body part 32.

[0017] The projecting part 33 supports a lower part of a front side of the dust collecting device 26, and the projecting part 33 is inclined toward its front part upward. A communication air passage 38 communicating with the dust collecting device 26 is formed in the projecting part 33. A main body suction port 39, to which the connection tube part 15 of the tube part 12 is connected, is formed on the front part of the projecting part 33 and is an opening of an upstream end of the communication air passage 38. The turn wheel is positioned on a lower part of the projecting part 33.

[0018] As shown in Figs. 1 to 4, in the dust collecting device 26, there are integrally provided: a first centrifugally separating part 41 positioned at the front side of the dust collecting device 26 and having an axis along the vertical direction; a plurality of second centrifugally separating parts 42 communicating with the first centrifugally separating part 41, positioned at the rear side of the dust collecting device 26 and having an axis along the vertical direction; an air passage part 43 making the centrifugally separating parts 41 and 42 communicate with each other; a dust collecting case 44 connected to a lower part of each second centrifugally separating part 42; and an exhaust air passage part 45 making each second centrifugally separating part 42 and a suction side of the electric blower 31 communicate with each other, and the dust collecting device 26 is formed in a unit shape. Upper parts of the first centrifugally separating part 41, the air passage part 43 and the second centrifugally separating parts 42 are covered with an outer cover 46.

[0019] The first centrifugally separating part 41 turns air containing dust, which has passed through the communication air passage 38, to centrifugally separate (cyclone-separate) and trap coarse dust D having relatively large grains such as fiber dust and has: a case body 51 having a cylinder with a bottom shape; a turning part 52 which is a cylindrical shade part arranged in the case body 51; and mesh-shaped dust collecting filters 53 and a compression filter 54 attached to the turning part 52. The first centrifugally separating part 41 is, for example, arranged so as to be inclined rear-upward in a state where the dust collecting device 26 is attached to the main body case 25.

[0020] The inside of the case body 51 is partitioned into an upper side, a separating chamber 56 for centrifugally separating coarse dust D, and a lower side, a dust collecting chamber 57 for housing the separated coarse dust D, and the case body 51 includes a cylindrical case main body 58 formed of, for example, synthetic resin having transmittance and a cover body 59 for covering/uncovering a lower end, which is one end, of the case main body 58. A suction port 60 as an inlet port, to which the communication air passage 38 is connected, is formed on one side of a rear part of the case main body 58, and air containing dust flows from the communication air passage 38 into the case body 51 via the suction port 60 along a tangential direction.

[0021] The turning part 52 is inserted into the case body 51 (case main body 58) from above the case body 51 (case main body 58) and arranged concentrically with the case body 51 (case main body 58). In the turning part 52, there are integrally provided: a cylindrical turning part main body 62 positioned at an upper side of the turning part 52; and a cylindrical (disk-shaped) large diameter part 63 positioned at a lower side thereof.

[0022] The separating chamber 56, in which air containing dust turns, is positioned between an outer circumferential surface of the turning part main body 62 and an inner circumferential surface of the case body 51 (case main body 58). A plurality of circumferential openings 65 are formed at the circumference of the turning part main body 62 and respectively covered with the dust collecting filters 53. An upper end, which is the other end, of the turning part main body 62 is airtightly connected to the

air passage part 43. Accordingly, each circumferential opening 65 communicates with each second centrifugally separating part 42 via the inside of the turning part 52 (turning part main body 62) and the air passage part 43.

[0023] In the large diameter part 63, there are integrally provided: an upper surface part 67 radially projecting on the whole circumference of a lower end of the turning part main body 62; a circumference projecting part 68 as a dust collecting part projecting downward from an edge of the upper surface part 67; and a projecting cylindrical part 69 which is a sucking part as a cylindrical part projecting downward from a central part of the upper surface part 67, has a diameter larger than that of the turning part main body 62 and is connected concentrically with the turning part main body 62. That is, the large diameter part 63 is increased in diameter with respect to the turning part main body 62 in a step shape. The dust collecting chamber 57 is positioned between a lower part of the large diameter part 63 and the case body 51, and influence of a turning flow (vortex flow) generated in the separating chamber 56 on the dust collecting chamber 57 is eliminated (suppressed) by the large diameter part 63.

[0024] A plurality of openings 71 are circumferentially formed, in the vicinity of an outer circumferential surface of the turning part main body 62, on the upper surface part 67 and each of the openings 71 is covered with a mesh-shaped filter body 72. The filter body 72 formed in the mesh shape compresses coarse dust D.

[0025] An outer circumferential surface of the circumference proj ectingpart 68 is close to the inner circumferential surface of the case body 51 (case main body 58) so that a gap narrower than the separating chamber 56 is formed. An inner circumference surface of the circumference projecting part 68 gradually becomes narrower in diameter from its lower side to its upper side (projecting cylindrical part 69 side) so as to be an inclined surface 68a as an inclined cylindrical surface.

[0026] The projecting cylindrical part 69 is cylindrically formed so as to have a diameter smaller than that of the turning part mainbody 62 and positioned concentrically with the turning part main body 62, and airtightly continues to the turning part main body 62. Further, a lower end of the projecting cylindrical part 69, an end side of the turning part 52, is an end opening 74 projecting to a part lower than a lower surface of the upper surface part 67, into the dust collecting chamber 57, and the end opening 74 is covered with the compression filter 54. The end opening 74 communicates with each second centrifugally separating part 42 via the inside of the turning part 52 (turning part main body 62) and the air passage part 43.

[0027] On the other hand, each second centrifugally separating part 42 centrifugally separates fine dust having relatively small grains such as powder dust the first centrifugally separating part 41 cannot centrifugally separate, that is, dust finer than coarse dust D separated by the first centrifugally separating part 41. In other words, the flow speed and centrifugally separating ability of each second centrifugally separating part 42 are higher than those of the first centrifugally separating part 41. For example, in the embodiment, five second centrifugally separating parts 42 back and forth at each side and four centrifugally separating parts back and forth at a central part, totaling fourteen second centrifugally separating parts, are arranged and connected in parallel to the air passage part 43.

[0028] Each second centrifugally separating part 42 includes a long cylindrical second centrifugally separating part main body 77 having a diameter gradually becoming smaller from its upper side to its lower side, from the upstream side to the downstream side, and a straightening part 78 arranged at an upper end of the second centrifugally separating part main body 77 and communicating with the air passage part 43.

[0029] Each second centrifugally separating part main body 77 turns air containing dust, which flows thereinto from the straightening part 78, along its inner circumferential surface. At least the maximum diameter of the inner circumferential surface of the second centrifugally separating part 77 is smaller than that of the case body 51 (case main body 58) of the first centrifugally separating part 41 and set, for example, not larger than half of the diameter of the inner circumferential surface of the case body 51 (case main body 58).

[0030] Each straightening part 78 is concentrically arranged by being inserted into each second centrifugally separating part main body 77 from above. In each straightening part 78, there are integrally provided a ventilation cylindrical part 81 as a ventilating part vertically cylindrically formed and a straightening passage part 82 spirally formed along the circumference of the ventilation cylindrical part 81.

[0031] A lower end side of each ventilation cylindrical part 81 is inserted and projected into the second centrifugally separating part main body 77 and an upper end side thereof communicates with the exhaust air passage part 45.

[0032] An upstream side of each straightening passage part 82 is opened forward, to the upstream side, in the air passage part 43 and each straightening passage part 82 is gradually inclined downward to the downstream side. Thus, each second centrifugally separating part 42 is constituted in a manner that air containing dust passing through the air passage part 43 flows into each second centrifugally separating part main body 77 along a tangential direction by each straightening passage part 82.

[0033] In the air passage part 43, there are integrally provided: a front side air passage part 84 as an upstream side air passage part positioned at the front side, which is the upstream side, and communicating with the first centrifugally separating part 41; and a rear side air passage part 85 as a downstream side air passage part positioned at the rear side, which is the downstream side, and communicating with the front side air passage part 84 and the second centrifugally separating parts 42.

[0034] The front side air passage part 84 is longitudinally formed back and forth and extends from the upper

part of first centrifugally separating part 41 to a front part of each second centrifugally separating part 42. A lower part of the front side of the front side air passage part 84 can be detachably connected to a downstream side of the first centrifugally separating part 41, an upper end of the turning part 52.

[0035] The rear side airpassagepart 85 is formed so as to surround the whole outside of all the second centrifugally separating parts 42 and wider than the front side air passage part 84 in a horizontal width direction. The upper end of the second centrifugally separating part main body 77 and the straightening part 78 of each second centrifugally separating part 42 are arranged in the rear side air passage part 85, and each straightening part 78 communicates in parallel with the rear side air passage part 85.

[0036] The dust collecting case 44 houses fine dust separated by the second centrifugally separating parts 42 and is positioned behind the first centrifugally separating part 41 and on the lower part of each second centrifugally separating part 42, and a lower end side of the second centrifugally separating part main body 77 of each second centrifugally separating part 42 is inserted into and airtightly connected to an upper part of the dust collecting case 44. The dust collecting case 44 can be attached/detached to/from each second centrifugally separating part 42.

[0037] The exhaust air passage part 45 is longitudinally formed back and forth along the upper part of each second centrifugally separating part 42 positioned at the central part in the horizontal width direction. Branch air passage parts 45a project and branch from both sides of the exhaust air passage part 45, the part 45a communicating with the downstream side of each of the second centrifugally separating parts 42 positioned at both the left and right sides, an upper end of the ventilation cylindrical part 81.

[0038] In the dust collecting device 26, a dust collecting air passage 87 is airtightly constituted which communicates with the suction port 60, the case body 51, the circumferential openings 65 (dust collecting filters 53), the end opening 74 (compression filter 54), the air passage part 43, each straightening part 78, each second centrifugally separating part main body 77, each ventilation cylindrical part 81 and the exhaust air passage part 45.

[0039] Next, operation of the embodiment will be described. Moreover, for clear description, the outer cover 46 is omitted in Fig. 1.

[0040] In cleaning, as shown in Figs. 4 and 5, the dust collecting device 26 is attached to the main body case 25 of the cleaner main body 13 in advance. In this state, the suction port 60 of the first centrifugally separating part 41 of the dust collecting device 26 is airtightly connected to the communication air passage 38, the exhaust air passage part 45 is airtightly connected to the suction side of the electric blower 31 and thus the tube part 12 and the dust collecting air passage 87 in the dust collecting device 26 are airtightly connected to the suction side of the electric blower 31.

[0041] Auser pulls out the power cord 37 from the cord leading-out port to connect the power cord 37 to a socket on a wall surface or the like, grips the grip part 21 and operates a desired set button 22 so that the control unit drives the electric blower 31 in a set operation mode.

[0042] Negative pressure generated by driving of the electric blower 31 is applied to the tube part 12 via the dust collecting air passage 87 in the dust collecting device 26, the communication air passage 38 and the main body suction port 39. The negative pressure is applied to the hose body 16, the extension tube 18 and the floor brush 19 in the tube part 12, and dust and air are vacuumed from a tip end of the floor brush 19 or the like put on a surface to be cleaned.

[0043] Air containing dust flows via the floor brush 19, the extension tube 18, and the hose body 16, flows from the main body suction port 39 via the communication air passage 38, and flows into the first centrifugally separating part 41 of the dust collecting device 26 from the suction port 60. The air containing dust flowing in from the suction port 60 circumferentially turns in the separating chamber 56, that is, between the case body 51 (case main body 58) and the turning part 52 (turning part main body 62), of the first centrifugally separating part 41. Coarse dust D is centrifugally separated, gravitationally drops downward and is collected in the dust collecting chamber 57, that is, between the case body 51 and the large diameter part 63 of a lower end of the turning part 52, of the first centrifugally separating part 41.

[0044] Most of air containing dust turning in the first centrifugally separating part 41 flows from the circumferential openings 65 into the turning part 52 via the dust collecting filters 53, and part of the rest thereof flows from the end opening 74 into the turning part 52 via the compression filter 54. That is, the amount of air passing through the end opening 74 is smaller than that of air passing through the circumferential openings 65. In the present embodiment, the ratio of the amount of air is, for example, approximately 9:1. When air containing dust passes through the dust collecting filters 53 in the separating chamber 56, dust finer than coarse dust D in the air containing dust is trapped by the dust collecting filters 53. Part of the air containing dust in the dust collecting chamber 57 passes through the compression filter 54 and the rest passes through the filter bodies 72 to circulate from an outer circumferential side of the large diameter part 63 into the large diameter part 63 again. Here, as shown by the imaginary lines in Fig. 1, the coarse dust D vacuumed by a flow of the air containing dust is collected to the lower end of the large diameter part 63 of the turning part 52 and strongly vacuumed to and compressed by the filter bodies 72 and the compression filter 54.

[0045] Air containing dust, which has passed through the turning part 52, passes through the front side air passage part 84 of the air passage part 43 and then flows

into the rear side air passage part 85. Then, the air containing dust branches and flows from the rear side air passage part 85 into the straightening passage part 82 of the straightening part 78 of each second centrifugally separating parts 42, and flows into each second centrifuging separating part main body 77 while being straightened by the straightening passage parts 82.

[0046] Air containing dust flowing into the second centrifugally separating part main body 77 circumferentially turns along the inner circumferential surface of the second centrifugally separating part main body 77 at a flow speed higher than that of turning in the case body 51 of the first centrifugally separating part 41, and fine dust is centrifugally separated, gravitationally drops from the lower end of each second centrifugally separating part main body 77 to the dust collecting case 44 and is trapped in the dust collecting case 44. Air, from which fine dust is removed, passes through the ventilation cylindrical part 81 of the straightening part 78 of each second centrifugally separating part 42, flows into the exhaust air passage part 45, and flows of air converge with each other.

[0047] Air flowing into the exhaust air passage part 45 is vacuumed into the electric blower 31, passes through and cools the electric blower 31 and then is exhausted, as exhaust air, from the electric blower 31 and is exhausted from the exhaust hole to the outside of the main body case 25 of the cleaner main body 13.

[0048] When cleaning is finished, a user operates the set button 22 shown in Fig. 5 so that the control unit stops the electric blower 31. When a predetermined amount or more of dust is collected in the dust collecting chamber 57 of the first centrifugally separating part 41 and the dust collecting case 44, the user detaches the dust collecting device 26 from the cleaner main body 13 to discard the collected dust.

[0049] According to the embodiment described above, since the dust collecting device 26, in which the first centrifugally separating part 41 and the second centrifugally separating parts 42 are connected in series, includes the compression filter 54 on the end opening 74 of the end of the turning part 52 of the first centrifugally separating part 41, coarse dust D trapped in the dust colleting chamber 57 of the first centrifugally separating part 41 can be strongly vacuumed to and compressed by the compression filter 54 when part of air containing dust, which turns around the turning part 52, passes through the end opening 74 and flows to the second centrifugally separating parts 42. Accordingly, coarse dust D can be effectively compressed by only a flow of air containing dust without making the volume of the first centrifugally separating part 41 (case body 51) large or providing a mechanical mechanism for compressing coarse dust D, and thus the dust collecting device 26 can be prevented from being upsized and complicated in constitution and further a sufficient amount of dust can be collected. Accordingly, the electric vacuum cleaner 11 can be made compact, the number of components is reduced, and a low cost electric vacuum cleaner 11 can be realized.

[0050] Since the dust collecting filters 53 are provided on the circumferential openings 65 of the first centrifugally separating part 41, part of the dust in air containing dust can be effectively trapped when the air containing dust flows from the circumferential openings 65 to the second centrifugally separating parts 42.

[0051] Since the plurality of parallel lines of the second centrifugally separating parts 42 are connected to the downstream side of the first centrifugally separating part 41, fine dust, which the first centrifugally separating part 41 cannot centrifugally separate, can be centrifugally separated more reliably by the second centrifugally separating parts 42 and dust collecting performance can be further improved.

[0052] Since the amount of air containing dust passing through the end opening 74 of the first centrifugally separating part 41 is made smaller than that of air containing dust passing through the circumferential openings 65, coarse dust D can be vacuumed to and effectively compressed by the compression filter 54 by the air containing dust passing through the end opening 74, a sufficient amount of air containing dust can pass to the second centrifugally separating parts 42 by the circumferential openings 65 without obstruction of the coarse dust D and the suction power can be prevented from lowering.

[0053] Since fine dust, which has passed through the first centrifugally separating part 41, is centrifugally separated by the second centrifugally separating parts 42 and trapped in the dust collecting case 44, clogging or the like is hardly generated in the dust collecting air passage 87 in this constitution such as in the constitution that fine dust, which has passed through the first centrifugally separating part 41, is filtration-trapped with use of a filtrating unit such as a filter, and suction force can be kept for a long period. Accordingly, no constitution is required that automatically removes dust from a filter, constitution and control can be further simplified, and downsizing and a low cost electric vacuum cleaner 11 can be further realized.

[0054] Moreover, in the embodiment, in place of providing one dust collecting case 44 corresponding to all the second centrifugally separating parts 42, for example, dust collecting cases respectively corresponding to the second centrifugally separating parts 42 may be provided.

[0055] The number of second centrifugally separating parts 42 may be arbitrarily set as long as the second centrifugally separating part(s) 42 can reliably separate fine dust which cannot be collected by the first centrifugally separating part 41, in other words, fine dust which passes through the first centrifugally separating part 41.

[0056] No dust collecting filter may be provided on the circumferential openings 65 of the first centrifugally separating part 41. That is, the circumferential opening 65 may be a mere opening.

[0057] The dust collecting device 26 is detachable from the cleaner main body 13 (main body case 25) in the electric vacuum cleaner 11 according to the embodiment.

However, even if the dust collecting device 26 is integrally incorporated in the cleaner main body 13 (main body case 25), the same operation and effect can be obtained. In this case, it is preferable that trapped dust can be easily discarded by, for example, making the first centrifugally separating part 41, the dust colleting case 44 and the like detachable from the cleaner main body 13 (main body case 25).

[0058] Not limited to a canister type electric vacuum cleaner 11, there can also be used: an upright type cleaner in which the floor brush 19 is connected to a lower part of a vertically long cleaner main body 13; a handy type cleaner; aself-traveling type cleaner and the like.

[0059] Further, although power is supplied from a commercial AC power supply with use of the cord reel device as a power supply part in the electric vacuum cleaner 11 according to the embodiment, a battery as a power supply part such as a secondary battery may be built in the cleaner main body 13.

[0060] While certain embodiments have been described, these embodiments have been presented by way of example only, and are not intended to limit the scope of the inventions. Indeed, the novel methods and systems described herein may be embodied in a variety of other forms; furthermore, various omissions, substitutions and changes in the form of the methods and systems described herein may be made without departing from the spirit of the inventions. The accompanying claims and their equivalents are intended to cover such forms or modifications as would fall within the scope and spirit of the inventions.

Claims

1. An electric vacuum cleaner comprising:

a cleaner main body housing an electric blower; and

a dust collecting part communicating with a suction side of the electric blower,

wherein the dust collecting part includes a first centrifugally separating part for centrifugally separating dust and second centrifugally separating parts which communicate with the first centrifugally separating part and centrifugally separate dust finer than that separated by the first centrifugally separating part, and

the first centrifugally separating part has: a case body capable of housing dust; a cylindrical turning part which includes, at its circumference, circumferential openings communicating with the second centrifugally separating parts and, at its end, an end opening communicating with the second centrifugally separating parts, is arranged in the case body and turns air containing dust between the turning part and the case body; a compression filter provided on the end opening.

2. The electric vacuum cleaner according to claim 1, wherein the first centrifugally separating part has dust collecting filters respectively provided on the circumferential openings.

3. The electric vacuum cleaner according to claim 1 or 2, wherein the plurality of parallel lines of the second centrifugally separating parts are connected to a downstream side of the first centrifugally separating part.

4. The electric vacuum cleaner according to any one of claims 1 to 3, wherein, in the first centrifugally separating part, the amount of air passing through the end opening is smaller than that of air passing through the circumferential openings.

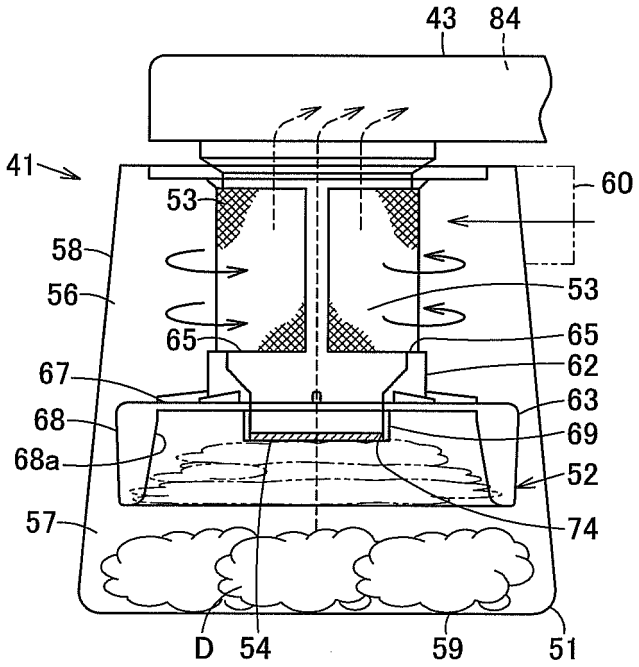

FIG. 1

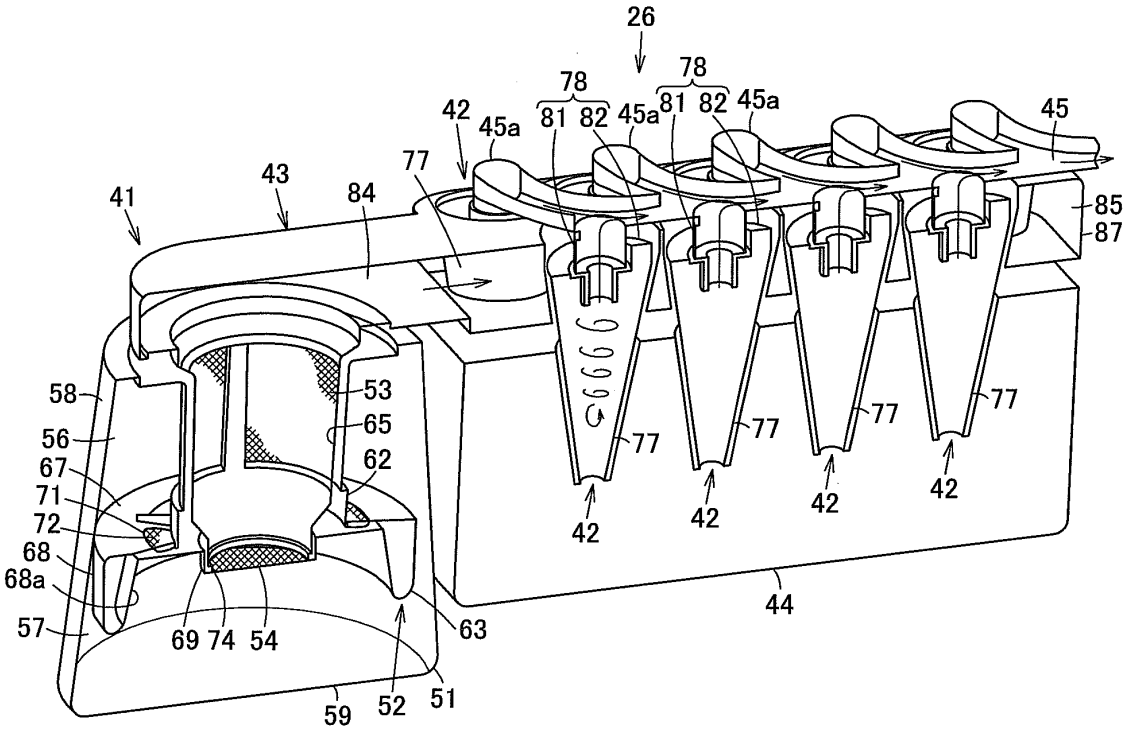
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FIG. 2

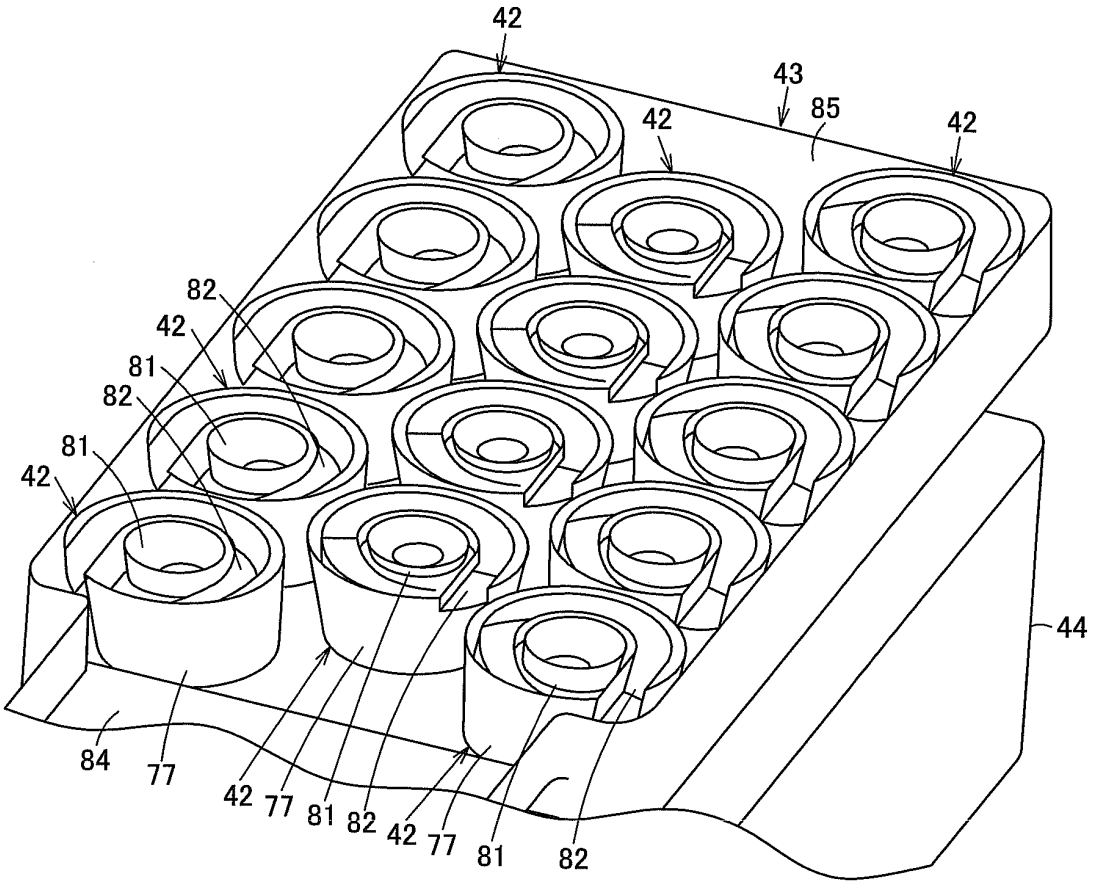

FIG. 3

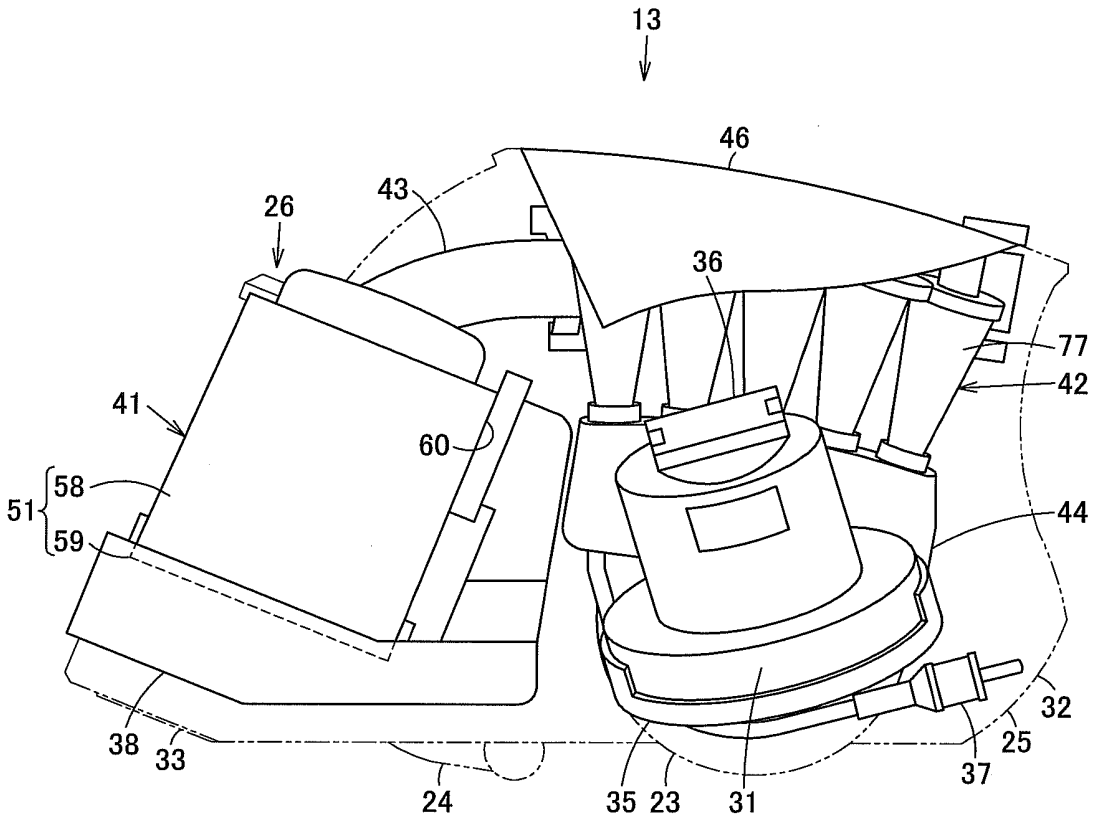

FIG. 4

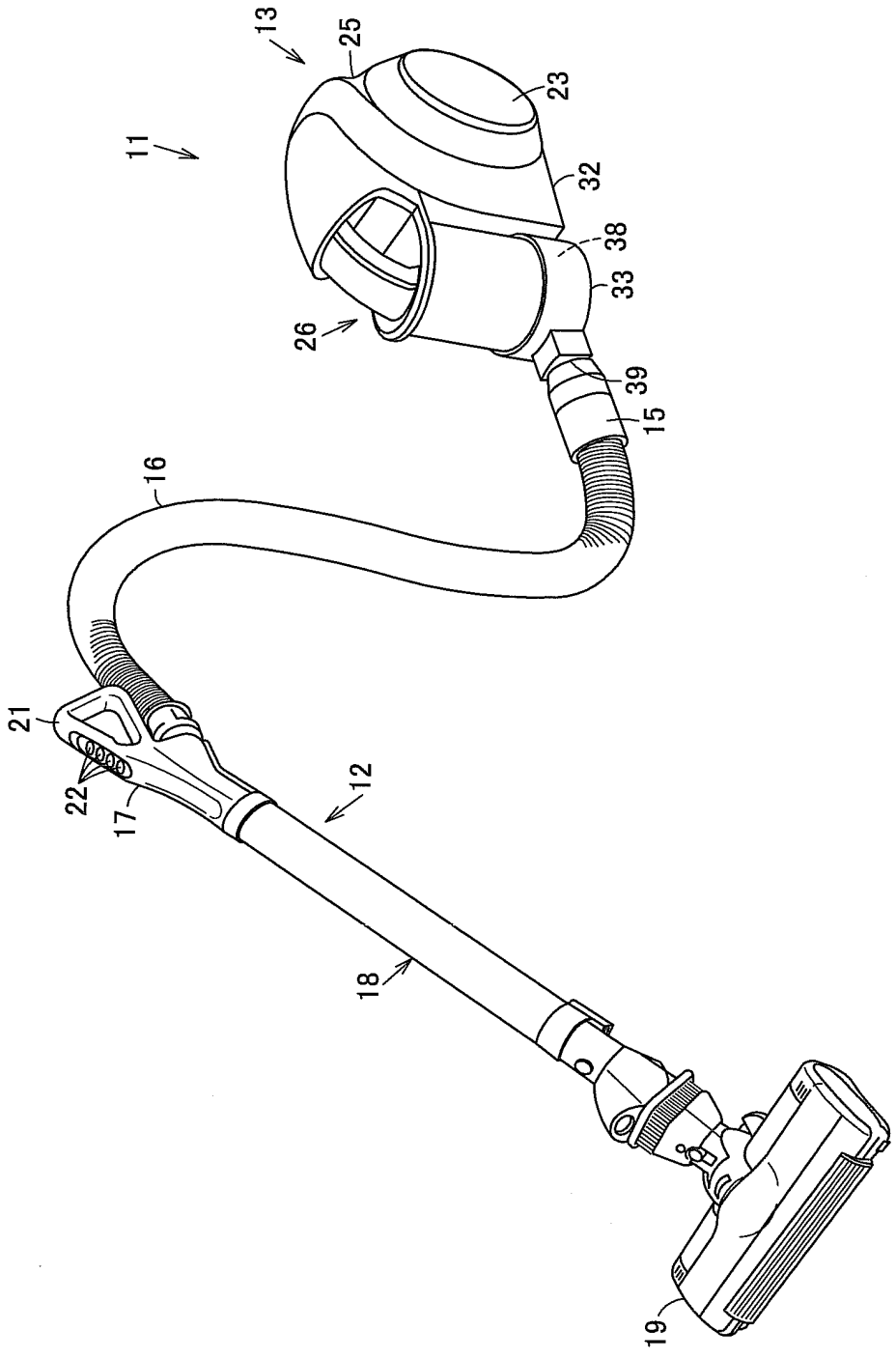

FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2011/077329

A. CLASSIFICATION OF SUBJECT MATTER
A47L9/16(2006.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A47L9/16

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2011
Kokai Jitsuyo Shinan Koho 1971-2011 Toroku Jitsuyo Shinan Koho 1994-2011

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2007-282929 A (Sharp Corp.), 01 November 2007 (01.11.2007), paragraphs [0022] to [0029]; fig. 1 to 4 (Family: none)	1-4
Y	JP 2007-160091 A (LG Electronics Inc.), 28 June 2007 (28.06.2007), paragraphs [0028], [0029], [0095]; fig. 3, 7, 8 & US 2008/0047094 A1 & US 2007/0151071 A1 & US 2007/0143953 A1 & US 2008/0023035 A1 & US 2008/0041421 A1 & US 2009/0178231 A1 & EP 1795102 A2 & KR 10-2007-0061643 A & CN 1981688 A	1-4

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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
08 December, 2011 (08.12.11)	20 December, 2011 (20.12.11)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2007222614 A **[0005]**