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(54) **SURFACE CLEANING HEAD AND SURFACE CLEANING DEVICE**

(57) The present application provides a surface cleaning apparatus and a surface cleaning head, the surface cleaning head comprising: a housing; a brush chamber disposed in a front portion of the housing and having a lower opening and a side opening; and a brush assembly removably mounted in the brush chamber comprising a connecting wall, a cleaning roller, and a side brush, the cleaning roller being configured to rotate around a transverse axis driven by a drive device, and the side brush mechanically coupled to the cleaning roller for following the roller in rotation around the transverse axis.

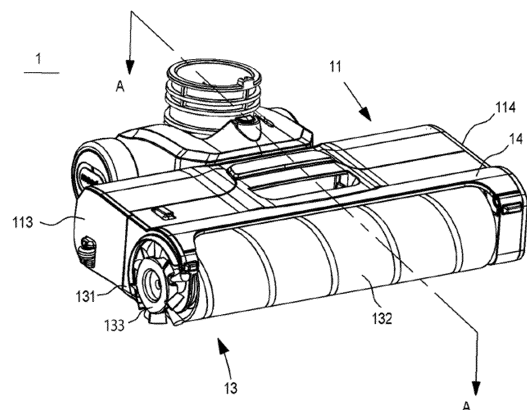


FIG.2

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Description**CROSS- REFERENCE TO RELATED APPLICATIONS**

[0001] This application claims the priority of Chinese Patent Application No. CN202110162832.3, filed on Feb.5, 2021, entitled "Surface cleaning head and surface cleaning apparatus"; Chinese Patent Application No. CN202110161044.2, filed on Feb.5, 2021, entitled "Cleaning head for surface cleaning apparatus"; Chinese Patent Application No. CN202110162831.9, filed on Feb.5, 2021, entitled "Cleaning brush assembly and cleaning head for surface cleaning apparatus"; Chinese Patent Application No. CN202110740007.7, filed on Jun.30, 2021, entitled "Surface cleaning apparatus"; Chinese Patent Application No. CN202110740700.4, filed on Jun.30, 2021, entitled "Surface cleaning apparatus"; Chinese Patent Application No. CN202110743377.6, filed on Jun.30, 2021, entitled "Surface cleaning apparatus"; Chinese Patent Application No. CN202110740073.4, filed on Jun.30, 2021, entitled "Floor cleaning apparatus"; and Chinese Patent Application No. CN202111361556.X, filed on Nov. 17, 2021, entitled "Surface cleaning apparatus "; the disclosure of which are incorporated by reference herein.

TECHNICAL FIELD

[0002] The present invention relates to the field of surface cleaning and, more particularly to a surface cleaning head as well as a surface cleaning apparatus.

BACKGROUND OF THE INVENTION

[0003] Surface cleaning apparatus, such as a wet floor cleaning apparatus, usually utilizes a surface cleaning head with a cleaning roller to brush the surface to be cleaned. In such apparatus, since the cleaning roller is usually surrounded by a housing, it cannot contact the edge surfaces of the wall or where the wall meets the floor, and thus cannot brush the edge surfaces. As a result, the operator has to clean such edge surfaces a second time, which is laborious.

BRIEF SUMMARY OF THE INVENTION

[0004] In view of the above technical problems, the present invention is intended to provide a surface cleaning head and a surface cleaning apparatus.

[0005] The present invention provides, in a first aspect, a surface cleaning apparatus used to clean surfaces such as floors. The surface cleaning apparatus has a surface cleaning head movable along a surface to be cleaned, a cleaning liquid delivery system containing a cleaning liquid tank, and a dirty liquid recovery system having a suction source and a recovery tank. The surface cleaning head comprises: a housing; a suction pathway located within the housing; a brush chamber provided at a forward portion of the housing in fluid communication with the suction pathway and having a lower opening facing the surface to be cleaned and a laterally outward side opening; and a brush assembly removably mounted in the brush chamber and comprising a connecting wall, a cleaning roller and a side brush, the connecting wall removably connected to the housing and covering at least a portion of the side opening, the connecting wall having an inside surface and an outside surface, an end of the cleaning roller mounted on the inside surface and the side brush mounted on the outside surface, the cleaning roller driven by a drive device to rotate around a transverse axis, wherein the side brush is mechanically coupled to the cleaning roller to follow the cleaning roller around the transverse axis. Therefore, when the operator moves the surface cleaning head on the surface to be cleaned, the side brush can be used to brush the edge surfaces (e.g., the floor area near the wall), and since the side brush rotates at the same time as the cleaning roller, there is no need for additional drive components, and the surface cleaning head structure can be kept simple.

[0006] In one embodiment of the invention that may be realized, the brush assembly comprises a fender mounted on the outside surface of the connecting wall, the fender surrounding at least an upper portion of the side brush, and at least a portion of the fender protrudes laterally from the outside surface of the connecting wall. At least a portion of the fender is optionally made of a flexible material.

[0007] In some embodiments of the invention that may be realized, the side brush comprises a brush holder and one or more cleaning elements disposed on the brush holder. In this embodiment, at least a portion of the one or more cleaning elements are distributed along a circumference around the transverse axis.

[0008] In addition, optionally, the outside surface of the connecting wall has a recessed portion intersected with the lower opening, and wherein the recessed portion is adapted to receive the side brush.

[0009] In addition, optionally, a forward portion of the connecting wall has a front opening located directly in front of and in communication with the recessed portion, and wherein a portion of the one or more cleaning elements are exposed outwardly through the front opening.

[0010] In addition, optionally, a lower portion of the connecting wall has a bottom opening, and a portion of the one or more cleaning elements are inclined in an inward direction and pass through the bottom opening.

[0011] In addition, optionally, the one or more cleaning elements comprise bristle tufts.

[0012] In addition, the cleaning roller and the side brush optionally are removable from the connecting wall.

5 **[0013]** In addition, the side brush is configured to be individually removable from the connecting wall when the brush assembly is mounted in the brush chamber.

[0014] In addition, optionally, the brush holder has an outer surface through by the transverse axis, and wherein at least a portion of the one or more cleaning elements are arranged on the outer surface.

10 **[0015]** In some embodiments of the invention that may be realized, the one or more cleaning elements comprise at least one of scouring pad material, softer bristle tufts, sponge blocks and short scraping blades.

[0016] In addition, optionally, the one or more cleaning elements are configured to be integrally separable from the outer surface.

[0017] In some embodiments of the invention that may be realized, at least a portion of the one or more cleaning elements protrude laterally from the outside surface of the connecting wall.

15 **[0018]** In some embodiments of the invention that may be realized, the surface cleaning head comprises an upper cover removably disposed on the top of the housing, and wherein the brush assembly is configured to be removed from the brush chamber only after the upper cover is removed from the housing.

[0019] In addition, optionally, the connecting wall has an upper surface, and the upper cover mounted on the top of the housing contacts the upper surface.

20 **[0020]** In addition, optionally, the surface cleaning head comprises a water baffle arranged at an inner surface of the upper cover, and wherein the water baffle contacts the cleaning roller when the upper cover is mounted on the top of the housing.

[0021] In some embodiments of the invention that may be realized, a portion of the outside surface of the connecting wall defines a portion of a side contour of the surface cleaning head.

25 **[0022]** In some embodiments of the invention that may be realized, the surface cleaning head comprises a lower wiper strip disposed at the bottom of the housing and an upper wiper strip adapted to contact the cleaning roller to remove excess liquid from the cleaning roller wetted with liquid, and wherein the lower wiper strip adapted to contact the surface to be cleaned defines at least a portion of a rear side edge of the lower opening.

30 **[0023]** In some embodiments of the invention that may be realized, the cleaning liquid delivery system comprises a first liquid spray nozzle for the cleaning roller and a second liquid spray nozzle for the side brush, and wherein the first and second liquid spray nozzles are fluidly connected to the cleaning liquid tank.

35 **[0024]** In some embodiments of the invention that may be realized, the apparatus is an upright apparatus comprising an upright body having an upright portion and a handle portion connected to the upright portion, a lower end of the upright portion pivotally connected to the surface cleaning head, and wherein the cleaning liquid tank, the recovery tank and the suction motor are arranged on the upright portion.

[0025] In some embodiments of the invention that may be realized, the apparatus is a self-moving robot.

40 **[0026]** The present invention provides, in a second aspect, a surface cleaning head. It can be used on apparatus that cleans surfaces such as floors. The surface cleaning head comprises: a pair of lateral sides set opposite each other on the left and right; a driving device; and at least one side brush arranged on at least one of the lateral sides and configured to be capable of being driven by the driving device to rotate around a transverse axis through the lateral sides, and wherein at least a portion of each of the at least one side brush is exposed outwardly from a corresponding portion of the lateral sides.

45 **[0027]** In some embodiments of the invention that may be realized, the surface cleaning head further comprises a cleaning roller driven by the drive device to rotate around the transverse axis disposed between the lateral sides, and wherein each of the at least one side brush is disposed to the left or the right of the cleaning roller.

[0028] In addition, optionally, one of the lateral sides comprises a first sidewall and a connecting wall removably coupled to a front side of the first sidewall, the connecting wall having an inside surface and an outside surface, and wherein one of at least one side brush is mounted on the outside surface and an end of the cleaning roller is supported on the inside surface.

50 **[0029]** In addition, optionally, the connecting wall, the cleaning roller, and the at least one side brush mounted on the connecting wall form together at least a portion of a brush assembly removable from the surface cleaning head.

55 **[0030]** In addition, optionally, the surface cleaning head further comprises a housing defining the first sidewall and a second sidewall, a brush chamber disposed in a front portion of the housing, the brush chamber having a lower opening facing the surface to be cleaned and a laterally outward side opening, and wherein the brush assembly is removably mounted in the brush chamber and the connecting wall is removably attached to the housing and covers at least a portion of the side opening.

[0031] In addition, optionally, the surface cleaning head further comprises a suction pathway located within the housing, and wherein the suction pathway is in fluid communication with the brush chamber.

[0032] In addition, optionally, the brush assembly comprises a fender mounted on the outside surface of the connecting wall and surrounding at least an upper portion of the side brush, and wherein at least a portion of the fender protrudes laterally from the outside surface of the connecting wall.

[0033] In addition, optionally, the brush assembly comprises a connector provided on the connecting wall, the connector having a bearing fixedly provided on the connecting wall and a shaft rotatably supported on the bearing, and wherein one end of the shaft is connected to an end of the cleaning roller and the other end of the shaft is connected to the side brush.

[0034] In some embodiments of the invention that may be realized, the surface cleaning head further comprises at least one disk brush disposed at the bottom and between the lateral sides, and wherein each of the at least one disk brush rotates around a longitudinal axis.

[0035] In addition, optionally, the rotation of the at least one disk brush is simultaneously driven by the driving device.

[0036] In addition, optionally, the surface cleaning head further comprises a suction nozzle provided at the bottom and located at the front side of the at least one disk brush.

[0037] In some embodiments of the invention that may be realized, the surface cleaning head further comprises a pair of the side brushes respectively arranged at the lateral sides.

[0038] In embodiments of the present invention, when the operator moves the cleaning head on the surface to be cleaned, brushing of the edge surfaces (e. g. floor area near the wall) can be realized simultaneously with the help of the side brush, without the need for a second cleaning by the operator, which saves time and effort.

[0039] Additional aspects and other advantages of the present invention will be partially given in the following description, and partially will become apparent from the following description, or through the practice of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0040] The present application will now be described with reference to the accompanying drawings, wherein:

FIG. 1 illustrates a three-dimensional view of a surface cleaning apparatus in accordance with an embodiment provided in the present application;

FIG. 2 illustrates a three-dimensional view of a surface cleaning head of the surface cleaning apparatus of FIG. 1;

FIG. 3 illustrates an elevation view of the surface cleaning head of the surface cleaning apparatus of FIG. 1;

FIG. 4 illustrates an exploded view of the surface cleaning head of the surface cleaning apparatus of FIG. 1;

FIG. 5 illustrates a sectional view of the surface cleaning head of FIG. 2 in the A-A direction;

FIG. 6 illustrates a view of internal features of the housing of the surface cleaning head of FIG. 3 in an elevation view;

FIG. 7 illustrates an exploded view of the brush assembly of the surface cleaning head of FIG. 3;

FIG. 8 illustrates a three-dimensional view of the connecting wall of FIG. 7;

FIG. 9a illustrates a three-dimensional view of a side brush according to an embodiment provided in the present application;

FIG. 9b illustrates a three-dimensional view of a side brush according to another embodiment provided in this application;

FIG. 9c illustrates a three-dimensional view of a side brush according to yet another embodiment provided in this application;

FIG. 10 illustrates an enlarged view of FIG. 3 at B;

FIG. 11 illustrates an indicative view of any of the side brush selected to be assembled in the recessed portion of a surface cleaning head according to an embodiment provided in the present application;

FIG. 12 illustrates a three-dimensional view of a surface cleaning head according to an embodiment provided in the present application, wherein the brush assembly is mounted at the brush chamber and the upper cover is removed;

FIG. 13 illustrates an enlarged view of FIG. 12 at C;

FIG. 14 illustrates a schematic view of the surface cleaning head of FIG. 2 as it moves over a surface to be cleaned;

5 Figure 15 illustrates a top view of a surface cleaning head according to another embodiment provided in the present application;

FIG. 16 illustrates a top view of the surface cleaning head of FIG. 15 with the upper cover removed;

10 FIG. 17 illustrates a schematic view of the surface cleaning head of FIG. 15 after removal of the upper cover and then removal of one end portion of the brush assembly from the housing;

FIG. 18 illustrates a three-dimensional view of the surface cleaning head of FIG. 17 with the brush assembly completely removed;

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FIG. 19 illustrates a sectional view of the surface cleaning head of FIG. 15 in the D-D direction;

FIG. 20 illustrates a top view of the brush assembly of FIG. 18;

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FIG. 21 illustrates a top cross-sectional view of the brush assembly of FIG. 20;

FIG. 22 illustrates a partial sectional view of the surface cleaning head of FIG. 16 in a transverse section of the brush assembly and the portion of the housing interior where the motor is located, with the upper cover removed;

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FIG. 23 illustrates an elevation view of the upper cover of FIG. 16;

FIG. 24 illustrates a schematic view of the surface cleaning head of FIG. 15 as it moves over a surface to be cleaned;

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FIG. 25 illustrates a schematic view in elevation of a surface cleaning head according to yet another embodiment provided by the present application;

FIG. 26 illustrates a schematic diagram of the transmission relationship between the side brush, the roller and the motor in the surface cleaning head of FIG. 25;

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FIG. 27 illustrates a schematic diagram of the surface cleaning head of FIG. 25 as it moves over a surface to be cleaned.

LIST OF REFERENCE SIGNS

40

100	surface cleaning apparatus	1	surface cleaning head
2	upright bod	21	upright portion
211	upright housing	212	lower connecting end
22	handle portion	221	handle
222	operation panel	223	wand
23	human-computer interaction panel	24	rechargeable battery
25	cleaning liquid tank	26	recovery tank
27	suction motor	11	housing
111	front portion	112	rear portion
113	first sidewall	114	second sidewall
12	brush chamber	121	lower opening
122	side opening	123	top opening
13	brush assembly	131	connecting wall
132	cleaning roller	133	side brush
134	fender	135	connector
1311	inside surface	1312	outside surface
1313	recessed portion	1314	front opening

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(continued)

	1315	locking mechanism	1316	convex portion
	1317	upper end face	1318	bottom opening
5	1319	front side face	1321	cylindrical brush body
	1322	cleaning element	1323	end portion
	1324	end portion	1331	brush holder
	1332	cleaning element	833	side brush
10	8331	brush holder	8332	cleaning element
	933	side brush	9331	brush holder
	9332	cleaning element	14	upper cover
	141	opening	142	water baffle
	15	suction pathway	16	moving wheels
15	17	rotatable joint	181	first liquid spray nozzle
	182	second liquid spray nozzle	183	pump
	191	lower wiper strip	192	upper wiper strip
	110	motor	5	surface cleaning head
20	51	housing	52	brush chamber
	53	brush assembly	54	upper cover
	55	suction pathway	56	moving wheels
	57	rotatable joint	58	liquid spray nozzles
	511	front portion	511	rear portion
25	513	first sidewall	514	second sidewall
	515	side brush	516	locking mechanism
	518	setting	519	shaft
	510	motor	521	lower opening
	522	side opening	523	top opening
30	531	connecting wall	532	cleaning roller
	533	side brush	534	fender
	5311	inside surface	5312	outside surface
	5315	bottom opening	5316	convex portion
35	5317	upper end face	5151	brush holder
	5152	cleaning element	535	connector
	5351	bearing mounting chamber	5352	bearing
	5353	shaft	5321	brush body
40	5322	cleaning element	5323	end portion
	5324	end portion	5325	joint
	5331	brush holder	5332	cleaning element
	5333	surface	542	water baffle
	591	lower wiper strip	6	surface cleaning head
45	61	housing	62	side brush
	611	front portion	612	rear portion
	613	first sidewall	614	second sidewall
	621	wiping surface	63	disk brush
	631	disk-shaped cleaning surface	64	suction nozzle
50	65	motor	300	surface to be cleaned
	400	vertical surface	500	vertical surface.

DETAILED DESCRIPTION OF THE EMBODIMENTS

55 **[0041]** The terms used in the embodiments of the present disclosure are merely used to describe the embodiments of the present application, and not intended to limit the present application.

[0042] Referring to FIG. 1, an embodiment of the present application provides a surface cleaning apparatus 100 being

an upright wet surface cleaning apparatus. The apparatus 100 comprises a surface cleaning head 1 capable of moving backward and forward on a surface to be cleaned, an upright body 2 rotatably attached to the surface cleaning head 1 at a lower portion, a cleaning liquid delivery system for providing a cleaning liquid to the surface cleaning head 1, and a dirt liquid recovery system from the surface to be cleaned. The upright body 2 comprises an upright portion 21 and a handle portion 22 fixedly connected to the upright portion 21 and located on the upper side of the upright portion 21. A lower end of the upright portion 21 is rotationally connected to the surface cleaning head 1. The orientation herein is based on the viewing angle when a user stands at the rear side of the surface cleaning apparatus 100 and pushes the surface cleaning apparatus 100 forward. For the purpose of description relative to the drawings, the terms "up", "down", "right", "left", "back", "front", "lateral", "vertical", "inner", "outside", and derivatives thereof, based on a viewpoint observation when a user stands at the rear side of the surface cleaning apparatus 100 of FIG. 1 and pushes the surface cleaning apparatus 100 forward.

[0043] Referring to FIGS. 2-5, there is provided a surface cleaning head 1 which includes a housing 11 forming a major skeletal portion of the surface cleaning head 1, a brush chamber 12 disposed in the front portion of the housing 11, a brush assembly 13 mounted within the brush chamber 12, and an upper cover 14 mounted on the top of the housing 11. The housing 11 is provided within a suction pathway 15 in fluid communication with the brush chamber 12.

[0044] The housing 11 may be assembled from a plurality of injection molded parts. The housing 11 includes a front portion 111, a rear portion 112, a first sidewall 113, and a second sidewall 114. Wherein, the second sidewall 114 extends further forward than the second sidewall 113. A pair of moving wheels 16 is mounted at the rear portion 112 of the housing 11. The pair of moving wheels 16 is capable of moving the surface cleaning head 1 over the surface to be cleaned.

[0045] As shown in FIG. 6, a motor 110 and a pump 183 are mounted on the inside of the rear portion of the housing 11. An output shaft of the motor 110 is connected by a transmission mechanism to a rotatable joint 17 mounted on the inside of the front portion of the second sidewall 114.

[0046] Continuing as shown in FIGS. 2-5, the front portion of the housing 11 also has a first liquid spray nozzle 181 and a second liquid spray nozzle 182. The first liquid spray nozzle 181 and the second liquid spray nozzle 182 are fluidly connected to the pump 183 to be able to dispense cleaning liquid to the brush assembly 13.

[0047] In other embodiments, the first liquid spray nozzle 181 and/or the second liquid spray nozzle 182 may also be configured to dispense the cleaning liquid directly to the surface to be cleaned. The front portion of the housing 11 is also fitted with a lower wiper strip 191 and an upper wiper strip 192. the upper wiper strip 192 is disposed above the lower wiper strip 191 and below both the first liquid spray nozzle 181 and the second liquid spray nozzle 182. In this example, the lower wiper strip 191 is a flexible strip, which is located at the bottom of the housing 11 and is configured to contact the surface to be cleaned. The upper wiper strip 191 is made of a rigid material, which is capable of contacting a cleaning roller 132 to remove excess liquid from the cleaning roller 132 that is rotating and liquid-impregnated.

[0048] The brush chamber 12 is defined by the front portion 111 of the housing 11, the first sidewall 113 and a second sidewall 114 together. An opening at one end of the suction pathway 15 is located in the front portion of the housing 11 and is in fluid communication with the brush chamber 12. The brush chamber 12 has a lower opening 121 facing the surface to be cleaned, a laterally outward side opening 122, and a top opening 123. In this embodiment, the lower wiper strip 191 would be capable of defining the rear edge of the lower opening 121.

[0049] As shown in FIG. 7, the brush assembly 13 is an integral assembly comprising a connecting wall 131, a cleaning roller 132 disposed on one side of the connecting wall 131, a side brush 133 disposed on the other side of the connecting wall 131, a fender 134 mounted to the connecting wall 131 and on the same side as the side brush 133. The cleaning roller 132 and the side brush 133 are mechanically coupled together, and they are capable of rotating relative to the connecting wall 131 together to rotate around a transverse axis X1.

[0050] Referring to FIG. 8, the connecting wall 131 may be a one-piece injection molded component or may be assembled from a plurality of parts. The body of the connecting wall 131 is a shell extending front to back and having a thickness. The connecting wall 131 includes an inside surface 1311 and an outside surface 1312 opposite to each other. The rear portion of the inside surface 1312 has a convex portion 1316 projecting transversely inwardly. The convex portion 1316 is fitted with an operable locking mechanism 1315. With the help of the locking mechanism 1315, the connecting wall 131 can be locked on the front portion of the housing 11. The outside surface 1312 has a recessed portion 1313 which is constructed to receive the side brush 133. The recessed portion 1313 intersects with the lower opening 121 of the brush chamber 12, i.e., the recessed space formed by the recessed portion 1313 is fluidly connected to the lower opening 121. The upper portion of the connecting wall 131 has an upper end face 1317. The lower portion of the connecting wall 131 has a bottom opening 1318. The front portion of the connecting wall 131 has a front side face 1319 as well as a front opening 1314 disposed directly in front of the recessed portion 1313. The front opening 1314 is in communication with the recessed portion 1313.

[0051] Continuing as shown in FIG. 7, the cleaning roller 132 comprises a cylindrical brush body 1321 and a cleaning element 1322 covering a peripheral surface of the cylindrical brush body 1321. The cleaning element 1322 may be composed of soft lint of one or plural specifications, such as cotton fiber lint, PP fiber lint, etc. The lint is preferably made of materials that can be moistened by liquid. One end portion 1323 of the cleaning roller 132 will be rotatably supported

on the inside surface 1312 of the connecting wall 131 by a connector 135. The cleaning roller 132 is removal provided on the connecting wall 131.

[0052] As shown in FIG. 9a, the side brush 133 comprises a brush holder 1331 and a cleaning element 1332 disposed on the brush holder 1331. The cleaning element 1332 contains a plurality of softer bristle tufts with short scraping blades. The cleaning element 1332 is distributed along a circumference whose center falls on the transverse axis X1, i.e. along the peripheral surface of the brush holder 1331.

[0053] As shown in FIG. 9b, a side brush 833 comprises a brush holder 8331 and a cleaning element 8332 disposed on the brush holder 8331. The cleaning element 8332 contains only a plurality of bristle tufts. The cleaning element 8332 is distributed along the circumference of a circle whose center falls on the transverse axis X11, i.e., along the peripheral surface of the brush holder 8331.

[0054] As shown in Fig. 9c, a side brush 933 comprises a brush holder 9331 and a cleaning element 9332 provided on the brush holder 9331. The cleaning element 9332 is flexible cleaning pads. The cleaning element 9332 is set or affixed to the entire periphery of the brush holder 9331.

[0055] Referring to FIGS. 4, 7, and 8, the side brush 133 is rotatably supported on the outside surface 1311 of the connecting wall 131 and disposed within the recessed portion 1313. The side brush 133 is also provided to be individually removable from the connecting wall 131. When the side brush 133 is mounted within the recessed portion 1313 of the outside surface 1312, the front portion of the cleaning element 1332 will be exposed outwardly via the front opening 1314 located in the front portion.

[0056] Referring to FIG. 10, a portion of the cleaning element 1332 of the side brush 133 is angled in an inward direction and twists as the side brush 133 is rotated so as to pass through a bottom opening 1318 of the connecting wall 131.

[0057] Referring to FIG. 11, the side brush 133, 833, or 933 can all be mounted within the recessed portion 1313 of the connecting wall 131. When the brush assembly comprising the side brush together with the cleaning rollers 132 is installed in the brush chamber 12, the side brush can be individually removed from the recessed portion 1313 of the connecting wall 131 without removing the brush assembly.

[0058] Referring to FIG. 8, the fender 134 is a curved flexible member that is fixedly disposed on the outside surface 1311 of the connecting wall 131 and surrounds the upper portion of the side brush 133. The fender 134 can effectively shield the liquid and dirt thrown out from the side brush 133. When the fender 134 is in contact with a surface perpendicular to the surface to be cleaned (such as a surface such as a low wall, etc.), the fender 134 can facilitate the formation of a sealing offset effect with the surface, thereby facilitating the formation of an effective negative pressure space at the recessed portion 1313 where the side brush 133 is located. This is more conducive to better utilizing the suction force to transfer the dirt around the side brush 133.

[0059] In some embodiments, at least a portion of the cleaning element 1332 of the side brush 133 protrudes outwardly from the recessed portion 1313 laterally from the outside surface 1311. In this way, when the outside surface 1311 is moved to a surface that is similar to a wall surface, the cleaning element 1332 enable scrubbing of the surface. In other embodiments, the cleaning element 1332 may also be completely housed within the recessed portion 1313. In some embodiments, the recessed portion 1313 is not necessary, such as where the outside surface of the connecting wall is nearly a flat surface on which the side brush is mounted directly. However, in some embodiments in which a recessed portion and a fender are provided on the outside surface of the connecting wall, whether the cleaning element can protrude outwardly or not depends on the depth of the recess of the recessed portion and the left and right widths of the fender.

[0060] Referring to FIG. 12, when the brush assembly 13 is mounted in the brush chamber 12, the connecting wall 131 intersects the first sidewall 113 front to back. The other end portion 1324 of the cleaning roller 132 is mechanically coupled to the rotatable joint 17. A locking mechanism 1315 on the connecting wall 131 locks onto the housing 11, thereby enabling positioning of the brush assembly 13 within the brush chamber 12. The connecting wall 131 covers most of the side opening 122 of the brush chamber 12, and a portion of the outside surface 1312 of the connecting wall 131 constitutes a portion of the side outer contour surface of the surface cleaning head 1. The cleaning element 1322 of the lower part of the cleaning roller 132 will pass through the lower opening 121 to contact the surface to be cleaned. The cleaning element 1332 of the lower part of the side brush 133 also pass through the lower opening 121 to contact the surface to be cleaned. The first liquid spray nozzle 181 is facing the cleaning rollers 132, the second liquid spray nozzle 182 is facing the side brushes 133, and the upper wiper strip 192 rests against the cleaning rollers 132 from the rear.

[0061] Continuing as shown in FIG. 12, the upper cover 14, is removably provided on the top of the housing 11. When the upper cover 14 is attached to the top of the housing 11, the upper cover 14 is located on the upper side of the brush assembly 13 and the upper cover 14 rest against the upper face 1317 of the connecting wall 131, and the upper cover 14 is capable of obscuring a portion of the top opening 123 of the brush chamber 12. In the embodiment, the upper cover 14 relies on being locked to the housing 11 by cooperating with the locking mechanism 115 located on the top of the housing 11. The top of the upper cover 14 also has an opening 141 through which a portion of the lock mechanism 1315 on the connecting wall 131 will be able to protrude externally for a user to operate the lock mechanism 1315 on the exterior of the brush chamber. The brush assembly 13 cannot removed from the brush chamber 12 until after the

upper cover 14 is removed from the housing 11.

[0062] As shown in FIG. 13, the inner surface of the upper cover 14 is provided with a water baffle 142, which resists the cleaning element 1322 of the cleaning roller 132 when the upper cover is mounted on the housing 11. The water baffle 142 not only can remove the liquid applied to the cleaning roller 132, but also can effectively prevent the liquid from flowing to the surface to be cleaned without passing through the cleaning roller 132 but directly from the gap between the cleaning roller 132 and the upper cover 14.

[0063] Continuing to refer to FIG. 1, the handle portion 22 has a handle 221 for a user to hold, an operation panel 222 disposed on the handle 221, and a wand 223 supporting the handle 221. A pair of ends of the wand 223 are fixedly coupled to the handle 221 and the upper end of the upright portion 21. Respectively, the operation panel 222 is not limited to the form of a pushbutton, a sliding knob, a trigger, etc.

[0064] The upright portion 21 includes an upright housing 211 and a lower connecting end 212 disposed at a lower end of the upright housing 211. The upright housing 211 constitutes an external skeleton of the upright portion 21 and is capable of holding a number of components, and the lower connecting end 212 is pivotally coupled to the surface cleaning head 1 to enable the upright body 2 to pivot relative to the surface cleaning head 1. An upper end of the upright housing 211 is provided with a human-computer interaction panel 23. The human-computer interaction panel 23 is configured to enable a user to control the surface cleaning apparatus 100 as well as to display to the user an operating status of the surface cleaning apparatus 100. The rear portion of the upright housing 211 is also configured with a rechargeable battery 24, which provides power to the energy-consuming components of the surface cleaning apparatus 100 and is configured to be electrically connected to an external power source.

[0065] The cleaning liquid delivery system includes a cleaning liquid tank 25 for storing and providing cleaning liquid to the outside, the first liquid spray nozzle 181 and the second liquid spray nozzle 182 are provided on the surface cleaning head 1, a liquid delivery pathway (not shown in the drawings) that fluidly connects the cleaning liquid tank 25 to the spray nozzles, and the pump 183 provided in the liquid delivery pathway and driving the cleaning fluid through the liquid delivery pathway. The cleaning liquid tank 25 is detachably connected to the upright housing 211 to facilitate a user to add cleaning liquid thereto. Wherein the cleaning liquid is not limited to being water, sanitized water with a disinfectant added, and a detergent solution with a cleaning agent added.

[0066] The first liquid spray nozzle 181 has a plurality of spray orifices. The plurality of spray orifices are arranged in a left-right direction and located at a rear side of the cleaning roller 132. In terms of the direction of rotation of the cleaning roller 132, the first liquid spray nozzle 181 is located downstream of the upper wiper strip 192. The water baffle 142 is located downstream of the first liquid spray nozzle 181.

[0067] The dirty liquid recovery system includes a recovery tank 26 for accepting and storing the foul fluid, a recovery pathway to achieve fluid communication between the recovery tank 26 and the brush chamber 12, and a suction motor 27 for generating negative vacuum pressure. The recovery tank 26 is configured to be removably attached to the upright housing 211 to facilitate a user in dumping the internal foul fluid. The suction motor 27 is disposed within the upright housing 211 and is fluidly connected to the recovery tank 26. Among other things, the recovery pathway includes a suction pathway 15 disposed within the housing 11, wherein the suction pathway 15 is upwardly connected to the recovery tank 26.

[0068] The following illustrates the working principle of the surface cleaning apparatus 100. For the sake of simplicity and clarity of the illustration, only the surface cleaning head 1 portion of the surface cleaning apparatus 100 is shown in the drawings as follows.

[0069] As shown in FIG. 14, the surface cleaning head 1 performs a cleaning operation on the surface 300 to be cleaned. The pump 183 is activated, and under the action of the pump 183, the cleaning liquid in the cleaning liquid tank 25 will be delivered to the first liquid spray nozzle 181 and the second liquid spray nozzle 182, which will then be dispensed to the cleaning rollers 132 and the side brush 133. The motor 110 starts and drives the cleaning rollers 132 and side brushes 133 to rotate, and the cleaning rollers 132 and side brush 133 wetted by the cleaning liquid can realize the wet cleaning of the surface to be cleaned at the location.

[0070] The suction motor 27 is activated and generates a negative vacuum pressure in the fluid pathway from the lower opening 121 to the suction motor 27. Under the negative vacuum pressure, the dirt liquid at the lower opening 121 and the dirt liquid scraped by the upper scraping strip 192 from the cleaning rollers 132 will be sucked into the suction pathway 15 together with the air and further sent to the recovery tank 26, where the solid dirt and the liquid will be retained in the recovery tank 26, and the clean air will be discharged to the outside after passing through the suction motor 27.

[0071] And when the surface cleaning head 1 is close to the position of the vertical surface 400, the fender 134 will be affixed to the vertical surface 400 to form a negative vacuum pressure space at the recessed portion 1313. At this time, the rotating cleaning roller 132 can continuously brush the surface to be cleaned located below it. The rotating side brush 133 will brush the portion of the surface to be cleaned located directly below the side brush 133, i.e., the portion of the surface 300 to be cleaned that intersects with the vertical surface 400. At this point, in the embodiment in which a portion of the cleaning element 1332 of the side brush 133 protrude laterally outwardly from the recessed portion 1313,

the portion of the cleaning element 1332 that protrudes outwardly from the recessed portion 1313 will enable scrubbing of the portion of the vertical surface 400. Since the portion of the cleaning element 1332 of the side brush 133 will be able to twist and reach out from the bottom opening 1318 of the connecting wall 131 to a position close to the cleaning roller 132 when rotating, it facilitates brushing of a portion of the surface 300 to be cleaned directly below the connecting wall 131, which can facilitate elimination of the cleaning blind zone between the cleaning roller 132 and the side brush 133 and located directly below the connecting wall 131.

[0072] Referring to FIG. 15, an embodiment of the present application provides a surface cleaning head 5. As shown in FIGS. 16-19, the surface cleaning head 5 comprises a housing 51 forming a major skeletal portion of the surface cleaning head 5, a brush chamber 52 disposed in a front portion of the housing 51, a brush assembly 53 disposed within the brush chamber 52, and an upper cover 54 mounted on an upper portion of the housing 51. The interior of the housing 51 is disposed in fluid connection with the brush chamber 52, with a suction pathway 55.

[0073] The housing 51 may be assembled from a plurality of injection-molded parts, with the housing 51 having a front portion 511, a rear portion 512, a first sidewall 513, and a second sidewall 514. wherein the second sidewall 514 extends further forward than the second sidewall 513. A pair of moving wheels 56 is mounted on the rear portion of the housing 51. The pair of moving wheels 56 is capable of moving the surface cleaning head 5 over the surface to be cleaned. A motor 510 and a pump (not shown in the drawings) are mounted on the inside of the rear portion of the housing 51, and an output shaft of the motor 510 is connected via a transmission mechanism to a rotatable joint 57 mounted on the inside of the front portion of the second sidewall 514. The front part of the housing 51 is also fitted with a lower wiper strip 591. The lower wiper strip 591 is a rigid element, which is located at the bottom of the housing 51 and can be integrally formed with the top of the housing 51, and which is configured to be able to contact the surface to be cleaned. In the embodiment, a rotatable side brush 515 is also mounted on the outside surface of the second sidewall 514, and the side brush 515 can also be simultaneously driven to rotate by the motor 510. In other embodiments, the side brush 515 can be removed.

[0074] The brush chamber 52 is defined by the front of the housing 51, the first sidewall 513 and the second sidewall 514 together. An opening at one end of the suction pathway 55 is located in the front portion of the housing 51 and is in fluid communication with the brush chamber 52. The brush chamber 52 has a lower opening 521 facing the surface to be cleaned, a laterally outward side opening 522, and a top opening 523. In the embodiment, the lower wiper strip 591 is able to define the rear edge of the lower opening 521. The bottom of the housing 51 is also provided with a flexible scraping strip 593 at the rear side located in the lower opening 521, the flexible scraping strip 593 being able to contact the surface to be cleaned in order to push the trash to the lower opening 521.

[0075] As shown in FIGS. 20-21, the brush assembly 53 is an integral assembly comprising a centrally located connecting wall 531, a cleaning roller 532 disposed on one side of the connecting wall 531, a side brush 533 disposed on the other side of the connecting wall 531, and a fender 534 mounted to the connecting wall 531 on the same outer side as the side brush 533. the cleaning roller 532 and the side brush 533 are mechanically coupled together, and they are able to rotate together around a transverse axis X2 relative to the connecting wall 531.

[0076] The connecting wall 531 may be a one-piece injection molded component or may be assembled from a plurality of parts. The main body of the connecting wall 531 is a shell extending front-to-back and having a thickness. The connecting wall 531 has an inside surface 5311 and outside surfaces 5312 opposite to each other, wherein the rear portion of the inside surface 5312 has a convex portion 5316 protruding transversally inwardly, which can be connected to a locking mechanism 516 provided on the front portion 511 and operable by a user. With the aid of the locking mechanism 516, the connecting wall 531 can be locked in place with a locking mechanism 516. The connecting wall 531 can be locked to the housing 51. The upper portion of the connecting wall 531 has an upper end face 5317 and the lower portion of the connecting wall 531 has a bottom opening 5315.

[0077] The cleaning roller 532 comprises a cylindrical brush body 5321 and a cleaning element 5322 covering a peripheral surface of the cylindrical brush body 5322. The cleaning element 5322 may be made up of one or plural sizes of soft lint, such as cotton fiber lint, PP fiber lint, etc., and the lint is preferably made of a material that can be moistened by liquid. One end portion 5323 of the cleaning roller 532 will be rotationally supported on the inside surface 5312 of the connecting wall 531 by a connector 535. A joint 5325 is provided at the other end portion 5324 of the cleaning roller 532. the cleaning roller 532 is provided so that it can be removed from the connecting wall 531.

[0078] The side brush 533 includes a brush holder 5331 and a cleaning element 5332 provided on the brush holder 5331. The side brush 533 is provided so as to be removable from the connecting wall 531. The brush holder 5331 has an outwardly facing surface 5333 with a transverse axis X2 through the surface 5333. The cleaning element 5332 is arranged on the surface 5333 and projects laterally on the outside surface 5311 of the connecting wall 531. In the present embodiment, the cleaning elements 5332 is a scouring pad material constructed so as to be integrally detachable from the surface 5333 of the brush holder 5331. In other embodiments, the cleaning elements 5332 may also include at least one of softer bristle tufts, sponge blocks, and rubber strips.

[0079] In the embodiment, the connector 535 is fixedly mounted on the connecting wall 531, and the connector 535 includes a bearing mounting chamber 5351 formed on the inside surface 5311 of the connecting wall 531, a bearing 5352 mounted on the bearing mounting chamber 5351, and a shaft 5353 rotationally supported on the bearing 5352.

The shaft 5353 is fixedly connected at one end to one end portion 5323 of the cleaning roller 532 and the other end is fixedly connected to the brush holder 5331 of the side brush 533.

[0080] The fender 534 is a curved flexible member that is fixedly disposed on the outside surface 5311 of the connecting wall 531 and surrounds the upper portion of the side brush 533. The fender 534 provides an effective shield against liquids and dirt thrown from the side brush 533, and the fender 534 also facilitates a sealing effect with a surface perpendicular to the surface to be cleaned, such as a low wall, which facilitates a better utilization of suction to transfer dirt that is in the vicinity of the side brush 533.

[0081] Referring to FIG. 22, when the brush assembly 53 is mounted within the brush chamber 52, the connecting wall 531 intersects the first sidewall 513 front to back. The joint 5325 at the other end portion 5324 of the cleaning roller 532 is mechanically coupled to the rotatable joint 57. The lock mechanism 516 at the front of the housing 511 locks the convex portion 5316 on the connecting wall 531 to the housing 51, thereby enabling positioning of the entire brush assembly 53 within the brush chamber 52. The connecting wall 531 covers most of the side openings 522 of the brush chamber 52, and a portion of the outside surface 5312 of the connecting wall 531 forms a portion of the side outer contour surface of the surface cleaning head 5. The cleaning element 5322 of the lower part of the cleaning roller 532 and the cleaning element 5332 of the lower part of the side brush 533 pass through the lower opening 521 to contact the surface to be cleaned. The side brush 515 has a brush holder 5151 and a cleaning element 5152 provided on the brush holder 5151, and the transverse axis X3 around which the side brush 515 is oriented is in the same straight line as the transverse axis X2. The brush holder 5151 is fixedly mounted on a setting 518, which is fixedly connected to the rotary joint 57 by an axle 519, and the motor 510 is capable of simultaneously driving the rotatable joint 57 and the setting 518 to rotate when it is in operation, so as to realize simultaneous driving of the cleaning rollers 532, the side brush 533 and the side brush 515 of the brush assembly 53 to rotate.

[0082] Referring to FIG. 23, the upper cover 54, is removably provided on the upper portion of the housing 51. When the upper cover 54 is attached to the housing 51, the upper cover 54 is located on the upper side of the brush assembly 53 and the upper cover 54 rests against the upper face 5317 of the connecting wall 531. The upper cover 54 is able to obscure the top opening 523 of the brush chamber 52.

[0083] In the embodiment, the upper cover 54 is locked to the housing 51 by virtue of a locking mechanism (not shown in the figures) located on the top of the housing 51. A water baffle 542 and a plurality of liquid spray nozzles 58 are provided on an inner wall surface of the upper cover 54. the plurality of liquid spray nozzles 58 are capable of dispensing cleaning liquid to the cleaning roller 532 and the side brush 533 of the brush assembly 53 and to the side brush 515. The plurality of liquid spray nozzles 58 in the center are facing the cleaning roller 532, one of the liquid spray nozzles 58 located at a side end portion is facing the side brush 533, and one of the liquid spray nozzles 58 at another side end portion is facing the side brush 515. In other embodiments. The liquid spray nozzles may also be configured to dispense cleaning liquid directly to the surface to be cleaned. The water baffle 542 will be against the cleaning element 5322 of the cleaning roller 532 when the upper cover 54 is mounted on the housing 51. The water baffle 542 will not only scrape the liquid applied to the cleaning roller 132, but it will also be effective in stopping the liquid from flowing directly from the gap between the cleaning roller 532 and the upper cover 54 to the surface to be cleaned without passing through the cleaning roller 532. The brush assembly 53 will not be removed from the brush chamber 52 until after the upper cover 54 has been removed from the housing 51.

[0084] Referring to FIG. 24, as the surface cleaning head 5 moves over the surface 300 to be cleaned, it is able to brush the surface 300 to be cleaned utilizing the cleaning roller 532 and the side brush 533 in the brush assembly 53, and as the first sidewall 513 moves closer to the position of the vertical surface 400 that is perpendicular to the surface 300, the fender 534 will be adhered to the vertical surface 400, and at the same time the side brushes 533 will also be adhered to the vertical surface 400, thereby realizing brushing of the portion of the vertical surface 400 in contact with it during rotation. When the second sidewall 514 is moved to a position close to the vertical surface 500 perpendicular to the surface 300, the rotating side brush 515 will realize brushing the part of the vertical surface 500 in contact with it.

[0085] Referring to FIG. 25, an embodiment of the present application provides a surface cleaning head 6 comprising a housing 61 capable of moving over the surface 300 to be cleaned. The housing 61 comprises a front portion 611, a rear portion 612, a first sidewall 613 and a second sidewall 614. The first sidewall 613 is provided with a side brush 62 capable of rotating around a transversal axis X4 on an outer wall surface.

[0086] The side brush 62 has a wiping surface 621 and projects laterally outwardly with respect to the outer wall surface of the first sidewall 613. The wiping surface 621 comprises at least one of scouring pad material, softer bristle tufts, sponge blocks and rubber strips, which is capable of satisfying the need for a clean wiping of the surface. The material of the wiping surface 621 may be composed of polyester or polyamide, etc., or any other suitable material known in the art constituting lint that can be used for cleaning surfaces, the preferred material being a liquid wettable material. In the embodiment, the wiping surface 621 is in the shape of a disk, in other embodiments the wiping surface may also be in the shape of a zigzag or an "S".

[0087] A pair of disk brushes 63 and a suction nozzle 64 are also arranged at the bottom of the housing 61. The pair of disk brushes 63 are disposed from side to side and are capable of rotating around longitudinal axis Y1 and axis Y2

respectively. The pair of disk brushes 63 each comprises a disk-shaped cleaning surface 631 capable of rotating within the surface 300 to be cleaned. The suction nozzle 64 is located on the front side of the pair of disk-shaped cleaning surfaces 631. Airflow, debris, and dirt liquid stirred up by the side brush 62 and the pair of disk brushes 63 will be drawn by the suction nozzles 64 into the interior of the housing 61. In other embodiments, the disk brushes 63 may also be replaced by oscillating brushes capable of translating in a side-to-side or front-to-back direction or fixed brushes that are not self-movable. The cleaning surface may also be of an oblong shape.

[0088] As shown in FIG. 26, a motor 65 is also arranged inside the housing 61. The motor 65 simultaneously drives a pair of disk brushes 63 to rotate, the pair of disk brushes 63 rotating in opposite directions at all times. The side brushes 62 are likewise driven to rotate by the motor 65. Therein, in order to satisfy the perpendicularity of the axis of rotation of the pair of disk brushes 63 and the side brush 62, a necessary commutation mechanism is provided between the motor 65 to the pair of disk brushes 63 and the side brush 62.

[0089] As shown in FIG. 27, when the surface cleaning head 6 is in operation, as the housing 61 moves back and forth within the surface 300, a pair of disk brushes 63 rotate simultaneously under the drive of the motor 65. During rotation, the disk-shaped cleaning surface 631 of the disk brushes 63 continuously contact the surface 300 to realize wet wiping of the surface 300 with the aid of a cleaning solution. When the first sidewall 313 moves close to the vertical surface 500 perpendicular to the surface 300 to be cleaned, the first sidewall 313 moving to a vertical surface 500 perpendicular to the surface 300 to be cleaned, the side brush 62 rotating, the wiping surfaces 621 continuously contact the vertical surface 500 to wet wipe the vertical surface 400 with the aid of the cleaning liquid. The airflow, debris, and dirty liquid stirred up by the pair of disk brushes 63 and the side brush 62 enter into the interior of the housing 61 from the suction nozzles 64 together.

[0090] The surface cleaning head in the above embodiment can be utilized in various types of surface cleaning apparatus, such as vertical surface cleaning apparatus, self-moving surface cleaning robots, and the like, which enable a surface cleaning apparatus fitted with the surface cleaning head of the embodiment to simultaneously satisfy the cleaning of target surfaces, such as surfaces of corner areas of a wall close to the wall.

[0091] In the description of the present specification, the description with reference to the term "embodiment" or the like means that specific features, structures, materials, or characteristics described in connection with the embodiment or example are included in at least one embodiment or example of the present invention. In this specification, schematic expressions of the above terms do not necessarily refer to the same embodiment or example. Moreover, the specific features, structures, materials, or characteristics described may be combined in any one or more embodiments or examples in a suitable manner.

Claims

1. A surface cleaning apparatus including a surface cleaning head movable along a surface to be cleaned, a cleaning liquid delivery system having a cleaning liquid tank, and a dirty liquid recovery system having a suction source and a recovery tank, wherein the surface cleaning head comprises:

a housing;

a suction pathway located within the housing;

a brush chamber provided at a forward portion of the housing in fluid communication with the suction pathway and having a lower opening facing the surface to be cleaned and a laterally outward side opening; and

a brush assembly removably mounted in the brush chamber and comprising a connecting wall, a cleaning roller and a side brush, the connecting wall removably connected to the housing and covering at least a portion of the side opening, the connecting wall having an inside surface and an outside surface, an end of the cleaning roller mounted on the inside surface and the side brush mounted on the outside surface, the cleaning roller driven by a drive device to rotate around a transverse axis, wherein the side brush is mechanically coupled to the cleaning roller to follow the cleaning roller around the transverse axis.

2. The surface cleaning apparatus of claim 1, wherein the brush assembly comprises a fender mounted on the outside surface of the connecting wall, the fender surrounding at least an upper portion of the side brush, and wherein at least a portion of the fender protrudes laterally from the outside surface of the connecting wall.

3. The surface cleaning apparatus of claim 2, wherein at least a portion of the fender is made of a flexible material.

4. The surface cleaning apparatus of claim 1, wherein the side brush comprises a brush holder and one or more cleaning elements disposed on the brush holder.

5. The surface cleaning apparatus of claim 4, wherein at least a portion of the one or more cleaning elements are distributed along a circumference around the transverse axis.
- 5 6. The surface cleaning apparatus of claim 4, wherein the outside surface of the connecting wall has a recessed portion intersected with the lower opening, and wherein the recessed portion is adapted to receive the side brush.
7. The surface cleaning apparatus of claim 6, wherein a forward portion of the connecting wall has a front opening located directly in front of and in communication with the recessed portion, and wherein a portion of the one or more cleaning elements are exposed outwardly through the front opening.
- 10 8. The surface cleaning apparatus of claim 4, wherein a lower portion of the connecting wall has a bottom opening, and wherein a portion of the one or more cleaning elements are inclined in an inward direction and pass through the bottom opening.
- 15 9. The surface cleaning apparatus of claim 4, wherein the one or more cleaning elements comprise bristle tufts.
10. The surface cleaning apparatus of claim 4, wherein the cleaning roller and the side brush are removable from the connecting wall.
- 20 11. The surface cleaning apparatus of claim 10, wherein the side brush is configured to be individually removable from the connecting wall when the brush assembly is mounted in the brush chamber.
12. The surface cleaning apparatus of claim 4, wherein the brush holder has an outer surface through by the transverse axis, and wherein at least a portion of the one or more cleaning elements are arranged on the outer surface.
- 25 13. The surface cleaning apparatus of claim 12, wherein the one or more cleaning elements comprise at least one of scouring pad material, softer bristle tufts, sponge blocks and short scraping blades.
14. The surface cleaning apparatus of claim 12, wherein the one or more cleaning elements are configured to be integrally separable from the outer surface.
- 30 15. The surface cleaning apparatus of claim 4, wherein at least a portion of the one or more cleaning elements protrude laterally from the outside surface of the connecting wall.
- 35 16. The surface cleaning apparatus of claim 1, wherein the surface cleaning head comprises an upper cover removably disposed on the top of the housing, and wherein the brush assembly is configured to be removed from the brush chamber only after the upper cover is removed from the housing.
- 40 17. The surface cleaning apparatus of claim 16, wherein the connecting wall has an upper surface, and wherein the upper cover mounted on the top of the housing contacts the upper surface.
18. The surface cleaning apparatus of claim 17, wherein the surface cleaning head comprises a water baffle arranged at an inner surface of the upper cover, and wherein the water baffle contacts the cleaning roller when the upper cover is mounted on the top of the housing.
- 45 19. The surface cleaning apparatus of claim 1, wherein a portion of the outside surface of the connecting wall defines a portion of a side contour of the surface cleaning head.
20. The surface cleaning apparatus of claim 1, wherein the surface cleaning head comprises a lower wiper strip disposed at the bottom of the housing and an upper wiper strip adapted to contact the cleaning roller to remove excess liquid from the cleaning roller wetted with liquid, and wherein the lower wiper strip adapted to contact the surface to be cleaned defines at least a portion of a rear side edge of the lower opening.
- 50 21. The surface cleaning apparatus of claim 1, wherein the cleaning liquid delivery system comprises a first liquid spray nozzle for the cleaning roller and a second liquid spray nozzle for the side brush, and wherein the first liquid spray nozzle and second liquid spray nozzle are fluidly connected to the cleaning liquid tank.
- 55 22. The surface cleaning apparatus of claim 1, wherein the apparatus is an upright apparatus comprising an upright

body having an upright portion and a handle portion connected to the upright portion, a lower end of the upright portion pivotally connected to the surface cleaning head, and wherein the cleaning liquid tank, the recovery tank and the suction motor are arranged on the upright portion.

- 5 **23.** The surface cleaning apparatus of claim 1, wherein the apparatus is a self-moving robot.
- 24.** A surface cleaning head, adapted to move back and forth across a surface to be cleaned, comprising:
 - 10 a pair of lateral sides set opposite each other on the left and right;
 a driving device; and
 at least one side brush arranged on at least one of the lateral sides and configured to be capable of being driven by the driving device to rotate around a transverse axis through the lateral sides, and wherein at least a portion of each of the at least one side brush is exposed outwardly from a corresponding portion of the lateral sides.
- 15 **25.** The surface cleaning head of claim 24, further comprising a cleaning roller driven by the drive device to rotate around the transverse axis and disposed between the lateral sides, and wherein each of the at least one side brush is disposed to the left or the right of the cleaning roller.
- 20 **26.** The surface cleaning head of claim 25, wherein one of the lateral sides comprises a first sidewall and a connecting wall removably coupled to a front side of the first sidewall, the connecting wall having an inside surface and an outside surface, and wherein one of at least one side brush is mounted on the outside surface and an end of the cleaning roller is supported on the inside surface.
- 25 **27.** The surface cleaning head of claim 26, wherein the connecting wall, the cleaning roller, and the at least one side brush mounted on the connecting wall form together at least a portion of a brush assembly removable from the surface cleaning head.
- 30 **28.** The surface cleaning head of claim 27, and further comprising a housing defining the first sidewall and a second sidewall, a brush chamber disposed in a front portion of the housing, the brush chamber having a lower opening facing the surface to be cleaned and a laterally outward side opening, and wherein the brush assembly is removably mounted in the brush chamber and the connecting wall is removably attached to the housing and covers at least a portion of the side opening.
- 35 **29.** The surface cleaning head of claim 28, and further comprising a suction pathway located within the housing, and wherein the suction pathway is in fluid communication with the brush chamber.
- 40 **30.** The surface cleaning head of claim 29, wherein the brush assembly comprises a fender mounted on the outside surface of the connecting wall and surrounding at least an upper portion of the side brush, and wherein at least a portion of the fender protrudes laterally from the outside surface of the connecting wall.
- 45 **31.** The surface cleaning head of claim 27, wherein the brush assembly comprises a connector provided on the connecting wall, the connector having a bearing fixedly provided on the connecting wall and a shaft rotatably supported on the bearing, and wherein one end of the shaft is connected to an end of the cleaning roller and the other end of the shaft is connected to the side brush.
- 50 **32.** The surface cleaning head of claim 24, and further comprising at least one disk brush disposed at the bottom and between the lateral sides, and wherein each of the at least one disk brush rotates around a longitudinal axis.
- 33.** The surface cleaning head of claim 32, wherein the rotation of the at least one disk brush is simultaneously driven by the driving device.
- 34.** The surface cleaning head of claim 32, and further comprising a suction nozzle provided at the bottom and located at the front side of the at least one disk brush.
- 55 **35.** The surface cleaning head of claim 24, and further comprising a pair of the side brushes respectively arranged at the lateral sides.

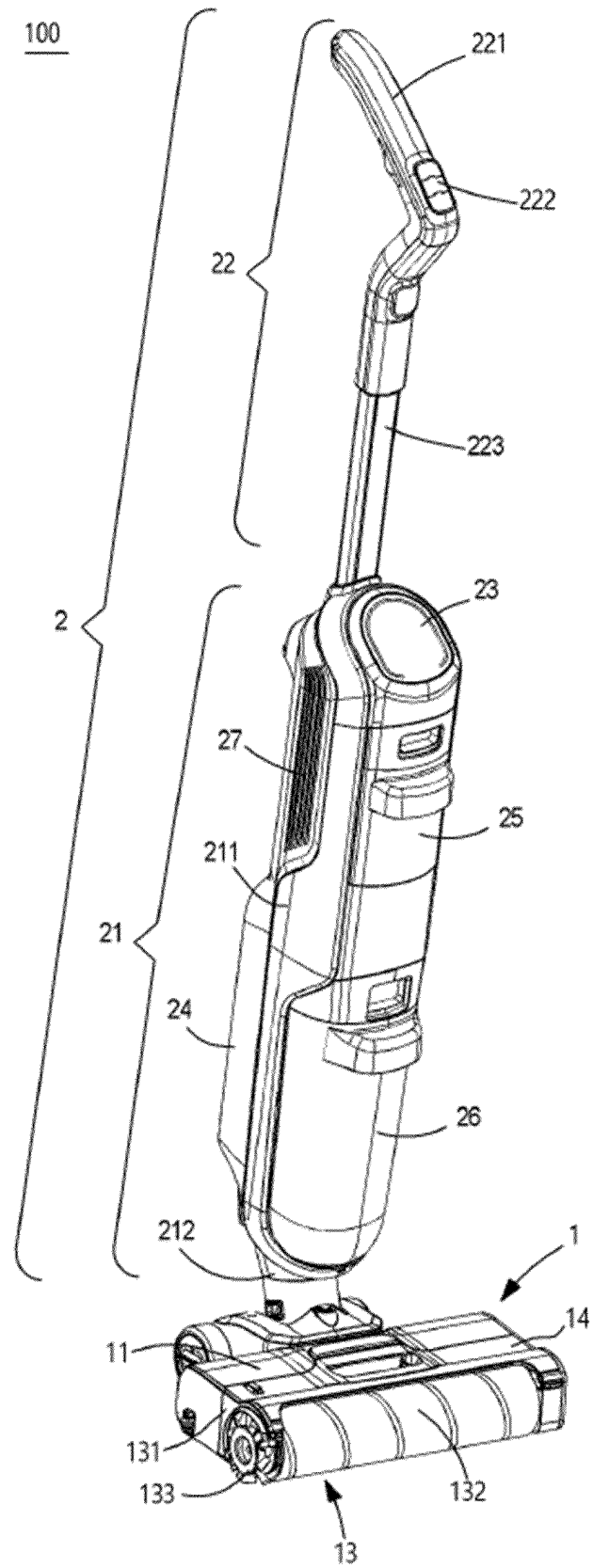


FIG.1

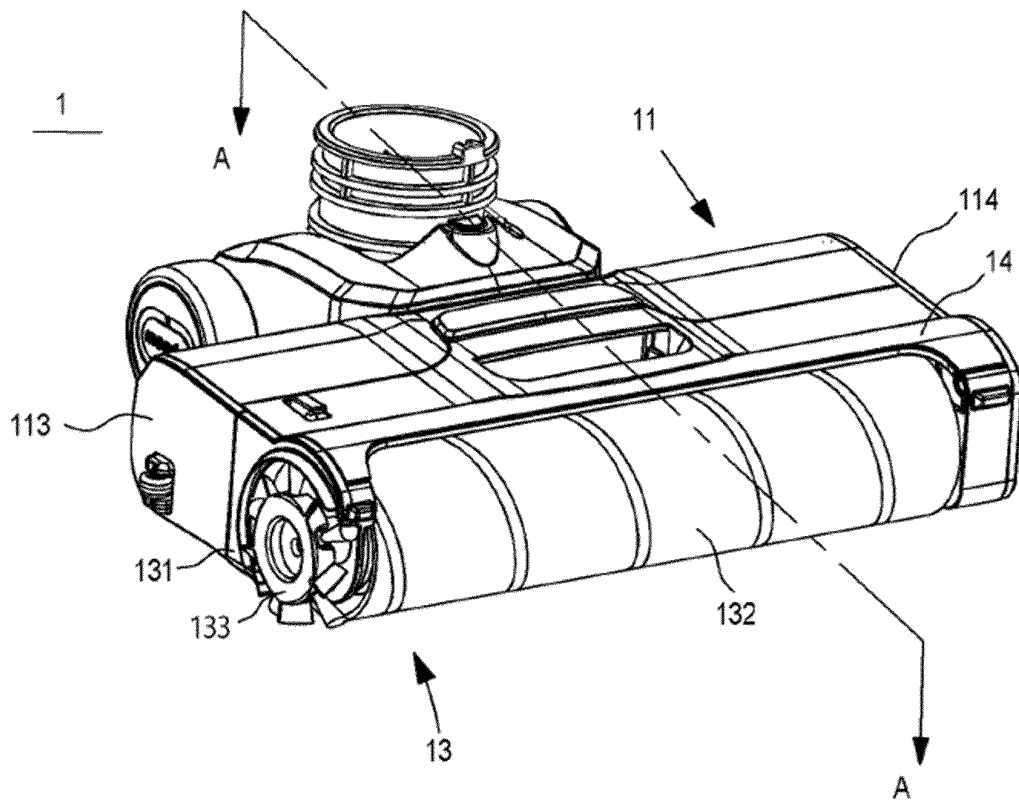


FIG. 2

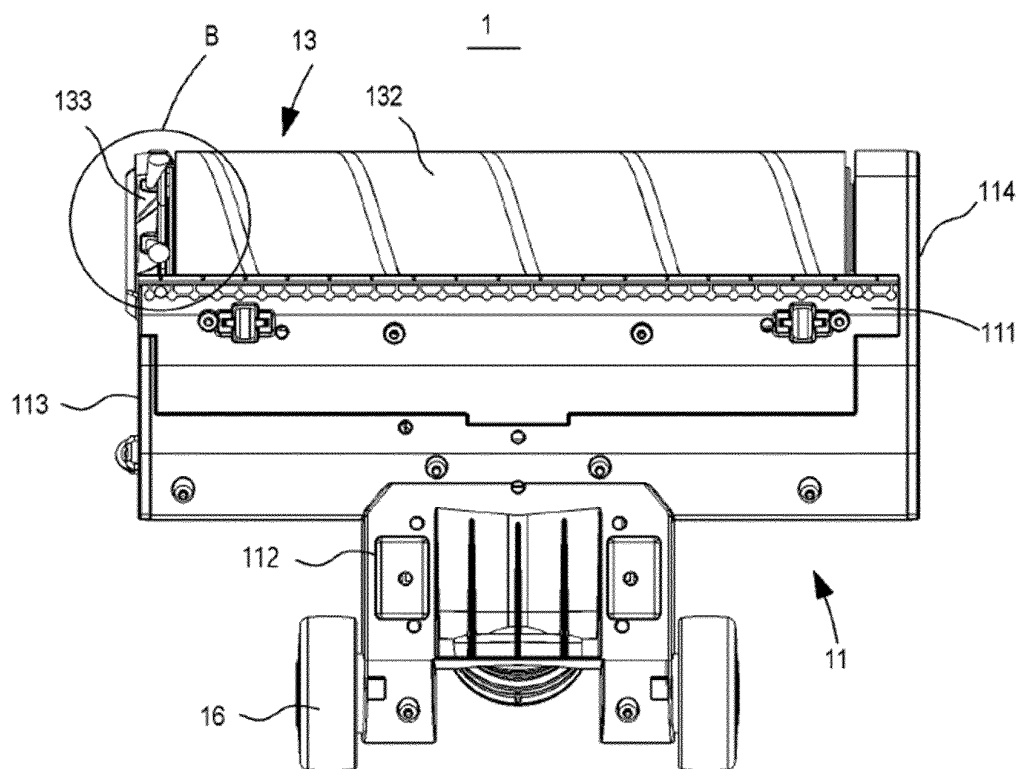


FIG. 3

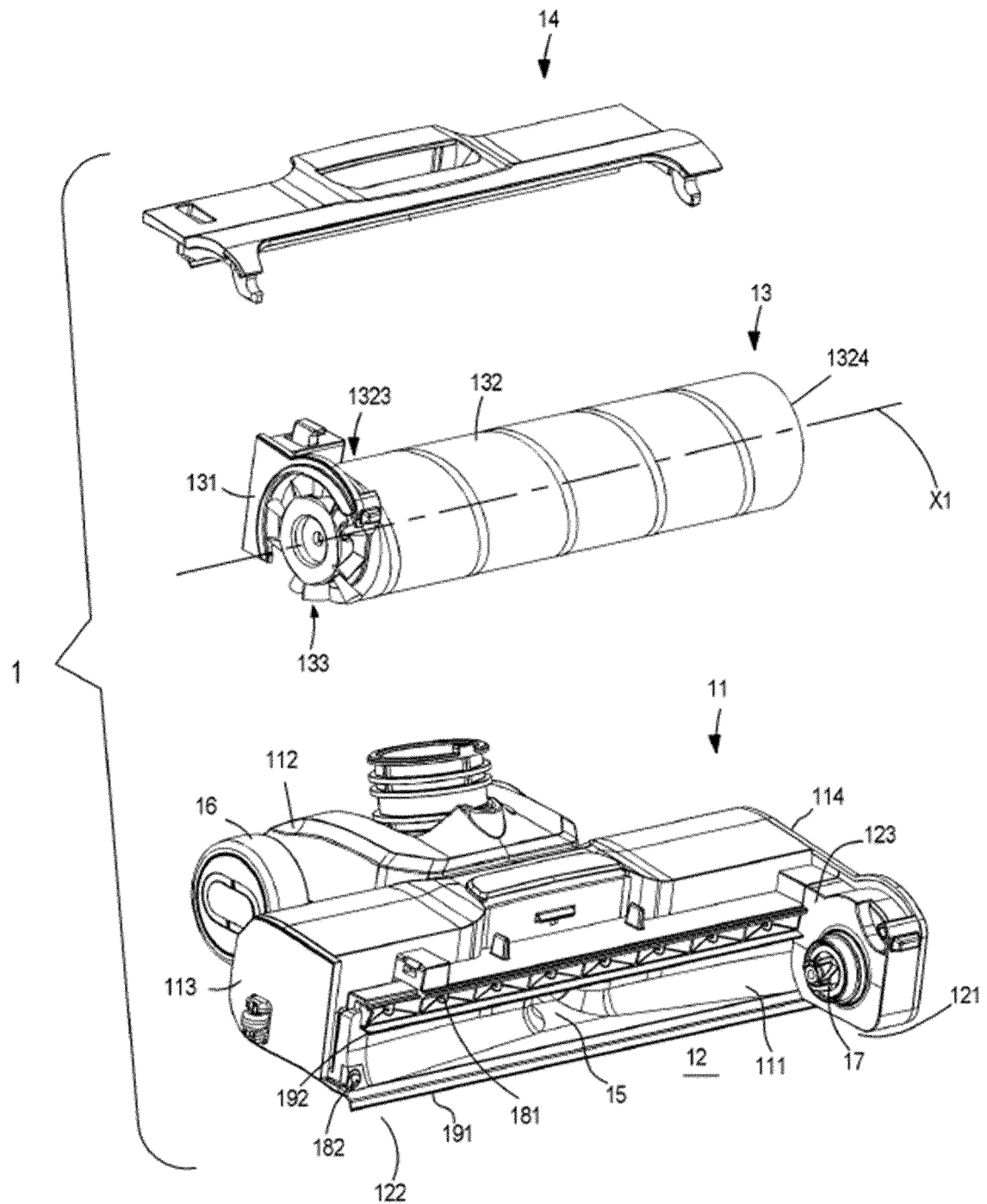


FIG. 4

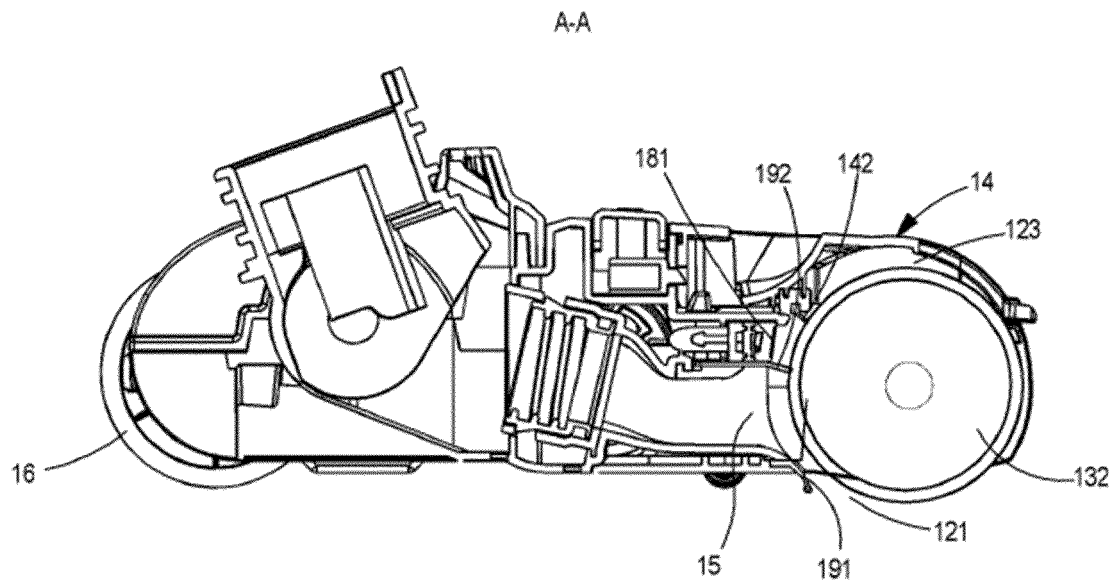


FIG. 5

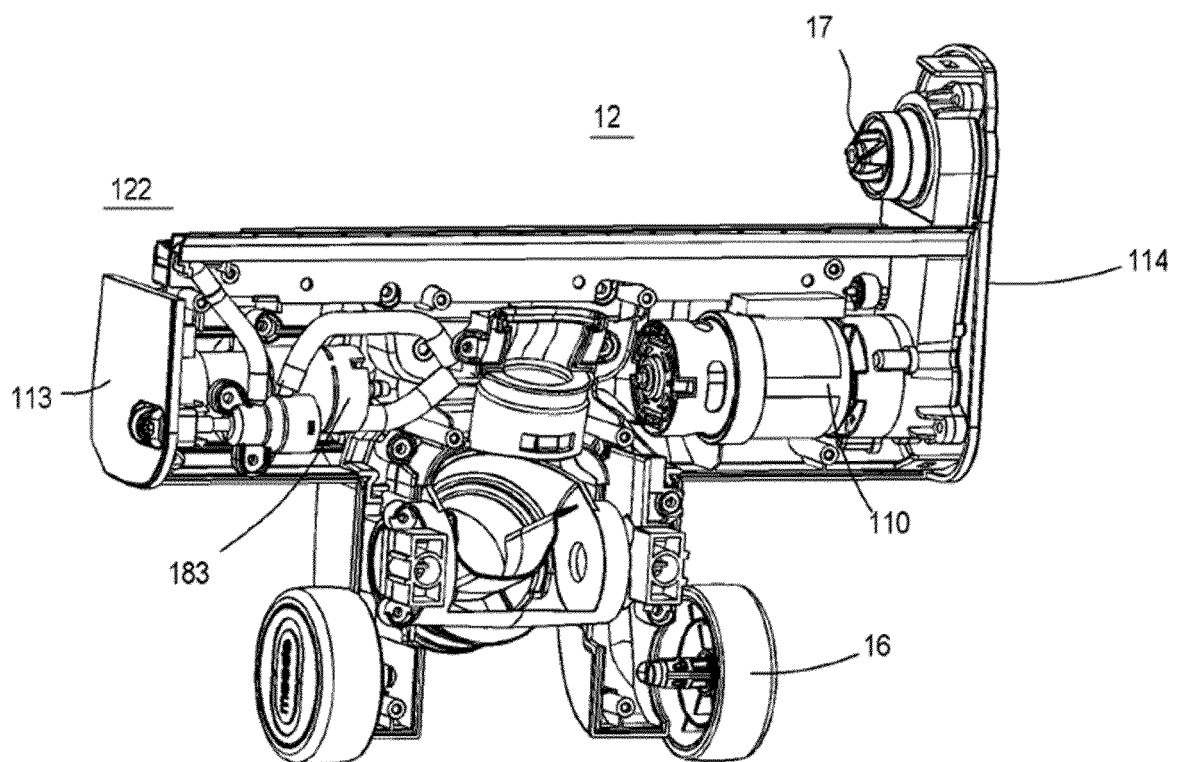


FIG. 6

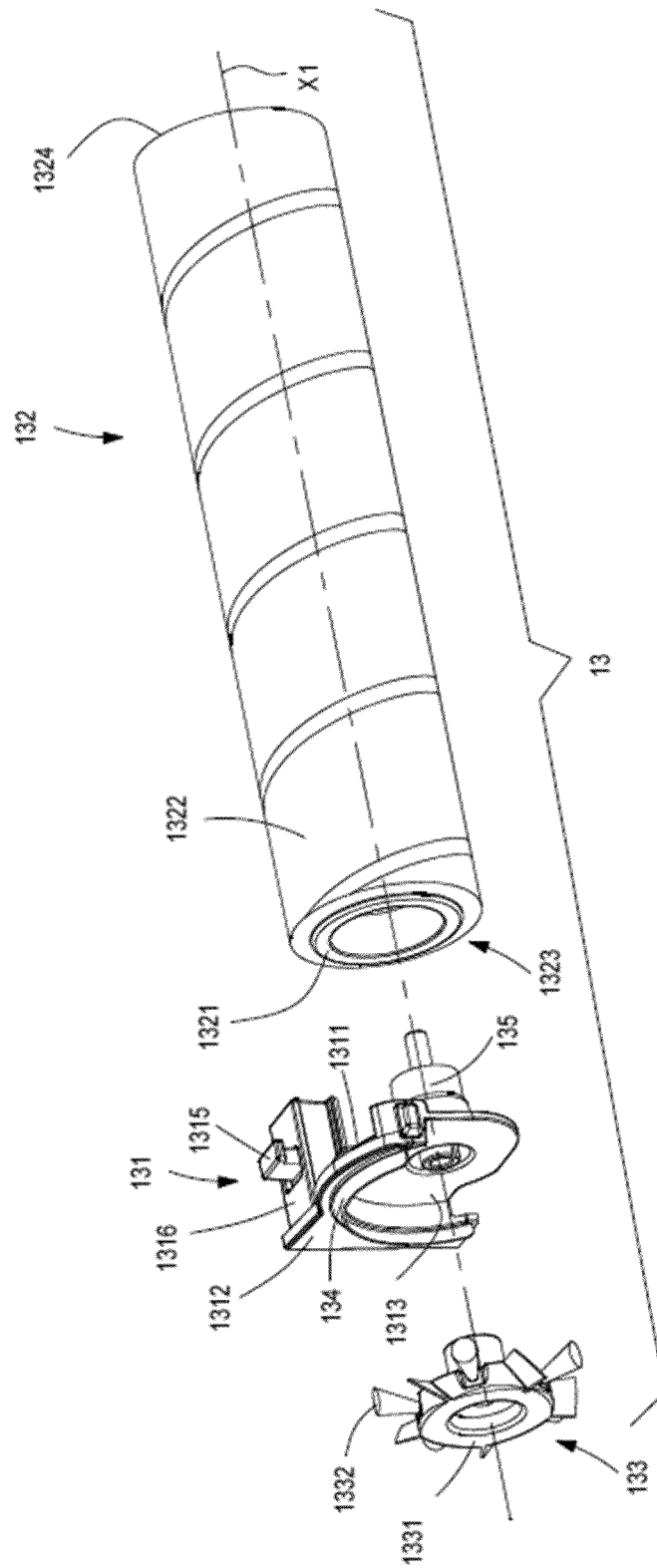


FIG.7

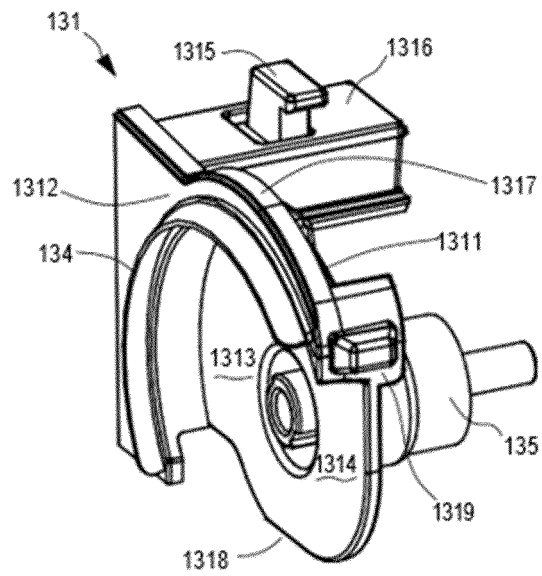


FIG. 8

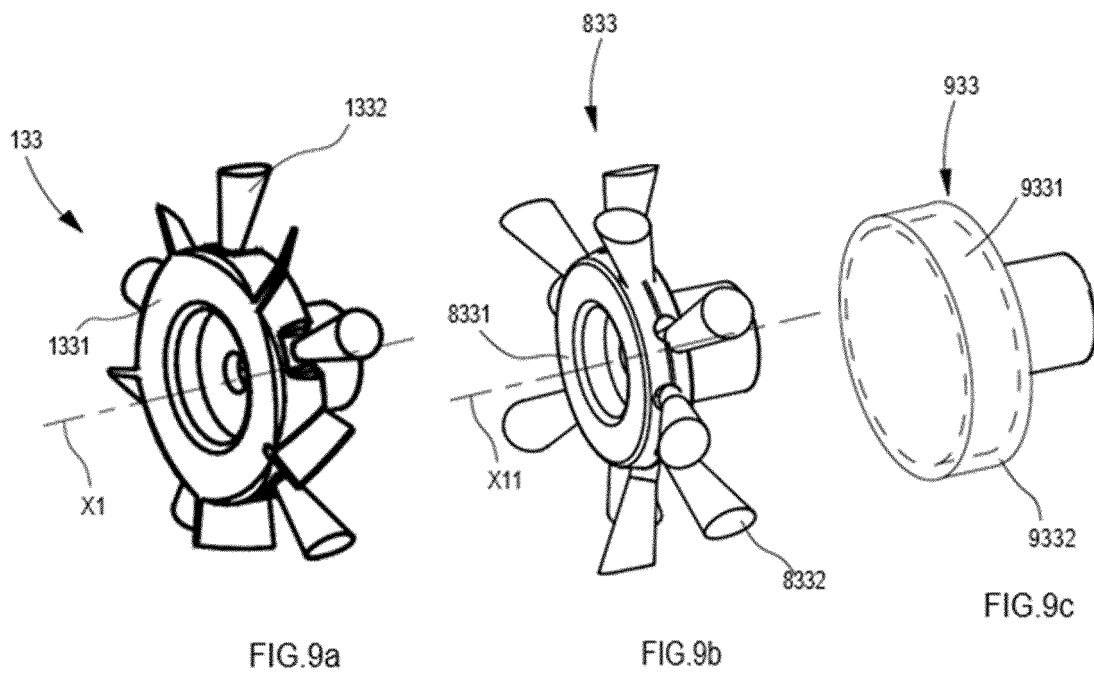


FIG. 9a

FIG. 9b

FIG. 9c

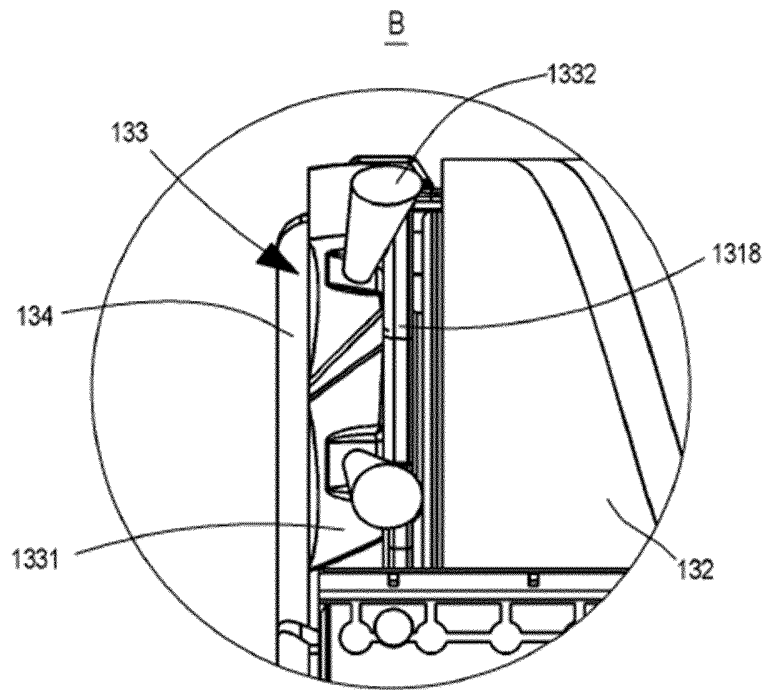


FIG. 10

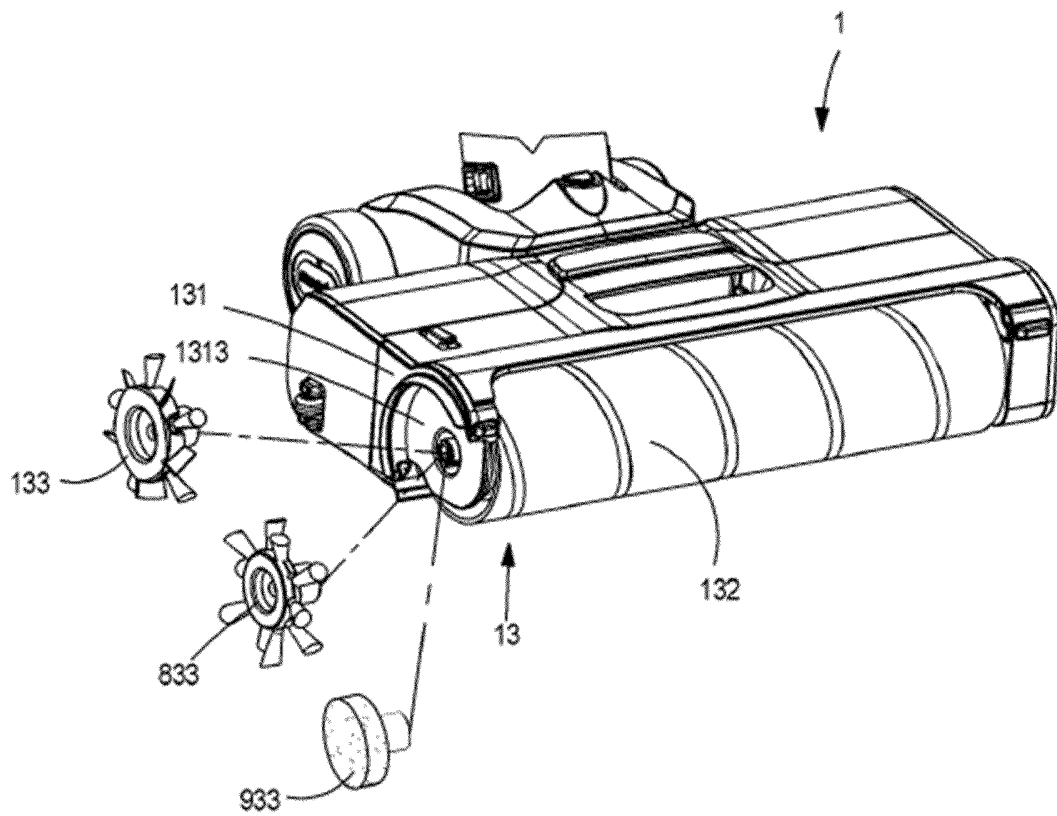
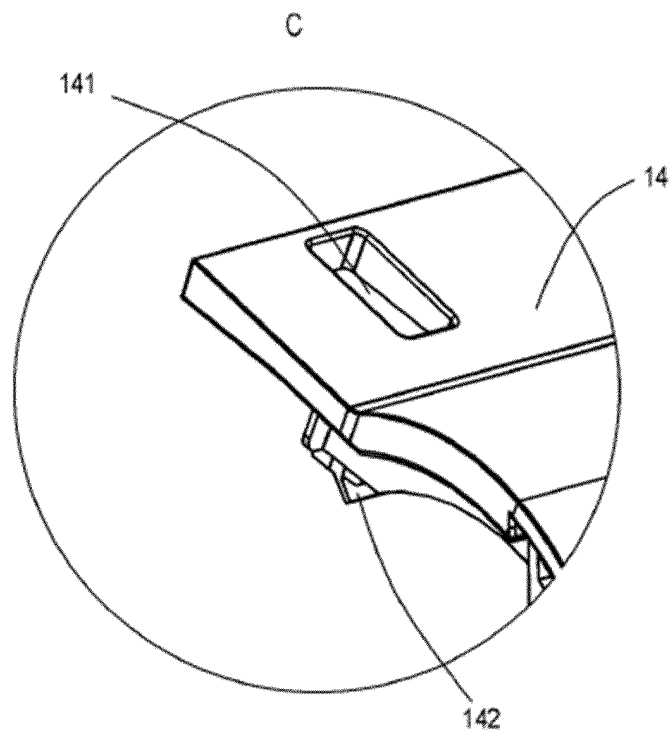
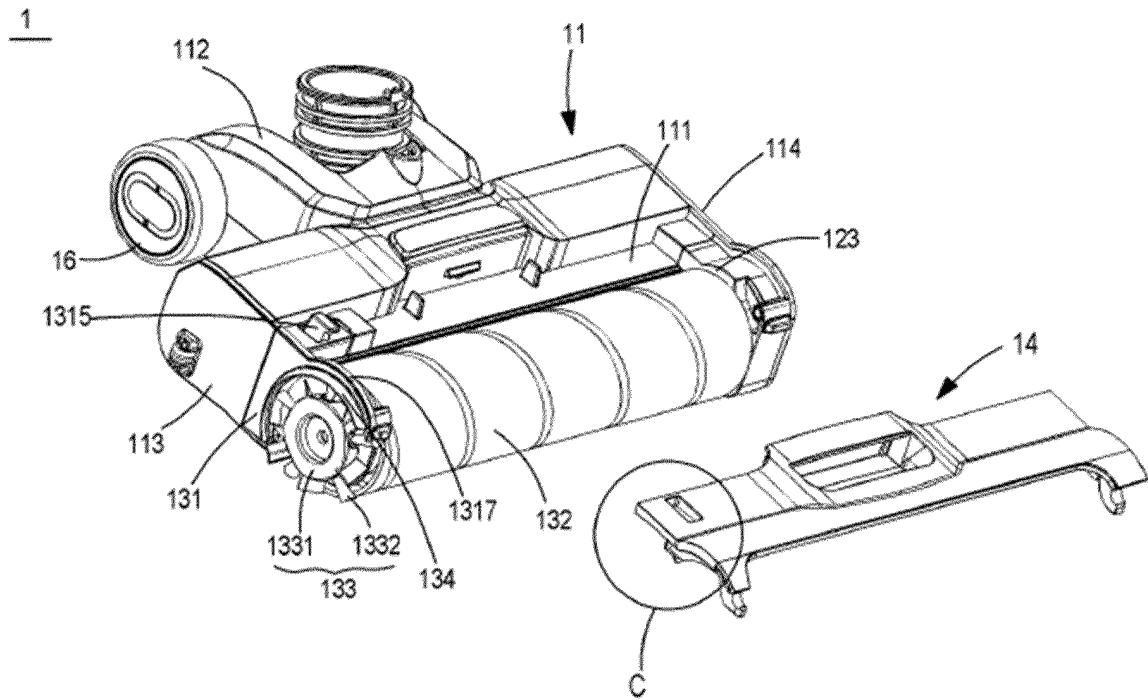


FIG. 11



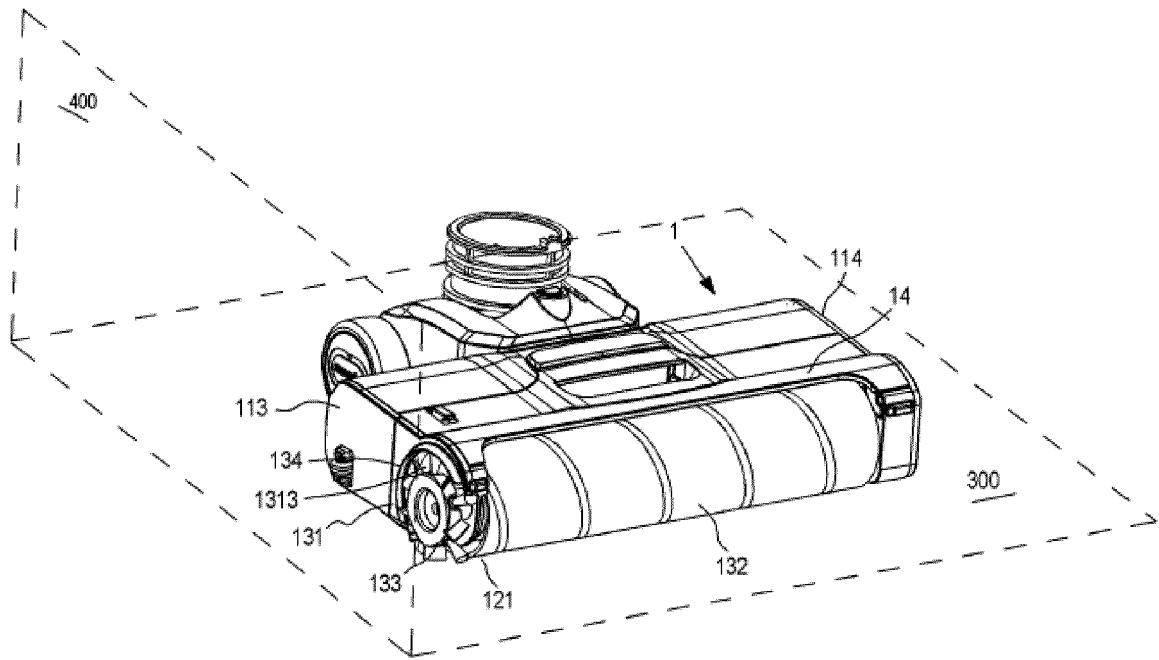


FIG. 14

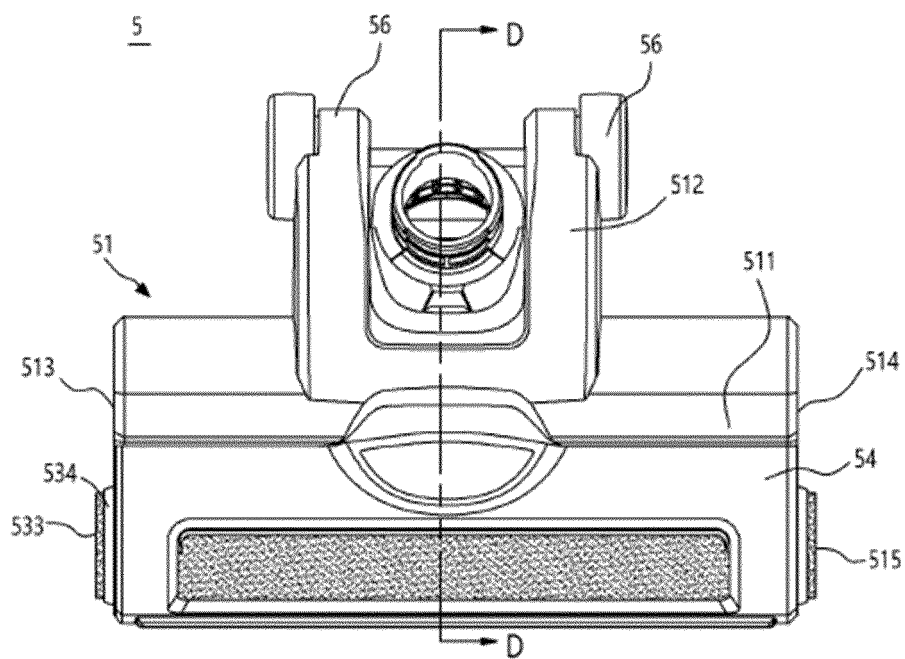


FIG. 15

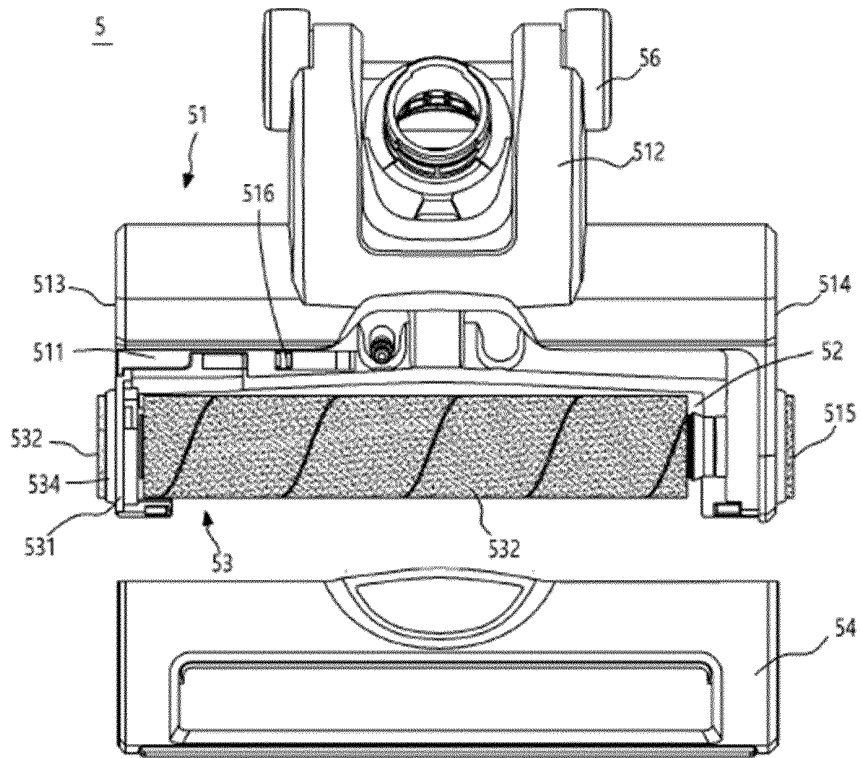


FIG. 16

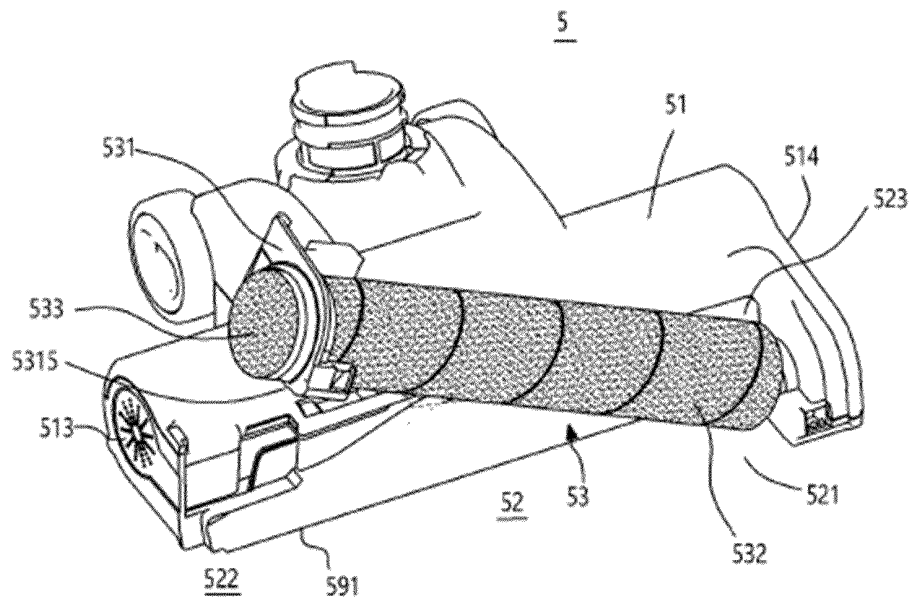


FIG. 17

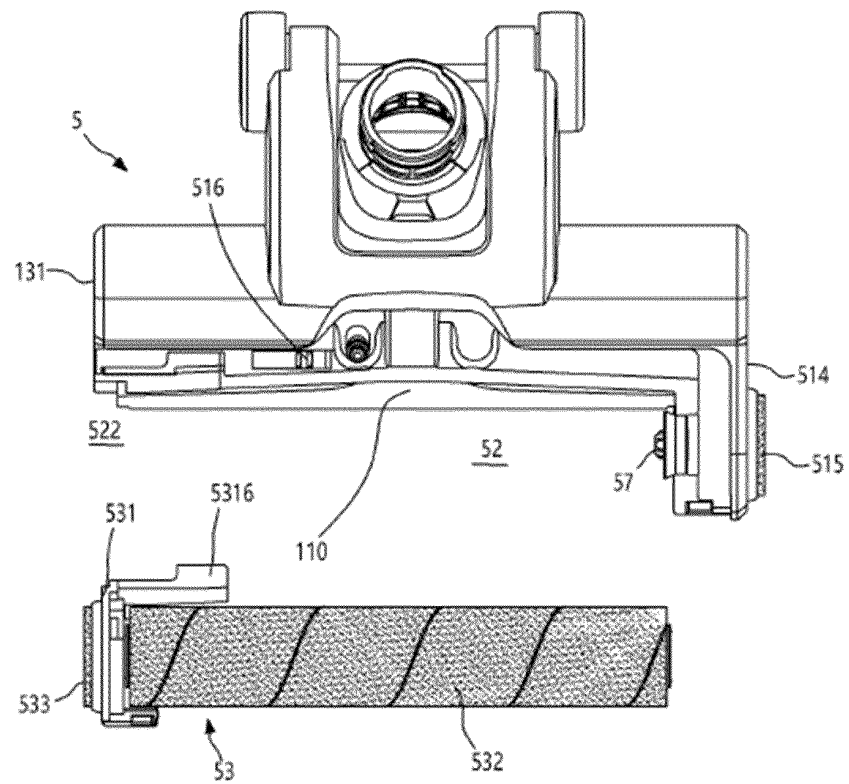


FIG. 18

D - D

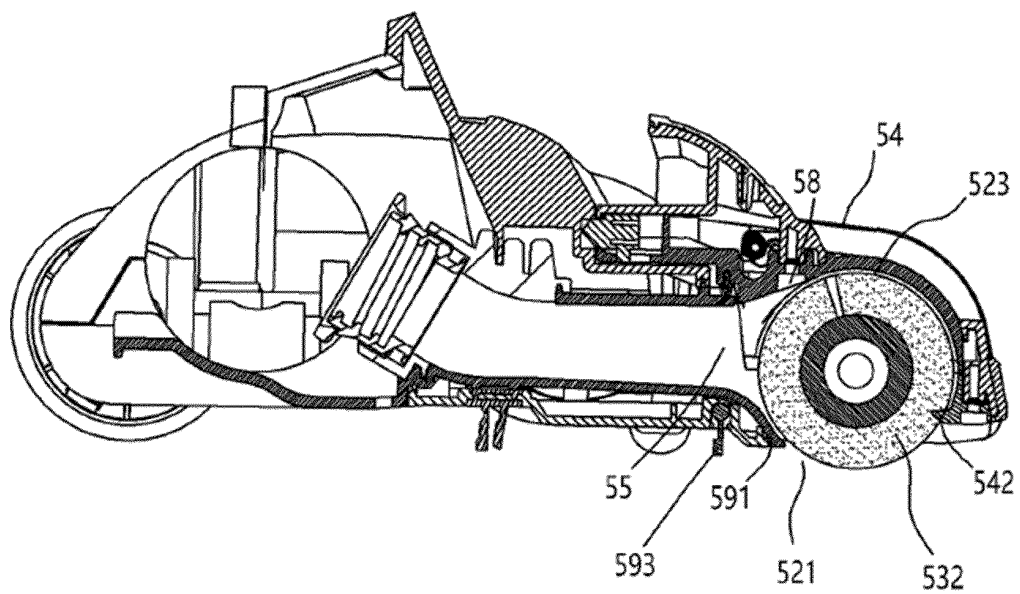


FIG. 19

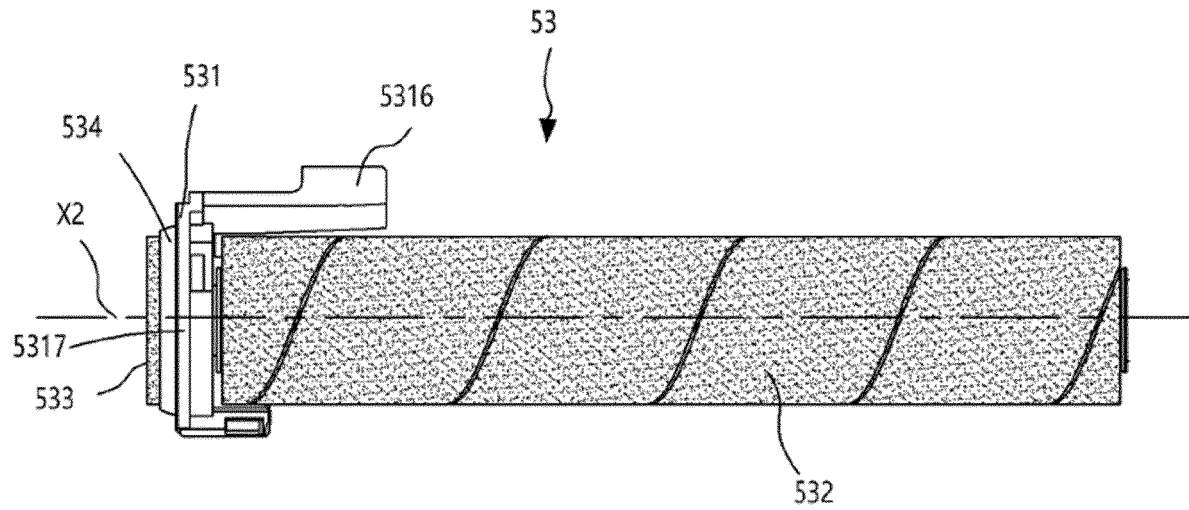


FIG. 20

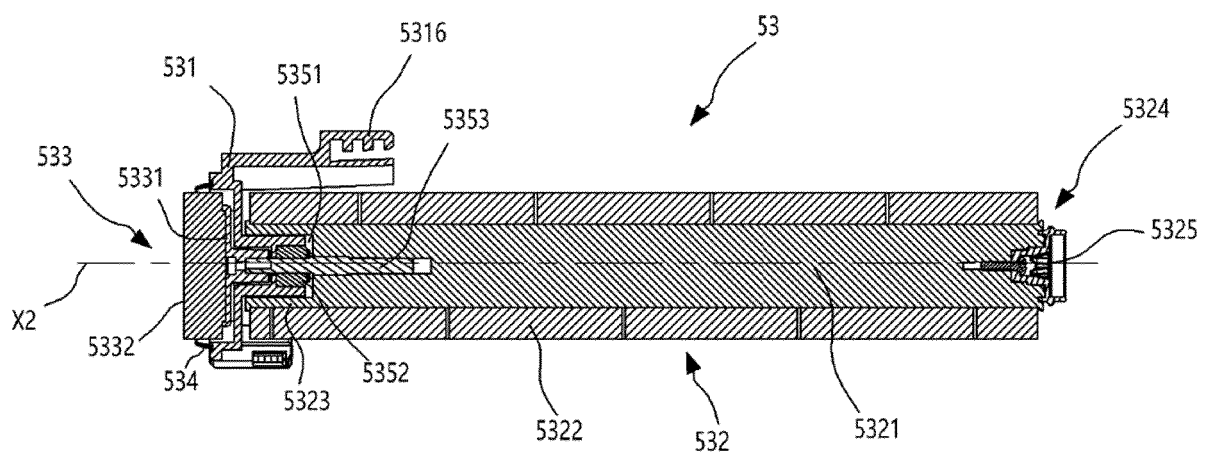


FIG. 21

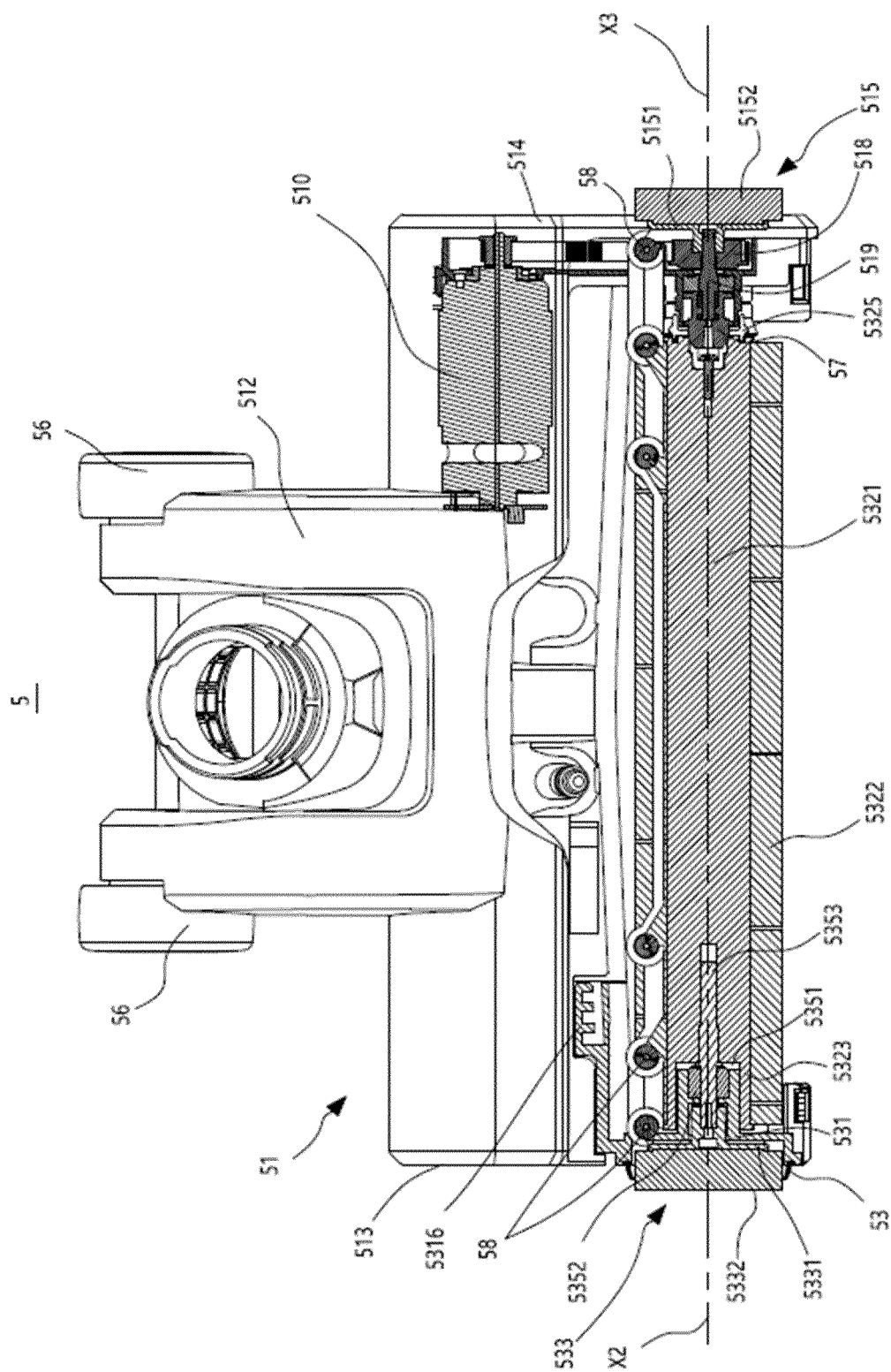


FIG. 22

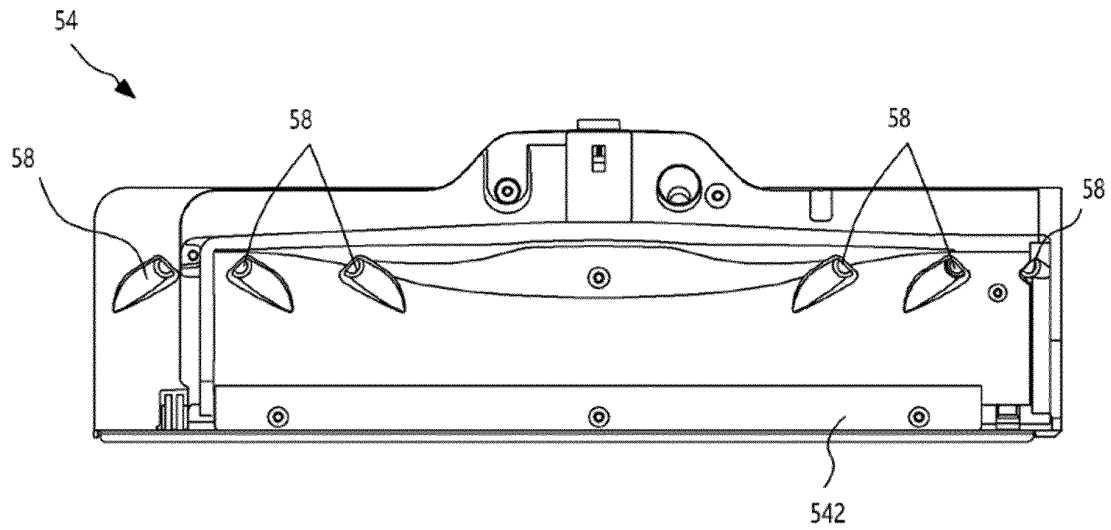


FIG. 23

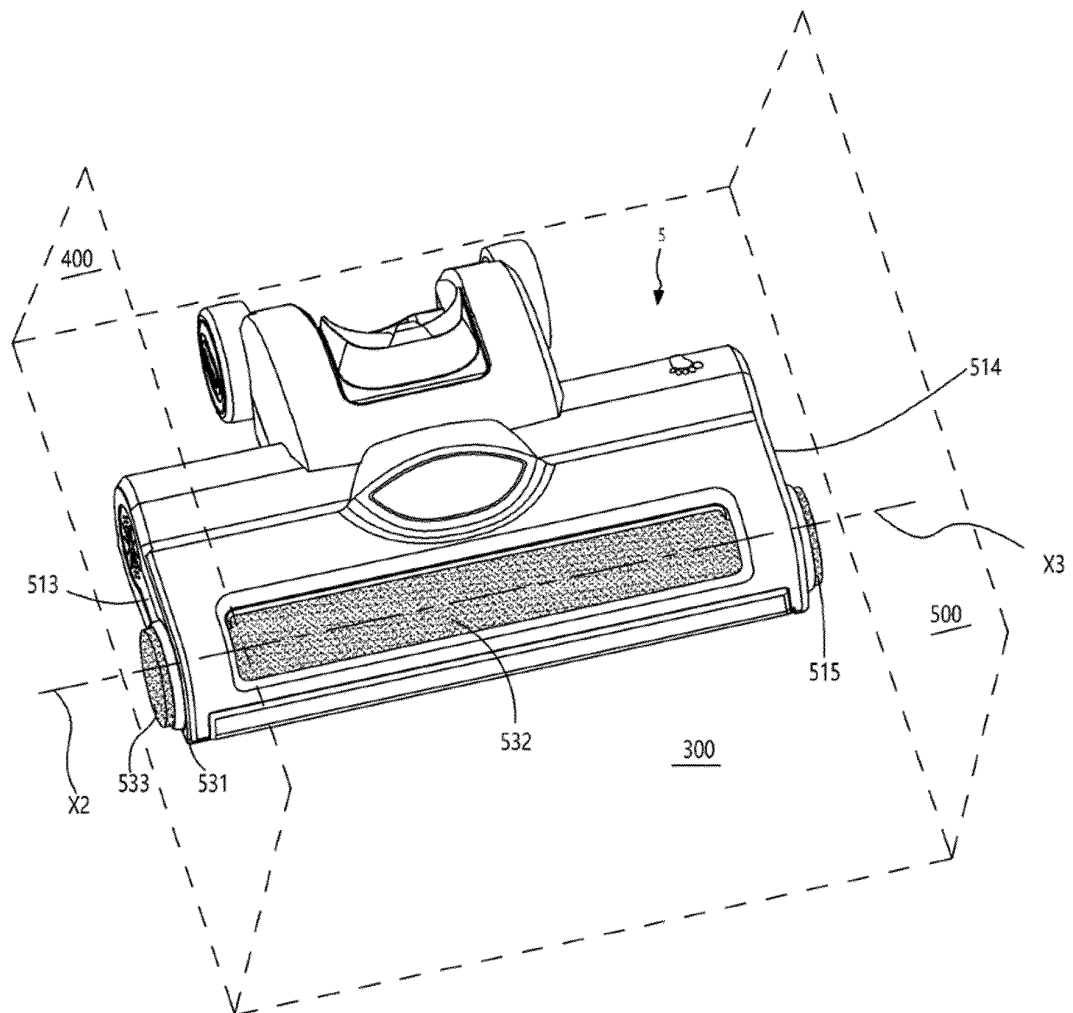


FIG. 24

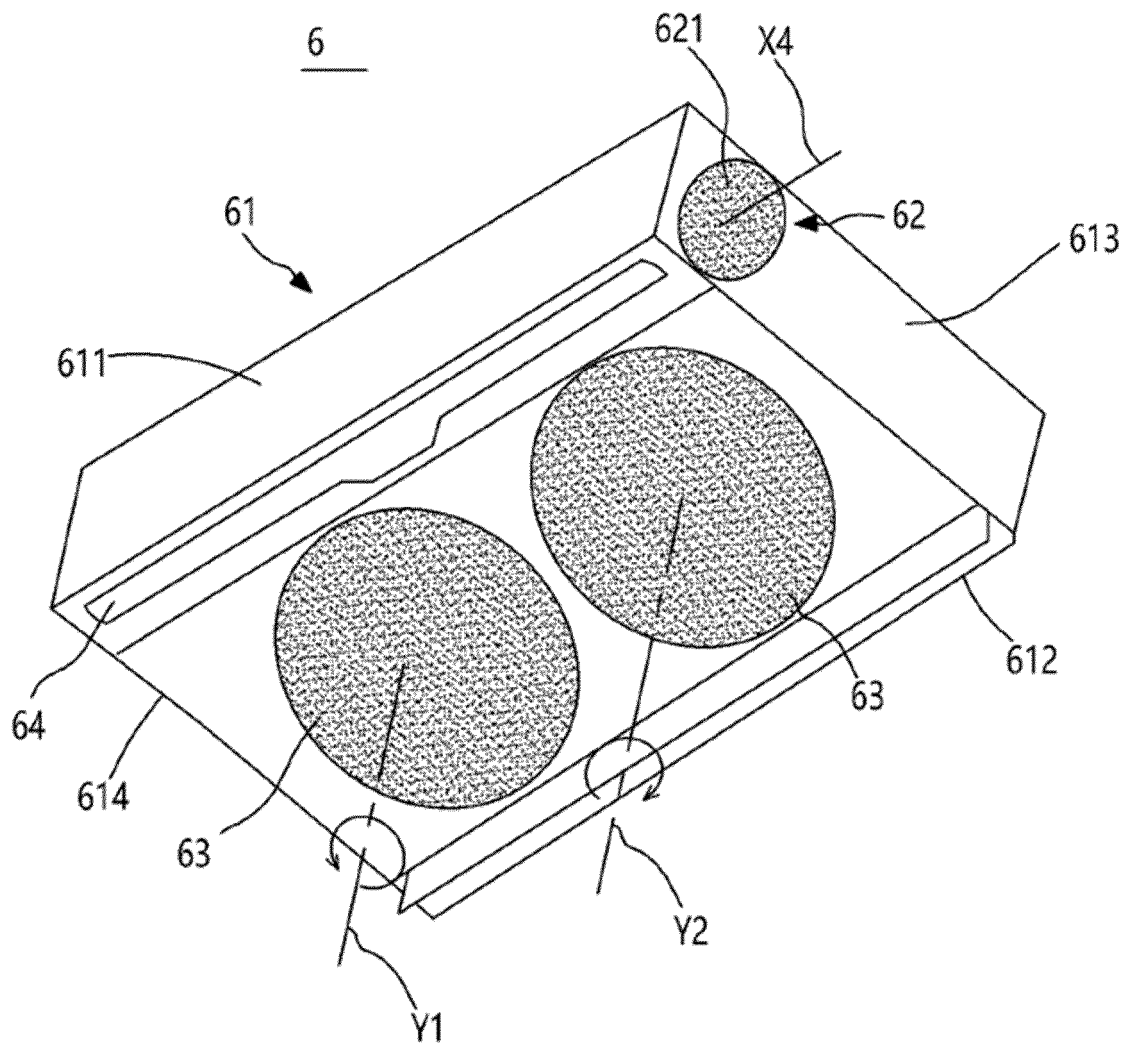


FIG.25

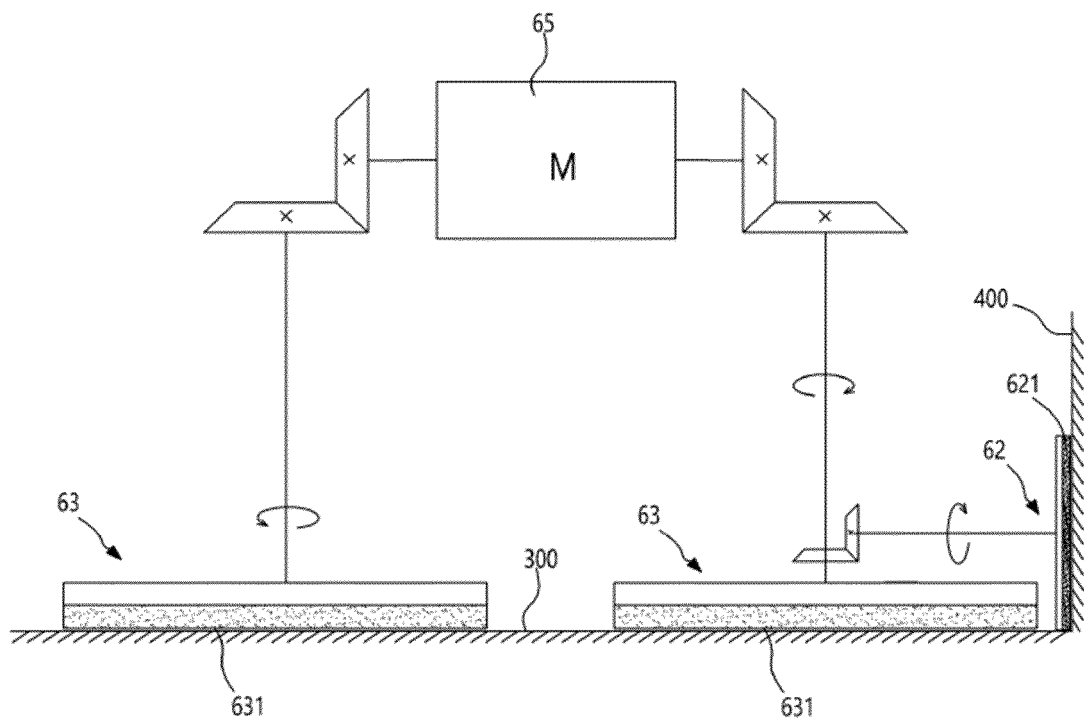


FIG.26

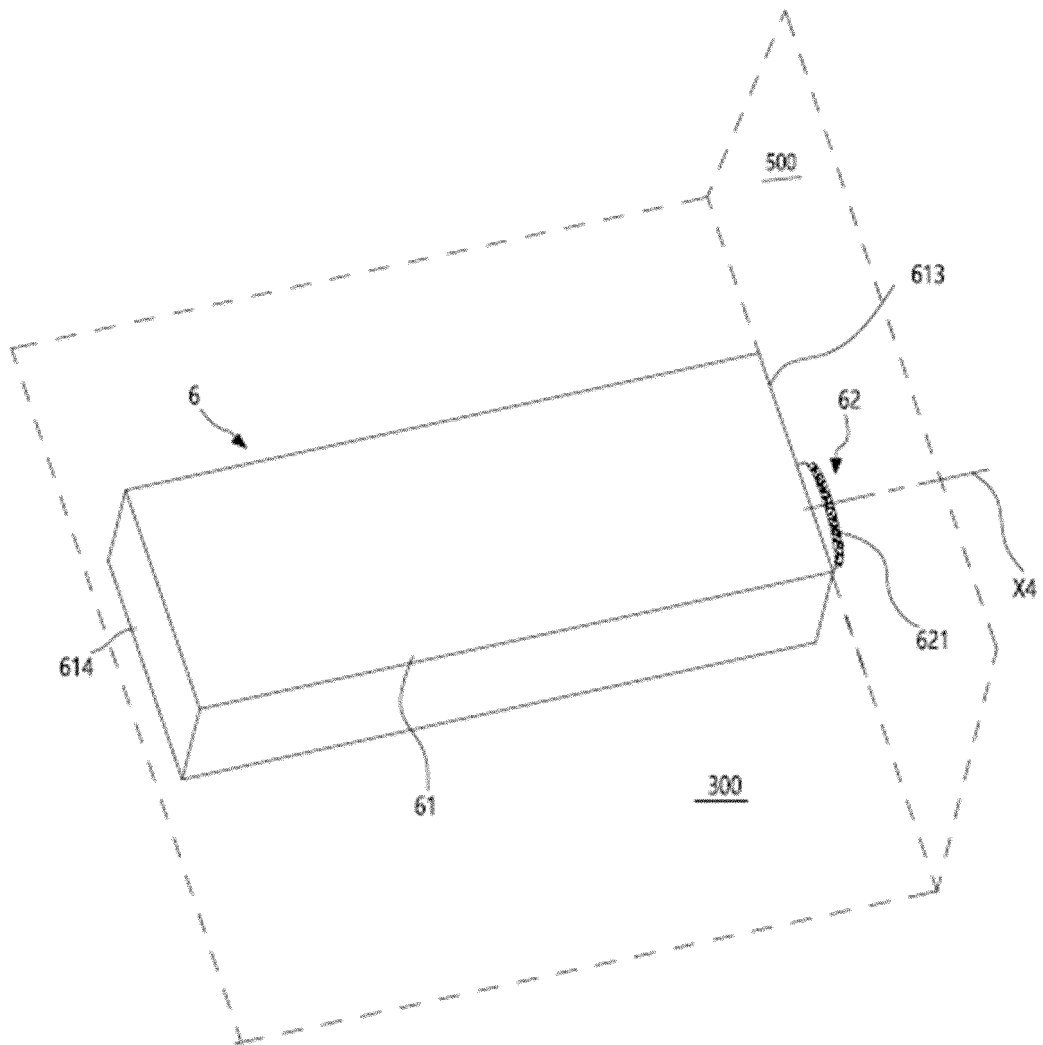


FIG.27

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2022/074502

A. CLASSIFICATION OF SUBJECT MATTER A47L 11/282(2006.01)i; A47L 11/40(2006.01)i According to International Patent Classification (IPC) or to both national classification and IPC																					
B. FIELDS SEARCHED																					
Minimum documentation searched (classification system followed by classification symbols) A47L																					
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched																					
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) CNTXT; WPABSC; ENTXTC; VEN: 瑞久, 边刷, 侧刷, 侧面, 侧边, 两侧, 两边, 边缘, 清洁, 清扫, 刷, 辊, side brush, side, two sides, both sides, edge, clean+, sweep+, brush, roller																					
C. DOCUMENTS CONSIDERED TO BE RELEVANT																					
<table border="1"> <thead> <tr> <th>Category*</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>X</td> <td>CN 209644812 U (NINGBO SAYEAH TOOLS CO., LTD.) 19 November 2019 (2019-11-19) description, paragraphs 29-33, figures 1-9</td> <td>24-25, 35</td> </tr> <tr> <td>Y</td> <td>CN 209644812 U (NINGBO SAYEAH TOOLS CO., LTD.) 19 November 2019 (2019-11-19) description, paragraphs 29-33, figures 1-9</td> <td>1-23, 26-34</td> </tr> <tr> <td>Y</td> <td>US 2002092125 A1 (ROYAL APPLIANCE MFG) 18 July 2002 (2002-07-18) description, paragraphs 27-28, figures 1-8</td> <td>1-23, 26-34</td> </tr> <tr> <td>X</td> <td>JP H0542076 A (MATSUSHITA ELECTRIC IND. CO., LTD.) 23 February 1993 (1993-02-23) description, paragraphs 3-13, figures 1-6</td> <td>24-25, 35</td> </tr> <tr> <td>Y</td> <td>JP H0542076 A (MATSUSHITA ELECTRIC IND. CO., LTD.) 23 February 1993 (1993-02-23) description, paragraphs 3-13, figures 1-6</td> <td>1-23, 26-34</td> </tr> <tr> <td>X</td> <td>WO 2018059713 A1 (ALFRED KAERCHER GMBH & CO. KG.) 05 April 2018 (2018-04-05) claims 4, 8, figures 1-2</td> <td>24-25, 35</td> </tr> </tbody> </table>	Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	X	CN 209644812 U (NINGBO SAYEAH TOOLS CO., LTD.) 19 November 2019 (2019-11-19) description, paragraphs 29-33, figures 1-9	24-25, 35	Y	CN 209644812 U (NINGBO SAYEAH TOOLS CO., LTD.) 19 November 2019 (2019-11-19) description, paragraphs 29-33, figures 1-9	1-23, 26-34	Y	US 2002092125 A1 (ROYAL APPLIANCE MFG) 18 July 2002 (2002-07-18) description, paragraphs 27-28, figures 1-8	1-23, 26-34	X	JP H0542076 A (MATSUSHITA ELECTRIC IND. CO., LTD.) 23 February 1993 (1993-02-23) description, paragraphs 3-13, figures 1-6	24-25, 35	Y	JP H0542076 A (MATSUSHITA ELECTRIC IND. CO., LTD.) 23 February 1993 (1993-02-23) description, paragraphs 3-13, figures 1-6	1-23, 26-34	X	WO 2018059713 A1 (ALFRED KAERCHER GMBH & CO. KG.) 05 April 2018 (2018-04-05) claims 4, 8, figures 1-2	24-25, 35
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Y	CN 209644812 U (NINGBO SAYEAH TOOLS CO., LTD.) 19 November 2019 (2019-11-19) description, paragraphs 29-33, figures 1-9	1-23, 26-34																			
Y	US 2002092125 A1 (ROYAL APPLIANCE MFG) 18 July 2002 (2002-07-18) description, paragraphs 27-28, figures 1-8	1-23, 26-34																			
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X	WO 2018059713 A1 (ALFRED KAERCHER GMBH & CO. KG.) 05 April 2018 (2018-04-05) claims 4, 8, figures 1-2	24-25, 35																			
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Name and mailing address of the ISA/CN China National Intellectual Property Administration (ISA/CN) No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088, China Facsimile No. (86-10)62019451	Authorized officer Telephone No.																				

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2022/074502

C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 2018059713 A1 (ALFRED KAERCHER GMBH & CO. KG.) 05 April 2018 (2018-04-05) claims 4, 8, figures 1-2	1-23, 26-34
A	CN 208065126 U (HUA XIN BAO INDUSTRIAL (SHENZHEN) CO., LTD.) 09 November 2018 (2018-11-09) entire document	1-35
A	CN 2857786 Y (LIN, Gaomin) 17 January 2007 (2007-01-17) entire document	1-35
A	US 2010107356 A1 (JAKUBOS JAMES D et al.) 06 May 2010 (2010-05-06) entire document	1-35
PX	CN 215272515 U (SUZHOU RUIJIU INTELLIGENT TECHNOLOGY CO., LTD.) 24 December 2021 (2021-12-24) description, paragraphs 23-36, figures 1-6	1-35

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2022/074502

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 209644812 U	19 November 2019	None	
US 2002092125 A1	18 July 2002	US 6514356 B2	04 February 2003
JP H0542076 A	23 February 1993	None	
WO 2018059713 A1	05 April 2018	None	
CN 208065126 U	09 November 2018	None	
CN 2857786 Y	17 January 2007	None	
US 2010107356 A1	06 May 2010	WO 2010062748 A1	03 June 2010
		EP 2358250 A1	24 August 2011
		MX 2011004633 A	24 June 2011
CN 215272515 U	24 December 2021	None	

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Patent documents cited in the description

- CN 202110162832 [0001]
- CN 202110161044 [0001]
- CN 202110162831 [0001]
- CN 202110740007 [0001]
- CN 202110740700 [0001]
- CN 202110743377 [0001]
- CN 202110740073 [0001]
- CN 202111361556X [0001]