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CLEANING SYSTEM AND SELF-CLEANING METHOD THEREOF

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This disclosure provides a cleaning system and a self-cleaning method thereof. The method includes: docking a cleaning device (1) to a base station (50) of the cleaning system; providing clear water to a roller (2) of the cleaning device (1) by a clear water storage device; continuing, in response to detecting that a dirty water tank (12) of the cleaning device (1) is full of water, to provide a predetermined amount of clear water to the roller (2) to make water accumulate in a cleaning groove
- (5)

of the base station (50); stopping providing water after continuing to provide the predetermined amount of clear water; and starting to work, by a water suction device (8) of the base station (50), to suck dirt into a dirty water collection device (3) of the base station (50) through a water suction channel (4), after stopping providing water for a first threshold period, wherein the roller (2) rotates in a first direction in above self-cleaning processes.

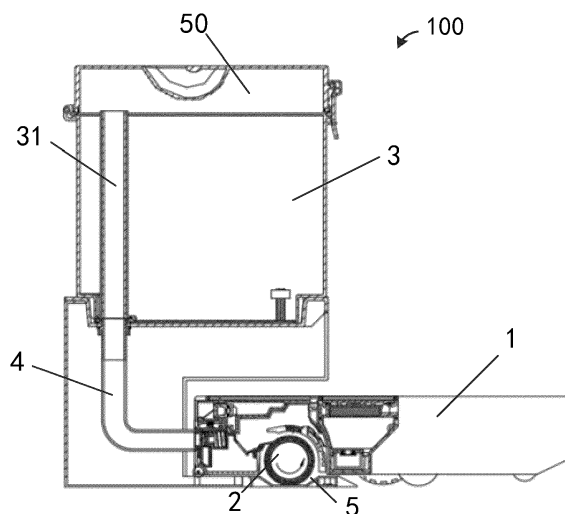


FIG. 2

Description

FIELD OF THE INVENTION

[0001] The present disclosure relates in general to a field of cleaning equipments, and in more particular, to a cleaning system and a self-cleaning method thereof.

BACKGROUND OF THE INVENTION

[0002] As a kind of intelligent appliances, cleaning systems such as mobile robots can automatically clean ground without human operations, providing convenience for modern life. However, for cleaning systems, especially the robots using roller mopping technology, cleaning components need to be cleaned after performing cleaning work.

[0003] To reduce burden of users, some cleaning systems provide a function that robots perform self-cleaning after returning to base stations. For example, CN110115550A discloses a sweeping robot, including a sweeping module, a clear water tank and a dirty water tank, wherein: the sweeping module comprises a sweeping section and a cleaning section; the clear water tank having a clear water outlet; and the dirty water tank having a dirty water inlet. When clear water in the clear water tank enters the cleaning section through a clear water outlet, the cleaning section can squeeze the sweeping section to make the resultant dirty water enter the dirty water tank through a dirty water inlet. The sweeping robot can realize cleaning of the sweeping module by the cooperation of the sweeping section and the cleaning section. Additionally, when the sweeping module is specifically disposed, the sweeping section can be positioned in the robot body of the sweeping robot, while the cleaning section can be positioned in the charging base of the sweeping robot, so that the cleaning of the sweeping module can be realized by the cooperation of the robot body and the charging base.

[0004] However, the self-cleaning of the above cleaning system merely cleans the sweeping section of the robot, but cannot clean other components of the robot, such as an accommodating groove for the sweeping section, the sweeping section, the dirty water tank, etc., which makes them easy to breed bacteria. Thus, these components require manual maintenance and cleaning by users, which is very complex. In addition, its self-cleaning method is not optimized enough, resulting in limited cleaning effect, and there is still too much dirt left after self-cleaning.

SUMMARY OF THE INVENTION

[0005] The present disclosure is provided to introduce some concepts that will be further described in the following specific embodiments in a simplified form. The disclosure is not intended to identify key features or essential features of the subject matter required to be pro-

tected, nor is it intended to help determine the scope of the subject matter required to be protected.

[0006] One of objects of the present disclosure is to provide a cleaning system and a self-cleaning method thereof. The method uses a roller rotating with water to form a water film, and cleans a roller cavity, a water injection port, etc. by the water film. In addition, the process of self-cleaning steps is optimized so that brush cloth on the roller is fully wet and effectively cleaned. Thus, the roller brush, the roller cavity, a scraper strip, a dirty water tank, etc., are cleaned at the same time when self-cleaning is completed. In another aspect, a large power drywet exhauster of a base station cooperates in sucking dirty water in the dirty water tank during the self-cleaning process, making advantage of a large air volume of the exhauster to carry water to wash the dirty water tank and the scraper strip. Compared with pumping dirty water by a vacuum pump through negative pressure, the dirty water tank and the scraper strip can be washed cleaner.

[0007] According to an aspect of the present disclosure, a cleaning system is provided, which comprises a cleaning device and a base station, wherein the cleaning device comprises: a roller for surface cleaning, the roller rotating in a first direction; a dirty water tank, positioned at a rear side of the roller related to a forward direction of the cleaning device; a clear water tank for providing clear water to the roller; and a scraper strip, positioned on one side of the dirty water tank to squeeze the roller when the roller rotates and guide squeezed water into the dirty water tank. The base station comprises: a dirty water collection device connected to the dirty water tank of the cleaning device through a water suction channel; a water suction device used to suck dirt in the dirty water tank into the dirty water collection device through the water suction channel; and a cleaning groove for accommodating the roller of the cleaning device when the cleaning device returns to the base station, wherein a width of a gap between the roller and a roller bracket wall is arranged to enable accumulated water in the cleaning groove to be lifted by the rotation of the roller and form a water film in the gap, and the scraper strip is disposed downstream of the first direction with respect to the roller bracket wall. Due to an appropriate gap arranged between the roller and the roller bracket wall, the accumulated water in the cleaning groove can be lifted by the rotation of the roller to form a water film in the gap, so as to clean the roller cavity, the scraper strip, and the dirty water tank of the cleaning system while cleaning the roller by the water film. In addition, the scheme of the present disclosure has simple structure, low cost, and convenient installation and adjustment process.

[0008] In one embodiment of the present disclosure, the water suction device is an exhauster, and the water suction device can suck dirt in both the cleaning groove and the dirty water tank into the dirty water collection device. In this way, the dust collection and dirty water suction of the base station can share a same set of suction device, and the suction of the exhauster can be used

to wash the dirty water tank and the scraper strip while sucking dirty water.

[0009] In one embodiment of the present disclosure, the dirty water collection device is provided with a water-air separation structure, which is used to separate water and air sucked into the dirty water collection device, so that separated water remains in the dirty water collection device, while separated air enters the water suction device through an air outlet pipe. The water-air separation structure effectively avoids the problems like the failure of the water suction device and high noises caused by sucking dirty water into the water suction device.

[0010] In a further embodiment of the present disclosure, the water-air separation structure is arranged as follows: a water outlet of the water suction channel and an air inlet of the air outlet pipe are disposed above a maximum water storage height of the dirty water collection device, and a height of the water outlet of the water suction channel is lower than a height of the air inlet of the air outlet pipe; and a shielding component is disposed between the water outlet of the water suction channel and the air inlet of the air outlet pipe, the shielding component is fixed on the upper cover of the dirty water collection device and extends downward. This structure is easy to manufacture and does not increase the manufacturing cost of the cleaning system. Gravity is used to achieve the effect of dirty water and air separation by disposing the shielding components.

[0011] According to another aspect of the present disclosure, a self-cleaning method for a cleaning system is provided, wherein the self-cleaning method comprises: docking a cleaning device to a base station of the cleaning system; providing clear water to a roller of the cleaning device by a clear water storage device; continuing, in response to detecting that a dirty water tank of the cleaning device is full of water, to provide a predetermined amount of clear water to the roller to make water accumulate in a cleaning groove of the base station; stopping providing water after continuing to provide the predetermined amount of clear water; and starting to work, by a water suction device of the base station, to suck dirt into a dirty water collection device of the base station through a water suction channel, after stopping providing water for a first threshold period, wherein the roller rotates in a first direction in above self-cleaning processes. The predetermined amount of clear water, provided after the dirty water tank is full, forms a water film on the surface of the roller with the rotation of the roller during the first threshold period, so as to clean the roller cavity, the scraper strip, and the dirty water tank of the cleaning system while cleaning the roller by the water film.

[0012] In one embodiment of the present disclosure, the predetermined amount is determined at least in part according to a capacity of the cleaning groove and a volume of a gap between the roller and the roller bracket wall. In this way, the amount of water in the cleaning groove and the roller cavity during the self-cleaning process can be made appropriate, and the water film required

for washing can be formed.

[0013] In one embodiment of the present disclosure, a width of the gap between the roller and the roller bracket wall is determined at least in part according to being able to make accumulated water in the cleaning groove be lifted by rotation of the roller and form a water film in the gap. In this way, an appropriate gap is disposed between the roller and the roller bracket wall, which can make water in the cleaning groove be lifted by the rotation of the roller and form a water film in the gap, so as to clean the roller cavity, the scraper strip, the dirty water tank, etc. of the cleaning system while cleaning the roller by the water film.

[0014] In one embodiment of the present disclosure, the first threshold period is determined according to washing effect of the water film on the cleaning groove, the roller, the roller bracket wall and the scraper strip used for squeezing the roller, wherein the scraper strip is positioned downstream of the first direction compared with the roller bracket wall. The water film can sufficiently clean the components such as the roller cavity and the scraper strip by setting this period.

[0015] In one embodiment of the present disclosure, the water suction device is an exhauster, and sucking dirt into the dirty water collection device of the base station further comprises: sucking, by the exhauster, dirt in both the cleaning groove and dirty water tank into the dirty water collection device. In this way, the dust collection and dirty water suction of the base station can share a same set of suction device, and the suction of the exhauster can be used to wash the sewage tank and scraper strip while sucking dirty water.

[0016] In one embodiment of the present disclosure, the self-cleaning method further comprises: stopping working, by the water suction device, after working for a second threshold period; detecting, by a dirt sensor disposed in a water suction channel of the base station, water quality in the water suction channel; and restarting the self-cleaning processes in response to a water pollution degree detected during operation of the water suction device exceeding a water quality requirement threshold. In this way, in the case that detected water quality fails to meet the requirement, the self-cleaning is carried out again until the water quality meets the requirement, that is, the entire cleaning system has been cleaned.

[0017] In one embodiment of the present disclosure, the clear water storage device comprises a clear water tank disposed in the cleaning device and/or a clear water bucket disposed in the base station. The clear water tank and/or the clear water bucket provide clear water for cleaning. This embodiment adds a different way to provide clear water, which can be freely selected according to the actual installation conditions.

[0018] In one embodiment of the present disclosure, the method further comprises emptying dirt in the dirty water tank of the cleaning device by the water suction device of the base station before providing clear water to the roller of the cleaning device by the clear water

storage device. In this way, before cleaning, ensure that the dirty water tank is empty to avoid residual dirt.

[0019] These and other features and advantages will become apparent by reading the following detailed description and referring to the associated drawings. It should be understood that the above general description and the following detailed description are only illustrative and do not limit aspects of the required protection.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] In order to understand in detail the methods used for the above features of the present disclosure, the contents briefly outlined above can be described in more detail with reference to various embodiments, some of which are shown in the attached drawings. However, it should be noted that the attached drawings only show some typical aspects of the present disclosure, so they should not be considered as limiting their scope, because the description may allow other equally effective aspects.

FIG. 1 shows a schematic view of a cleaning system according to an embodiment of the present disclosure.

FIG. 2 shows a schematic view of docking between a cleaning device and a base station according to an embodiment of the present disclosure.

FIG. 3 shows a bottom view of a cleaning device according to an embodiment of the present disclosure.

FIG. 4 shows a schematic exploded view of a cleaning device according to an embodiment of the present disclosure.

FIG. 5 shows a partial enlarged view of the schematic exploded view according to FIG. 4.

FIG. 6 shows a schematic exploded view of a base station according to an embodiment of the present disclosure.

FIG. 7 shows an external schematic view of a dirty water collection device according to an embodiment of the present disclosure.

FIG. 8 shows an internal schematic view of a dirty water collection device according to an embodiment of the present disclosure.

FIG. 9 is a flowchart of a self-cleaning method for a cleaning system according to an embodiment of the present disclosure.

[0021] Description of Reference Labels:

100 cleaning system; 1 cleaning device; 50 base station;

31 water suction pipe; 4 water suction channel; 3 dirty water collection device; 2 roller; 5 cleaning groove; 14 clear water tank; 13 scraper strip; 15 water injection port; 16 bracket; 12 dirty water tank; 121 dirty water tank port; 161 bracket wall; 10 dust collection tank; 6 dust bag; 7 dust suction channel; 9 air inlet; 8 water suction device; 32 upper cover; 321 shielding component; 33 air outlet pipe.

DETAILED DESCRIPTION

[0022] The embodiments of the present disclosure will be described in more detail below with reference to the attached drawings. Although some embodiments of the present disclosure are shown in the attached drawings, it should be understood that the present disclosure can be realized in various forms and should not be interpreted as limited to the embodiments described herein. On the contrary, these embodiments are provided for a more thorough and complete understanding of the present disclosure. It should be understood that the drawings and embodiments of the present disclosure are only for illustrative purposes and are not intended to limit the scope of protection of the present disclosure.

[0023] In the description of the present disclosure, it should be noted that, unless otherwise specified, the term "multiple" means more than two; orientational or positional relationships indicated by the terms "upper", "lower", "left", "right", "inner" and "outer" and the like are only for the convenience of describing and simplifying the description of the present disclosure, rather than indicating or implying that the device or element referred to must have a specific orientation, be constructed and operated in a specific orientation, and therefore cannot be understood as a limitation of the present disclosure. In addition, the terms "first", "second", and "third" are used for descriptive purposes only and should not be understood as indicating or implying relative importance. "Vertical" is not strictly vertical, but within the allowable range of error. "Parallel" is not strictly parallel, but within the allowable range of error.

[0024] The orientation terms appearing in the following description are the directions shown in the drawings, and do not limit the specific structure of the present disclosure. In the description of the present disclosure, it should be noted that, unless otherwise specified and defined, the terms "mount", "connected", and "connect" should be comprehended in a broad sense. For example, the term may be a fixed connection, or a detachable connection, or an integrated connection; or may be a direct connection or an indirect connection via an intermediate medium. For those of ordinary skill in the art, specific meanings of the foregoing terms in the present disclosure may be understood based on specific situations.

[0025] The reference to "embodiment" herein means that specific features, structures, or characteristics described in combination with the embodiments can be included in at least one embodiment of the present disclosure.

sure. The phrase appearing in various positions of the specification does not necessarily refer to the same embodiment, nor does it refer to an independent or alternative embodiment mutually exclusive with other embodiments. Those skilled in the art understand explicitly and implicitly that the embodiments described herein may be combined with other embodiments.

[0026] In the description of the embodiment of the present disclosure, the term "and/or" is only an association relationship describing the associated object, indicating that there may be three kinds of relationships, such as A and/or B, which may indicate that there are three cases: A alone, A and B simultaneously, and B alone. In addition, the character "j" herein generally indicates that the previous and latter associated objects is an "or" relationship.

[0027] FIG. 1 shows a schematic view of a cleaning system 100 according to an embodiment of the present disclosure. FIG. 2 shows a schematic view of docking between a cleaning device and a base station according to an embodiment of the present disclosure. As shown in FIGS. 1 and 2, the cleaning system 100 may comprise a cleaning device 1 and a base station 50. In an example of FIG. 1, the cleaning device 1 is a cleaning robot, which can automatically move away from the base station 50 to perform surface cleaning tasks. In an example in FIG. 2, the cleaning device 1 returns to the base station 50 for maintenance, including charging, dust collection, water injection, dirt suction, self-cleaning, etc. At that time, corresponding interfaces of the cleaning device 1 and the base station 50 interconnect with each other. It should be noted that the description of the sweeper cleaning robot as an example of cleaning device in the drawings of the present disclosure is only for the convenience of description. Those skilled in the art will understand that the structures and improvement points of the present disclosure are not only applicable to cleaning robots, but also applicable to other types of cleaning devices, such as handheld cleaning devices.

[0028] As a non-limiting embodiment, the cleaning device 1 may be a sweeping and mopping integrated cleaning robot as shown in FIG. 3. As shown in a bottom view of FIG. 3, the chassis of the cleaning device 1 is equipped with a side brush and a dust suction port for sweeping function, and a roller 2 for the mopping function. The mopping function is typically wet cleaning, which means that sweeping sections are wetted by applying cleaning liquid during a cleaning process to complete mopping. It should be noted that the present disclosure mainly relates to the self-cleaning of the roller 2 and related components, so the sweeping function is not necessary for the cleaning device 1. In other words, the cleaning device 1 may also have the function of mopping the floor (sometimes referred to as "washing the floor") and corresponding components only.

[0029] The structure and working principle of the cleaning device 1 will be described below in connection with FIG. 4 and FIG. 5. The cleaning device 1 may comprise

a roller 2 for surface cleaning. In FIGS. 4 and 5, the forward direction of the cleaning device 1 when moving is from left to right on the paper. That is, the right side is the forward direction of the cleaning device 1 in the general sense, so that this direction is taken as a front side of the cleaning device 1, and a direction opposite to the front side is taken as a rear side of the cleaning device 1. From this perspective, the roller 2 rotates in a counter-clockwise direction. The cleaning device 1 may further comprise a clear water tank 14, which is used to supply clear water to the roller 2. For example, the clear water tank 14 can provide clear water to the roller 2 through a water injection port 15 on a bracket 16 above the roller 2. The cleaning device 1 may further comprise a dirty water tank 12, which is positioned at a rear side of the roller 2, i.e., a left side in FIGS. 4 and 5, with respect to the forward direction of the cleaning device 1. A scraper strip 13 is positioned on one side of the dirty water tank 12, which is used to squeeze the roller 2 when the roller 2 rotates and guide squeezed water into the dirty water tank 12. As a further non-limiting embodiment, a top of the dirty water tank 12 may also be equipped with a dirty water tank port 121, which may have a valve to control opening and closing of the dirty water tank 12. According to this embodiment, the scraper strip 13 is located downstream of the rotation direction of the roller 2 with respect to the roller bracket wall 161, which makes a gap between the roller 2 and the roller bracket wall 161 free from blocking, as compared with being positioned at an upstream as usual. It facilitates forming a water film in the gap between the roller 2 and the roller bracket wall 161 caused by water lifted by the rotation of the roller 2, and will not have a negative impact on a flow rate and an impact force of the water film. The formed water film can wash the roller bracket wall 161, and further wash the scraper strip 13 after passing through the water injection port 15, flushing dirt on the scraper strip 13 into the dirty water tank 12 with the water flow.

[0030] The structure and working principle of the base station 50 will be described below in connection with FIGS. 1, 2, 4, 5, and 6. The base station 50 may comprise a dirty water collection device 3, which is interfaced with the dirty water tank 12 of the cleaning device 1 through a water suction channel 4. Wherein, for example, the dirty water collection device 3 may be a dirty water bucket. The base station 50 may further comprise a water suction device 8, which is used to suck dirt in the dirty water tank 12 into the dirty water collection device 3 through the water suction channel 4. As a further non-limiting embodiment, the dirty water collection device 3 may also be equipped with a water suction pipe 31, which is connected to the water suction channel 4. During suction, water in the dirty water tank 12 may flow through the water suction channel 4, then through the water suction pipe 31, and finally enter the dirty water collection device 3.

[0031] The base station 50 may also be provided with a cleaning groove 5, which is used to accommodate the roller 2 of the cleaning device 1 when the cleaning device

1 returns to the base station 50. Specifically, as shown in FIGS. 1, 4, and 5, the cleaning device 1 has returned to the base station 50, and the roller 2 is parking on the cleaning groove 5 used to accommodate the roller 2 of the base station 50. The bottom of the roller 2 may contact or not contact a bottom of the cleaning groove 5.

[0032] When the cleaning device 1 returns to the base station 50 and performs the self-cleaning of the roller, the clear water tank 14 provides clear water to the roller 2, which makes the roller 2 wet. At the same time, the roller 2 starts to rotate counter-clockwise. After being squeezed by the scraper strip 13, the roller 2 will be squeezed out of a certain amount of water and the squeezed water enters the dirty water tank 12.

[0033] In one embodiment of the present disclosure, the water suction device 8 may be an exhaustor, and the water suction device 8 may suck dirt in both the cleaning groove 5 and the dirty water tank 12 into the dirty water collection device 3. In some existing cleaning systems, a water pump is generally used to suck dirty water from the cleaning device into the base station, and an exhaustor is used to perform dust collecting, i.e., collect dust from a dust box in the cleaning device into a dust collection tank 10 of the base station. Differently, dirty water extraction and dust collection in the present disclosure are carried out by a common high-power exhaustor, which can eliminate the need for water pumps and other related components. In addition, the high-power exhaustor has obvious effects on improving the cleaning of related components, which will be described in detail below. As shown in FIG. 6, the base station 50 may interface the dust box of the cleaning device 1 through a dust suction channel 7. The inhaled dust and air enter a dust bag 6. After filtering of the dust bag 6, the dust is accumulated in the dust bag 6 and the air enters an air inlet 9 of the exhaustor 8. On the other side, as previously described, the base station 50 interfaces with the dirty water tank 12 of the cleaning device 1 through the water suction channel 4, and inhaled water and air enter the dirty water collection device 3.

[0034] In a further embodiment of the present disclosure, as described in connection with FIGS. 7 and 8, the dirty water collection device 3 can be further provided with a water-air separation structure for separating water and air sucked into the dirty water collection device 3, so that separated water remains in the dirty water collection device 3, and separated air enters the water suction device 8 through an air outlet pipe 33. It can effectively avoid sucking dirty water into the water suction device and causing problems such as the failure of the water suction device and high noise by the water-air separation structure.

[0035] As a non-limiting embodiment, the water-air separation structure is arranged as follows: a water outlet of the water suction channel 4 and an air inlet of the air outlet pipe 33 are disposed above a maximum water storage height of the dirty water collection device 3, and the height of the water outlet of the water suction channel 4

is lower than the height of the air inlet of the outlet pipe 33; and a shielding component 321 is disposed between the water outlet of the water suction channel 4 and the air inlet of the outlet pipe 33, and a shielding component 321 is fixed on an upper cover 32 of the dirty water collection device 3 and extends downward. The shielding component 321 fixed and formed on the upper cover 32 of the dirty water collection device 3 may help to clean the interior of the dirty water collection device 3. When the upper cover 32 is opened, the shielding component 321 is moved out of the interior of the dirty water collection device 3, thereby reducing the operation barrier. Specifically, the base station 50 may use the exhaustor 8 to suck water. The dirty water enters the dirty water collection device 3 through the water suction pipe 31. The dirty water shielding component 321 is located on the upper cover 32 of the dirty water tank. The dirty water falls due to the shielding of the dirty water shielding component 321, and then enters the bottom of the dirty water collection device 3, while the air enters the air outlet pipe 33 and then enters the air inlet 9 of the exhaustor. This structure is easy to manufacture and does not increase the manufacturing cost of the dirty water collection device 3. By disposing the shielding component 321, the gravity is made advantage of to achieve the effect of separating the dirty water and air.

[0036] The following will continue to refer to FIGS. 1-8 and describe a self-cleaning method for a cleaning system according to an embodiment of the present disclosure in connection with FIG. 9. As shown in FIG. 9, the method 900 begins at a step 902 by docking a cleaning device 1 to a base station 50 of the cleaning system 100. The cleaning device 1 is usually programmed to return to the base station 50 automatically after the cleaning task is completed, or when the battery is low, or in response to the user's instructions, so as to perform maintenance operations, including charging, dust collection, dirty water suction, water injection, self-cleaning, etc. These maintenance operations may also be automatic or manually controlled by the user. When starting the self-cleaning task, the roller 2, which may be dirty, starts to rotate in the first direction (for example, the counter-clockwise direction described in FIGS. 4-5) and continues to rotate throughout the self-cleaning process.

[0037] At a step 904, the clear water storage device provides clear water to the dirty roller 2 of the cleaning device 1 and makes the roller 2 sufficiently wet with the rotation of the roller 2. When rotating through the downstream scraper strip 13, the roller 2 will be squeezed out of water after being squeezed by the scraper strip 13 and squeezed water enters the dirty water tank 12. As this process continues, the water level in the dirty water tank 12 will continue to rise until it is full. During this process, the dirty water tank port 121 may remain open, so after the dirty water tank is full, water will continue to overflow out of the dirty water tank port. In this process, a certain degree of self-cleaning of the roller 2 can be achieved. For the cleaning device 1 in the base station after per-

forming surface cleaning work, the roller 2 may be cleaned by continuously adding clear water and collecting the scraped dirt into the dirty water tank. However, on this basis, first, the cleanliness of the roller 2 itself is not enough. Second, mechanisms related to self-cleaning such as the roller bracket wall 161, the scraper strip 13, and the dirty water tank 12 will remain dirty.

[0038] In a further embodiment of the present disclosure, the clear water storage device may comprise a clear water tank 14 disposed in the cleaning device 1 and/or a clear water bucket disposed in the base station 50. After the cleaning device returns to the base station, the clear water bucket of the base station 50 may be interfaced with the clear water tank 14 of the cleaning device through the water injection channel to fill the water for the latter. In some settings, the water injection port that supplies clear water to the roller 2 may be connected to the clear water tank 14 of the cleaning device 1. Alternatively, the water injection port may also be connected to the water injection channel, so that the clear water bucket of the base station 50 can directly provide clear water for the roller self-cleaning. This embodiment adds a different way to provide clear water, which can be freely selected according to actual installation conditions.

[0039] At a step 906, in response to detecting that the dirty water tank 12 of the cleaning device 1 is full of water, continue to provide a predetermined amount of clear water to the roller 2 to make water accumulate in the cleaning groove 5 of the base station 50. As water will continue to overflow out of the dirty water tank and fall into the cleaning groove 5, water will accumulate in the cleaning groove 5, so that the roller 2 may be cleaned in it. At the same time, some water will be brought back into the roller cavity under the rotation of the roller 2. According to this embodiment, a width of a gap between the roller 2 and the roller bracket wall 161 can be disposed to enable water in the cleaning groove 5 to be lifted by the rotation of the roller 2 and form a water film in the gap. Therefore, by the washing effect of the water film, it is helpful to clean the roller cavity, the water injection port 15 and the scraper strip 13. The gap being too large or too small will affect the formation of the water film. As a non-limiting example, the gap may be 4-5 mm. In an embodiment of the present disclosure, the above predetermined amount of clear water may be determined at least in part according to a capacity of the cleaning groove 5 and a volume of the gap between the roller 2 and the roller bracket wall 161. As a non-limiting example, the predetermined amount may be 100 ml. In this manner, t may generate excess water may be generated in the roller cavity during the self-cleaning process by continuing to provide clear water to the roller after the dirty water tank is full and form a water film under the rotation of the roller, so as to the water film may be used to clean the roller cavity and components therein. Next, at a step 908, after continuing to provide the predetermined amount of clear water, stop providing water.

[0040] Finally, at a step 910, after stopping providing

water for a first threshold period, the water suction device 8 of the base station starts to work to suck dirt into the dirty water collection device 3 of the base station through the water suction channel 4. As mentioned in the step 906, under the rotation of the roller, the surface of the roller has a water film ready to wash the roller cavity. After stopping the water injection, this state reaches balance and maintains until the water suction device 8 starts. During this period, the water film continuously cleans the roller cavity and various components therein, so keeping this state for a certain period may help to clean these components. In another embodiment of the present disclosure, the first threshold period may be determined according to the washing effect of the water film on the cleaning groove 5, the roller 2, the roller bracket wall 161 and the scraper strip 31 for squeezing the roller 2. For example, through experiments, it may be roughly determined that how long the threshold period is set, so dirt on each component may be basically cleaned. As a non-limiting example, the first threshold period may be set to 30 seconds. After the water suction device 8 starts, under the suction, water in the dirty water tank 12 starts to be sucked into the dirty water collection device 3 of the base station through the water suction channel 4. Different from sucking dirty water in the dirty water tank 12 by the water pump, the water suction device of the high-power exhauster may form a larger negative pressure in the dirty water tank 12 and form an entrainment effect through the negative pressure air so as to form the cleaning of the interior of the dirty water tank 12. The water level in the dirty water tank 12 gradually decreases. At this time, under the suction of the water suction device, water in the whole roller cavity and the cleaning groove 5 will also be gradually sucked into the dirty water tank 12 and sucked away through the water suction channel 4. Finally, all water in the dirty water tank 12, the cleaning groove 5 and the roller cavity will be sucked dry. After the water suction device 8 starts to work, under the action of its strong wind suction, the scouring force of the water in the roller cavity on the components on the air channel such as the roller wall 161, the scraper strip 13 and the water inlet of the dirty water tank 12 will increase, which facilitates further cleaning these components.

[0041] In a further embodiment of the present disclosure, the self-cleaning method 900 may further comprise: the water suction device 8 stopping working after it works up to a second threshold period; detecting the water quality in the water suction channel 4 by a dirt sensor disposed in a water suction channel 4 of the base station; and restarting the self-cleaning process in response to a water pollution degree detected during the operation of the water suction device 8 exceeding a water quality requirement threshold. As mentioned above, in an embodiment of the present disclosure, the water suction device 8 may work until water in the dirty water tank 12 is sucked dry (that is, the water in the cleaning groove and the roller cavity is sucked dry) after starting. This process requires a certain amount of period, which may be determined by

experiments, and for example, the amount of period (i.e., the second threshold period) may be 3 minutes. Alternatively, a water level sensor or other sensors may also be disposed to detect whether it has been sucked dry. After this period, the water suction device 8 stops working, and the self-cleaning process is over. Optionally, it is possible to detect whether the self-cleaning has achieved desired effect, and thus determine whether it is necessary to run the self-cleaning process again. Therefore, according to an example of the present disclosure, the dirt sensor may be disposed in the water suction channel 4 to detect the water quality in the water suction channel 4. The dirt sensor may be disposed to operate continuously since the water suction device 8 starts to work, and continuously record the detected data. The detected data may be compared with the pre-set threshold of water quality requirement. If the data indicates that the water quality meets the requirement, that is, the degree of dirt is low, then the self-cleaning process is over. On the contrary, the self-cleaning process may be restarted. That is, clear water is supplied to the roller again, the roller rotates, and continues to supply water until the dirty water tank is full, a water film forms in the roller cavity to wash the roller cavity, and then the water suction device starts water suction and the water quality detection. In this way, in the case that the detected water quality fails to meet the requirement, the self-cleaning is carried out again until the water quality meets the requirement, that is, the entire cleaning system has been cleaned.

[0042] In another embodiment of the present disclosure, dirt in the dirty water tank 12 of the cleaning device 1 may be emptied by the water suction device 8 of the base station before the clear water storage device supplies clear water to the roller 2 of the cleaning device 1. In this way, before cleaning, ensure that the dirty water tank is empty to avoid residual dirt.

[0043] A cleaning system and its self-cleaning method of the present disclosure are described above. Compared with the schemes in the prior art, the present disclosure has at least the following advantages:

(1) The arrangement of the roller, the scraper strip and the roll cavity of the present disclosure may form a water film in the roller cavity under the roller with water rotation when the roller rotates, and the components such as the roller cavity and the water injection port are cleaned with the water film;

(2) The present disclosure optimizes the process of the self-cleaning steps so that the brush cloth on the roller is fully wet, and the roller brush, the roller cavity, the scraper strip, and the dirty water tank are cleaned at the same time when the self-cleaning is completed;

(3) The present disclosure uses a large power exhauster of the base station to cooperate with the dirty water tank in sucking dirty water during the self-

cleaning process and makes use of a large air volume of the exhauster to carry water to wash relevant components. Compared with pumping dirty water by a vacuum pump, the dirty water tank and the scraper strip may be washed cleaner.

[0044] The content already described above comprises examples of various aspects of the subject matter required to be protected. Of course, it is impossible to describe every conceivable combination of components or methods for the purpose of describing the required protection subject, but those of ordinary skill in the art should recognize that many further combinations and arrangements of the required protection subject are possible. Thus, the subject matter disclosed is intended to cover all such changes, modifications and changes falling within the spirit and scope of the appended claims.

Claims

1. A cleaning system comprising a cleaning device (1) and a base station (50), wherein:

the cleaning device (1) comprises:

a roller (2) for surface cleaning, the roller (2) rotating in a first direction;
a dirty water tank (12), positioned at a rear side of the roller (2) relative to a forward direction of the cleaning device (1);
a clear water tank (14) for providing clear water to the roller (2); and
a scraper strip (13), positioned on one side of the dirty water tank (12), to squeeze the roller (2) when the roller (2) rotates, and guide squeezed water into the dirty water tank (12); and

the base station (50) comprises:

a dirty water collection device (3) connected to the dirty water tank (12) of the cleaning device (1) through a water suction channel (4);
a water suction device (8) used to suck dirt in the dirty water tank (12) into the dirty water collection device (3) through the water suction channel (4); and
a cleaning groove (5) for accommodating the roller (2) of the cleaning device (1) when the cleaning device (1) returns to the base station (50),
wherein a width of a gap between the roller (2) and a roller bracket wall (161) is arranged to enable accumulated water in the cleaning groove (5) to be lifted by rotation of the roller (2) and form a water film in the

- gap, and the scraper strip (13) is disposed downstream of the first direction with respect to the roller bracket wall (161).
2. The cleaning system according to Claim 1, wherein the water suction device (8) is an exhaustor, and the water suction device (8) can suck dirt in both the cleaning groove (5) and the dirty water tank (12) into the dirty water collection device (3).
 3. The cleaning system according to Claim 1, wherein the dirty water collection device (3) is provided with a water-air separation structure, which is used to separate water and gas sucked into the dirty water collection device (3), so that the separated water remains in the dirty water collection device (3), while the separated air enters the water suction device (8) through an air outlet pipe (33).
 4. The cleaning system according to Claim 3, wherein the water-air separation structure is arranged as follows:

a water outlet of the water suction channel (4) and an air inlet of the air outlet pipe (33) are disposed above a maximum water storage height of the dirty water collection device (3), and a height of the water outlet of the water suction channel (4) is lower than a height of the air inlet of the outlet pipe (33); and

a shielding component (321) is disposed between the water outlet of the water suction channel (4) and the air inlet of the outlet pipe (33), and the shielding component (321) is fixed on an upper cover of the dirty water collection device (3) and extends downwardly.
 5. A self-cleaning method for a cleaning system, wherein the self-cleaning method comprises:

docking a cleaning device (1) to a base station (50) of the cleaning system;

providing clear water to a roller (2) of the cleaning device (1) by a clear water storage device;

continuing, in response to detecting that a dirty water tank (12) of the cleaning device (1) is full of water, to provide a predetermined amount of clear water to the roller (2) to make water accumulate in a cleaning groove (5) of the base station (50);

stopping providing water after continuing to provide the predetermined amount of clear water; and

starting to work, by a water suction device (8) of the base station (50), to suck dirt into a dirty water collection device (3) of the base station (50) through a water suction channel (4), after stopping providing water for a first threshold period,

wherein the roller (2) rotates in a first direction in above self-cleaning processes.

6. The self-cleaning method according to Claim 5, wherein the predetermined amount is determined at least in part according to a capacity of the cleaning groove (5), and a volume of a gap between the roller (2) and a roller bracket wall (161).
7. The self-cleaning method according to Claim 6, wherein a width of the gap between the roller (2) and the roller bracket wall (161) is determined at least in part according to being able to make accumulated water in the cleaning groove (5) be lifted by rotation of the roller (2) and form a water film in the gap.
8. The self-cleaning method according to Claim 7, wherein the first threshold period is determined according to washing effect of the water film on the cleaning groove (5), the roller (2), the roller bracket wall (161), and the scraper strip (13) used for squeezing the roller (2), wherein the scraper strip (13) is positioned downstream of the first direction with respect to the roller bracket wall (161).
9. The self-cleaning method according to Claim 5, wherein the water suction device (8) is an exhaustor, and sucking dirt into the dirty water collection device (3) of the base station (50) further comprises: sucking, by the exhaustor, dirt in both the cleaning groove (5) and the dirty water tank (12) into the dirty water collection device (3).
10. The self-cleaning method according to Claim 5, wherein the self-cleaning method further comprises:

stopping working, by the water suction device (8), after working for a second threshold period;

detecting, by a dirt sensor disposed in a water suction channel (4) of the base station (50), water quality in the water suction channel (4); and

restarting the self-cleaning processes in response to a water pollution degree detected during operation of the water suction device (8) exceeding a water quality requirement threshold.
11. The self-cleaning method according to Claim 5, wherein the clear water storage device comprises a clear water tank disposed in the cleaning device (1) and/or a clear water bucket disposed in the base station (50).
12. The self-cleaning method according to Claim 5, wherein the method further comprises: emptying dirt in the dirty water tank (12) of the cleaning device (1) by the water suction device (8) of the base station (50) before providing clear water to the roller (2) of the cleaning device (1) by the clear water

storage device.

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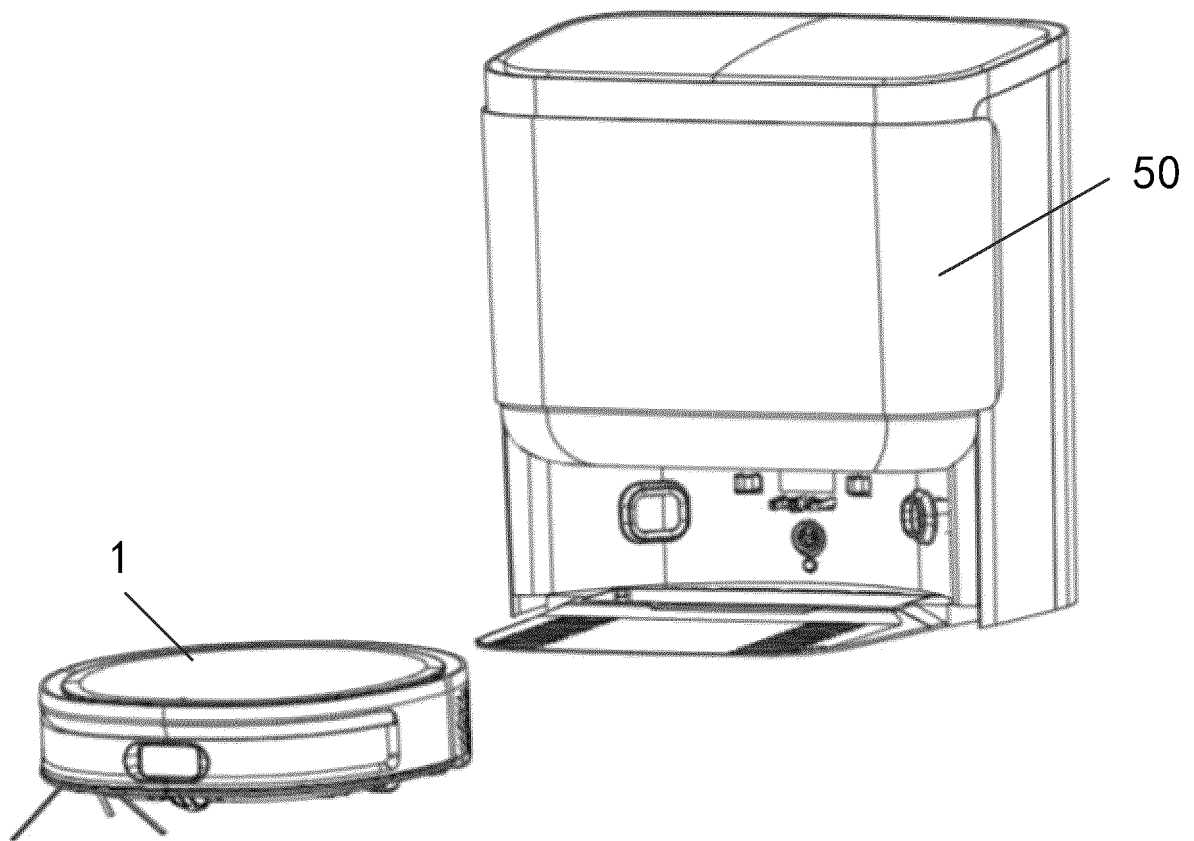


FIG. 1

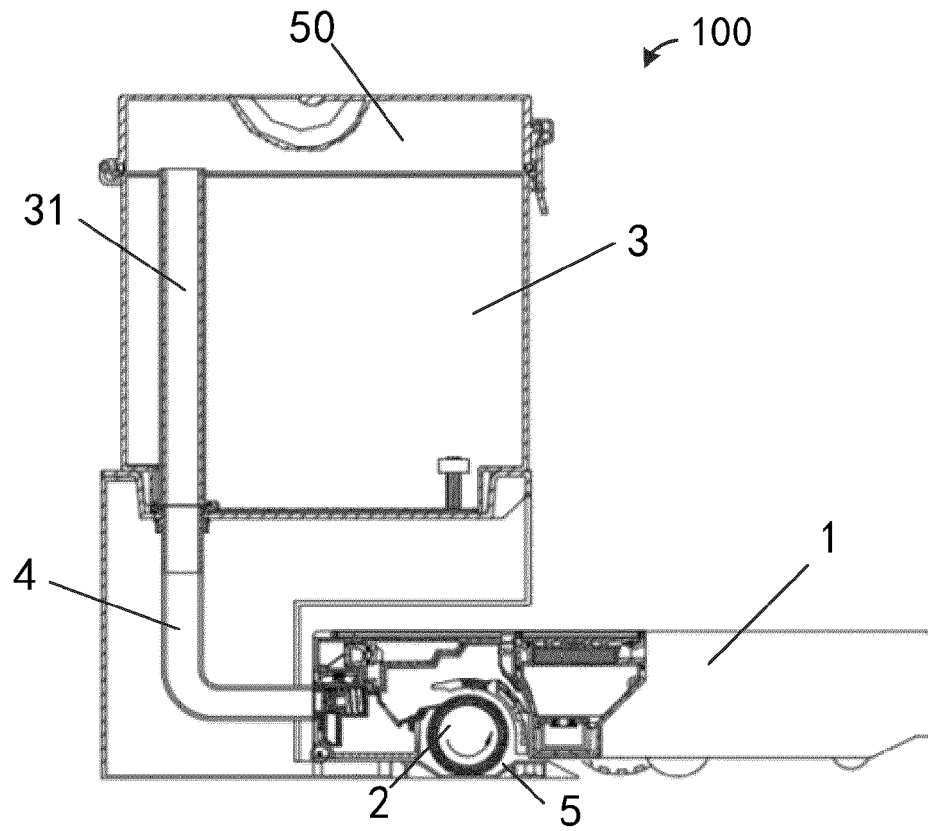


FIG. 2

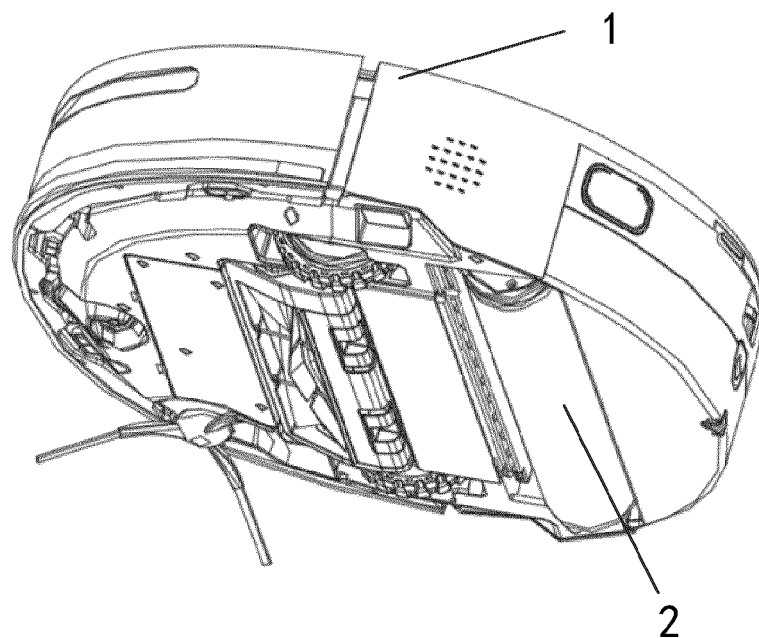


FIG. 3

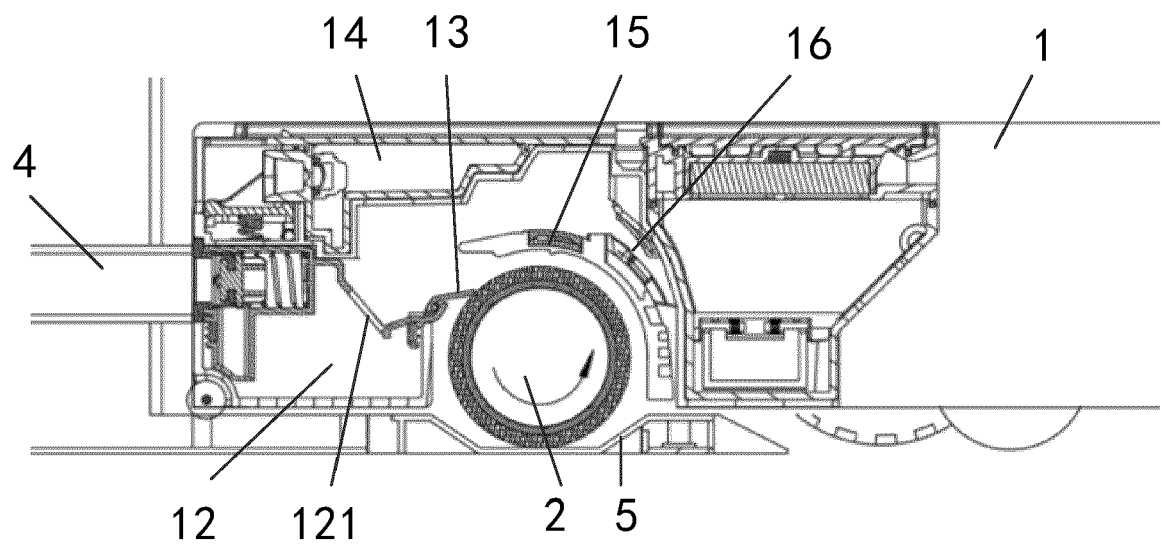


FIG. 4

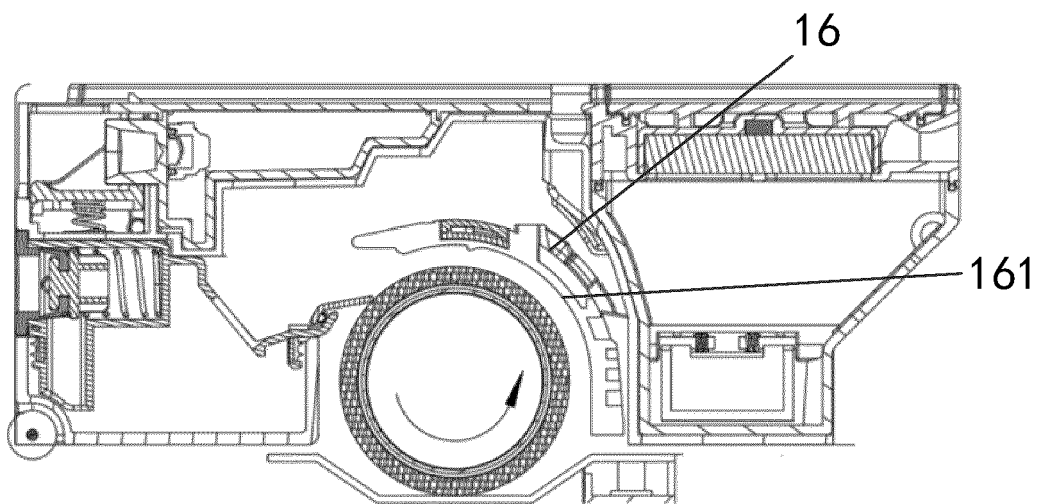


FIG. 5

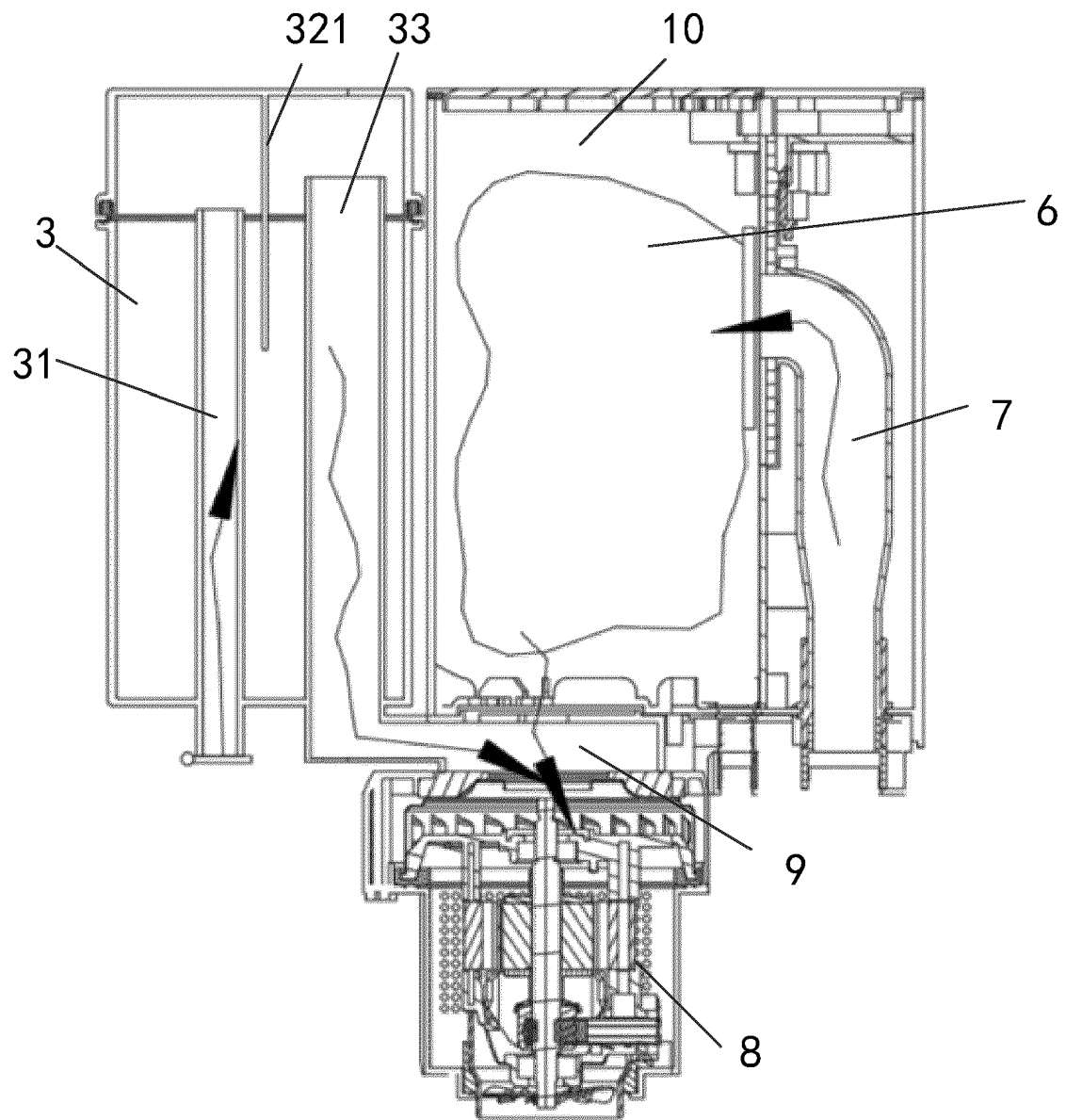


FIG. 6

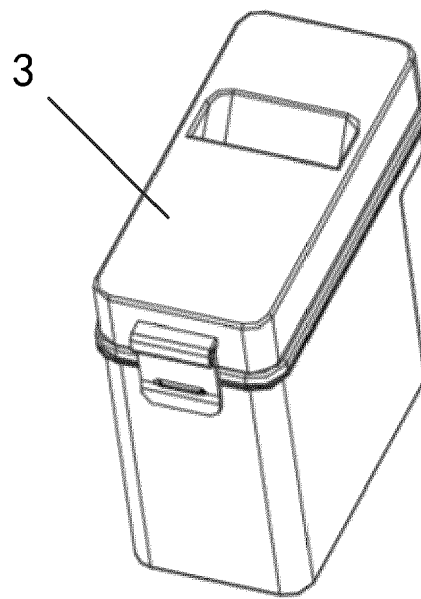


FIG. 7

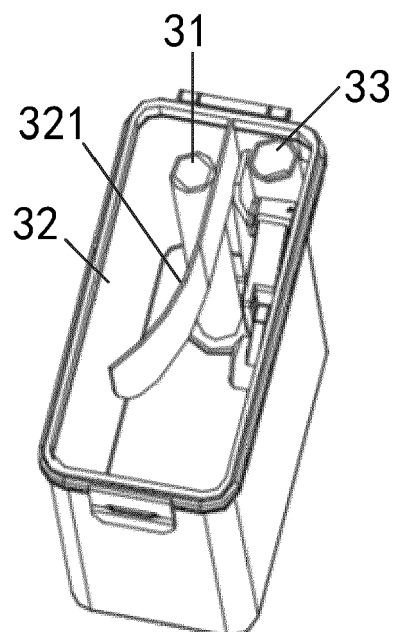


FIG. 8

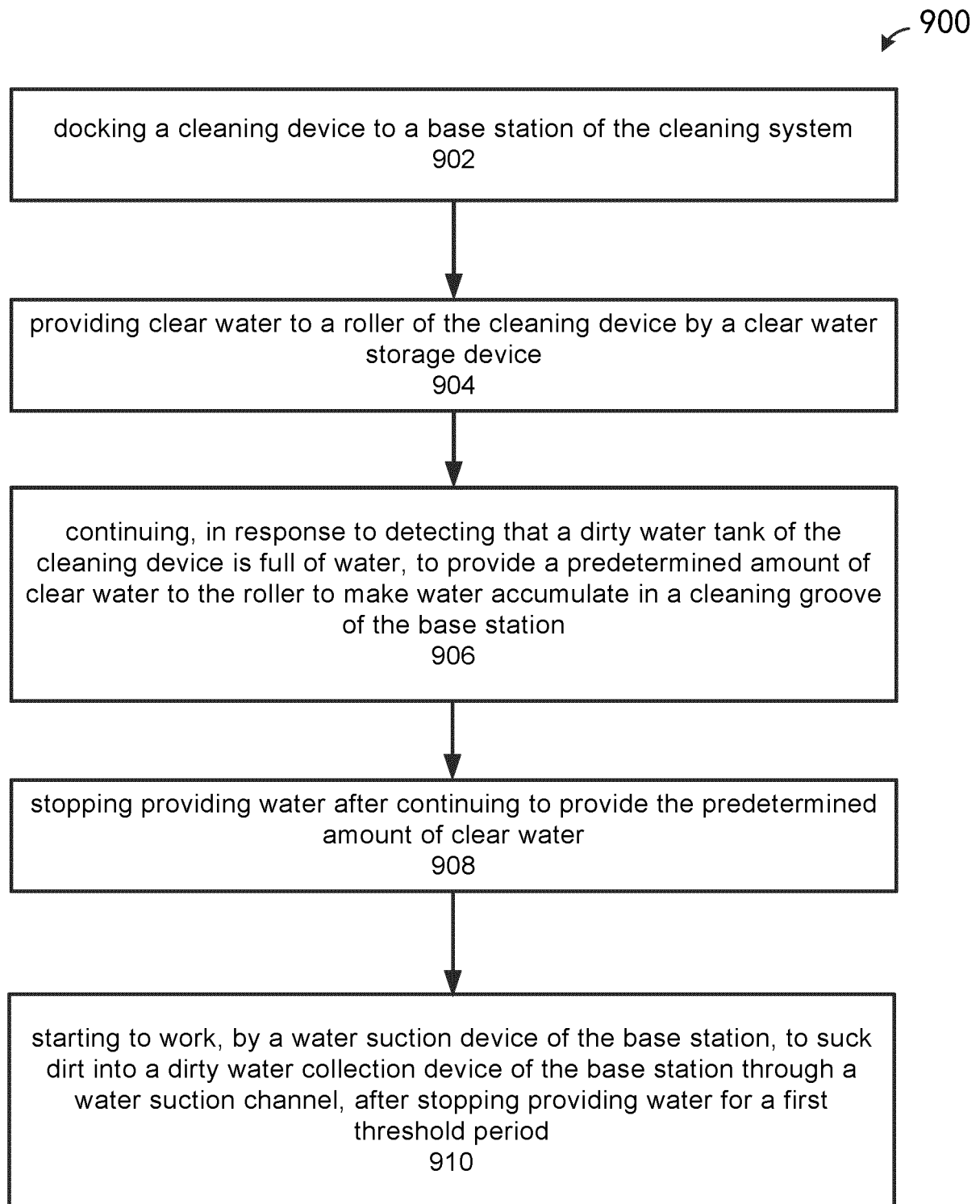


FIG. 9



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Place of search Munich		Date of completion of the search 18 August 2023	Examiner Jezierski, Krzysztof
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