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(54) **ROBOT CLEANING SYSTEM, AND METHOD FOR CONTROLLING SAME**

(57) The present invention provides a robot cleaning system. The robot cleaning system includes a cleaning robot, and a base station for the cleaning robot to stop. The cleaning robot includes: a main body; a walking module, arranged on the main body and driving the cleaning robot to move on a working surface; a mopping module, movably connected to the main body and including a replaceable cleaning layer, where the mopping module includes at least a first state and a second state, in the first state, the cleaning layer is fitted to the working surface, and in the second state, the cleaning layer is separated from the working surface, so that a working surface of the cleaning layer is exposed and is in contact with a cleaning layer removal mechanism; a driving mechanism, configured to drive the mopping module to switch between the first state and the second state; and a control module, configured to at least control the driving mechanism to drive the mopping module to switch from the first state to the second state when the cleaning layer needs to be replaced. The cleaning robot in the present invention has an intelligent mopping module, which can facilitate replacement of the cleaning layer.

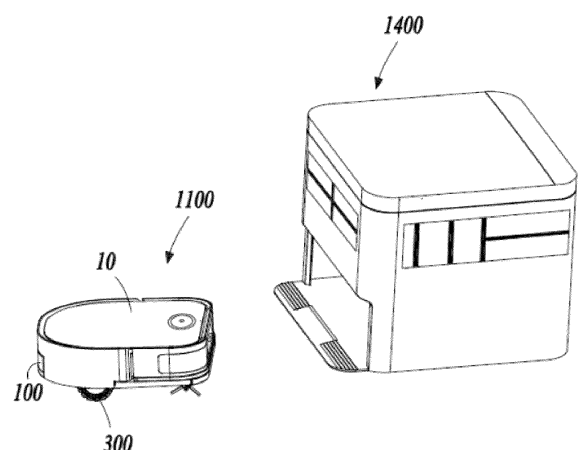


FIG. 1

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Description

Technical Field

[0001] The present invention relates to the field of intelligent device technologies, and in particular, to a robot cleaning system and a control method thereof.

Background

[0002] With the development of science and technology, an intelligent robot is well known to people. The robot can automatically execute preset related tasks thorough set programs without any human operation and intervention, thereby greatly saving time of people and bringing great convenience to life.

[0003] A cleaning robot having a mopping function can help people perform household cleaning work. A mop is arranged on a bottom portion of the cleaning robot. The cleaning robot automatically walks in a room to perform mopping work, but after the cleaning robot works for a period of time, the mop becomes dirty, affecting a cleaning effect, and the mop needs to be manually cleaned or replaced, which is relatively troublesome.

[0004] In the prior art, mops of some cleaning robots are automatically cleaned through base stations. For example, a stop position of the cleaning robot on the base station is provided with a cleaning tank below the corresponding mop. A cleaning drum and clean water are arranged in the cleaning tank, the cleaning drum rotates relative to the mop, and the mop is cleaned in a squeezing manner through the rotation of the cleaning drum. Alternatively, a scraper is arranged in the cleaning tank, and the mop is cleaned and squeezed through the scraper. Then, sewage is recycled to a sewage tank.

[0005] Although an automatic water washing solution for the cleaning robot in the prior art reduces the manual intervention, a cleaning effect of a mop is not very ideal, and the mop and the base station also have sewage residue after cleaning. When the mop is cleaned, noise is also relatively large, affecting user experience.

SUMMARY

[0006] In view of this, an objective of the present invention is to provide a robot cleaning system for automatically replacing a mop.

[0007] To resolve the foregoing technical problem, a technical solution provided in the present invention is as follows.

[0008] A robot cleaning system is provided, including: a cleaning robot, and a base station for the cleaning robot to stop, where the cleaning robot includes: a main body, including a front end; a walking module, arranged on the main body and driving the cleaning robot to move on a working surface; a mopping module, including a mopping base, where the mopping base is for a replaceable cleaning layer to attach to form a cleaning surface, and the

cleaning surface is configured to clean the working surface; the mopping module is movably connected to the main body to switch between a first state and a second state; and in the first state, the cleaning surface is fitted to the working surface, and in the second state, the cleaning surface is separated from the working surface; a driving module, configured to drive the mopping module to switch between the first state and the second state; and a control module, configured to at least control the driving module to drive the mopping module to switch from the first state to the second state when the cleaning layer needs to be replaced; and the robot cleaning system includes: a cleaning layer replacement mechanism, where when the mopping module is in the second state, the cleaning layer replacement mechanism is configured to operably act on the cleaning layer, to replace the cleaning layer for the mopping module.

[0009] In an embodiment, the mopping base includes an attachment surface attached to the cleaning layer, and in the second state, an angle is formed between the attachment surface and a first direction, where the first direction is a direction in which the cleaning robot enters the base station.

[0010] In an embodiment, when the mopping module is in the second state, the angle formed between the attachment surface and the first direction is greater than or equal to 30 degrees and less than or equal to 90 degrees.

[0011] In an embodiment, when the mopping module is in the second state, the attachment surface is perpendicular to the first direction.

[0012] In an embodiment, when the mopping module is in the second state, the angle formed between the attachment surface and the first direction is greater than or equal to 45 degrees and less than or equal to 60 degrees.

[0013] In an embodiment, the cleaning layer replacement mechanism includes a cleaning layer removal mechanism arranged on the base station; and the cleaning system includes a first transmission mechanism; and the cleaning system has a cleaning layer removal position for removing the cleaning layer on the mopping module, where the cleaning layer removal mechanism is configured to pick up the cleaning layer on the mopping module at the cleaning layer removal position; and the first transmission mechanism is configured to drive at least one of the cleaning layer removal mechanism and the mopping module to move, so that the cleaning layer removal mechanism and the mopping module generate relative displacement, to separate the cleaning layer on the mopping module from the mopping module.

[0014] In an embodiment, the first transmission mechanism is at least configured to drive the mopping module to move in at least a part of a process of separating the cleaning layer on the mopping module from the mopping module, where in the at least a part of the process of separating the cleaning layer on the mopping module from the mopping module, a position of the cleaning layer

removal mechanism is fixed.

[0015] In an embodiment, the first transmission mechanism includes the walking module, and the walking module is at least configured to drive the cleaning robot to move toward the cleaning layer removal mechanism in the at least a part of the process of separating the cleaning layer on the mopping module from the mopping module, so that the mopping module and the cleaning layer removal mechanism generate the relative displacement, where in the at least a part of the process of separating the cleaning layer on the mopping module from the mopping module, a position of the mopping module relative to the cleaning robot is fixed.

[0016] In an embodiment, the first transmission mechanism includes a movable member arranged on the cleaning robot and at least configured to drive the mopping module to move toward the cleaning layer removal mechanism in the at least a part of the process of separating the cleaning layer on the mopping module from the mopping module, where in the at least a part of the process of separating the cleaning layer on the mopping module from the mopping module, a position of the cleaning robot is fixed.

[0017] In an embodiment, the first transmission mechanism includes a first movable mechanism at least configured to drive the cleaning layer removal mechanism to move in at least a part of a process of separating the cleaning layer on the mopping module from the mopping module, where in the at least a part of the process of separating the cleaning layer on the mopping module from the mopping module, positions of the cleaning robot and the mopping module are fixed.

[0018] In an embodiment, the mopping base is detachably connected to the cleaning layer; the mopping plate has a removal region; the cleaning layer removal mechanism includes a hook; and when the hook and the mopping plate are located at the cleaning layer removal position, the hook matches the removal region, to remove the cleaning layer from the mopping module, where the removal region is not connected to the cleaning layer.

[0019] In an embodiment, the removal region includes a mop removal groove configured for the hook to pass through.

[0020] In an embodiment, the cleaning layer replacement mechanism includes a dirty mop box configured to accommodate the cleaning layer separated from the mopping module.

[0021] In an embodiment, the dirty mop box is arranged on a moving path of the cleaning layer separated from the mopping module, so that the cleaning layer falls into the dirty mop box.

[0022] In an embodiment, the cleaning layer removal position is located in the dirty mop box.

[0023] In an embodiment, the cleaning layer removal mechanism is arranged on the dirty mop box; the dirty mop box is provided with a first opening; and the first opening is configured to allow the mopping module to

extend into and allow the cleaning layer to be left in the dirty mop box when the mopping module leaves.

[0024] In an embodiment, the first opening of the dirty mop box faces a second direction at least at the cleaning layer removal position, where the second direction is a direction opposite to the first direction.

[0025] In an embodiment, the first transmission mechanism includes a second movable mechanism at least configured to drive the dirty mop box to move in at least a part of a process of separating the cleaning layer on the mopping module from the mopping module, so that the cleaning layer removal mechanism is displaced relative to the mopping module, where in the at least a part of the process of separating the cleaning layer on the mopping module from the mopping module, a position of the cleaning layer removal mechanism relative to the dirty mop box is fixed, a position of the cleaning robot is fixed, and a position of the mopping module relative to the cleaning robot is fixed.

[0026] In an embodiment, the first transmission mechanism is at least configured to drive the mopping module to move in at least a part of a process of separating the cleaning layer on the mopping module from the mopping module, where in the at least a part of the process of separating the cleaning layer on the mopping module from the mopping module, a position of the dirty mop box is fixed.

[0027] In an embodiment, the first transmission mechanism includes the walking module at least configured to drive the cleaning robot to move toward the dirty mop box in the at least a part of the process of separating the cleaning layer on the mopping module from the mopping module, so that the mopping module is displaced relative to the cleaning layer removal mechanism, where in the at least a part of the process of separating the cleaning layer on the mopping module from the mopping module, a position of the cleaning layer removal mechanism relative to the dirty mop box is fixed, and a position of the mopping module relative to the cleaning robot is fixed.

[0028] In an embodiment, the first transmission mechanism includes a movable member arranged on the cleaning robot and at least configured to drive the mopping module to move toward the dirty mop box in the at least a part of the process of separating the cleaning layer on the mopping module from the mopping module, so that the mopping module is displaced relative to the cleaning layer removal mechanism, where in the at least a part of the process of separating the cleaning layer on the mopping module from the mopping module, a position of the cleaning layer removal mechanism relative to the dirty mop box is fixed, and a position of the cleaning robot is fixed.

[0029] In an embodiment, the cleaning system has a cleaning layer removal position for removing the cleaning layer on the mopping module; the cleaning layer replacement mechanism includes a cleaning layer removal mechanism arranged on the cleaning robot and configured to separate the cleaning layer on the mopping mod-

ule from the mopping module at the cleaning layer removal position; and the cleaning system includes a motion mechanism, and the motion mechanism is configured to drive the cleaning layer removal mechanism to move, so that the cleaning layer removal mechanism and the mopping module generate relative displacement, to separate the cleaning layer on the mopping module from the mopping module, where in at least a part of a process of separating the cleaning layer on the mopping module from the mopping module, positions of the cleaning robot and the mopping module are fixed.

[0030] In an embodiment, the cleaning layer removal mechanism includes a flipping member, and the flipping member includes an open state and a closed state; when the flipping member is in the open state, the cleaning layer is separable from the mopping module; when the flipping member is in the closed state, the cleaning layer is mounted on the mopping module; and the motion mechanism includes a driving apparatus, and the driving apparatus is configured to drive the flipping member to switch from the closed state to the open state, so that the cleaning layer on the mopping module is separated from the mopping module.

[0031] In an embodiment, the cleaning layer replacement mechanism includes a dirty mop box configured to accommodate the cleaning layer separated from the mopping module.

[0032] In an embodiment, the dirty mop box is arranged on a moving path of the cleaning layer separated from the mopping module, so that the cleaning layer falls into the dirty mop box.

[0033] In an embodiment, the cleaning layer removal position is located in the dirty mop box.

[0034] In an embodiment, the cleaning layer replacement mechanism includes a clean mop box configured to accommodate a cleaning layer to be mounted on the mopping module; the cleaning system has a cleaning layer mounting position; the cleaning layer mounting position is a position at which the cleaning layer in the clean mop box is mounted on the mopping module; and the cleaning system includes a second transmission mechanism configured to drive at least one of the clean mop box and the mopping module to move, to reach the cleaning layer mounting position, so as to mount the cleaning layer in the clean mop bin on the mopping module.

[0035] In an embodiment, the second transmission mechanism is at least configured to drive the mopping module to move in at least a part of a process of mounting the cleaning layer on the mopping module on the mopping module, where in the at least a part of the process of mounting the cleaning layer on the mopping module on the mopping module, a position of the clean mop box is fixed.

[0036] In an embodiment, the second transmission mechanism includes the walking module at least configured to drive the cleaning robot to move to drive the mopping module to move toward the clean mop box in the at least a part of the process of mounting the cleaning layer

in the clean mop box on the mopping module, where in the at least a part of the process of mounting the cleaning layer in the clean mop box on the mopping module, a position of the clean mop box is fixed, and a position of the mopping module relative to the cleaning robot is fixed.

[0037] In an embodiment, the second transmission mechanism includes a movable member arranged on the cleaning robot and at least configured to drive the mopping module to move toward the clean mop box in the at least a part of the process of mounting the cleaning layer in the clean mop box on the mopping module, where in the at least a part of the process of mounting the cleaning layer in the clean mop box on the mopping module, positions of the cleaning robot and the clean mop box are fixed.

[0038] In an embodiment, the second transmission mechanism includes a third movable mechanism at least configured to drive the clean mop box to move toward the mopping module in at least a part of a process of mounting the cleaning layer in the clean mop box on the mopping module, where in the at least a part of the process of mounting the cleaning layer in the clean mop box on the mopping module, positions of the cleaning robot and the mopping module are fixed.

[0039] In an embodiment, the clean mop box is provided with a second opening; and the second opening is configured to allow the mopping module to extend into, to mount the cleaning layer on the mopping module.

[0040] In an embodiment, the second opening of the clean mop box faces a second direction at least at the cleaning layer mounting position, where the second direction is a direction opposite to the first direction.

[0041] In an embodiment, a cleaning surface of the cleaning layer in the clean mop box is parallel to the attachment surface; or an angle formed between a cleaning surface of the cleaning layer in the clean mop box and the first direction is equal to the angle formed between the attachment surface and the first direction.

[0042] In an embodiment, the cleaning layer is a sheet-like mop; and when there are at least two sheet-like mops, the at least two sheet-like mops are arranged in the clean mop box in a stacking manner.

[0043] In an embodiment, the mopping base has an adhesion region; and the cleaning layer is adherable to the adhesion region.

[0044] In an embodiment, a support part is arranged in the clean mop box and is configured to support the cleaning layer, so that the angle is formed between the cleaning surface of the cleaning layer accommodated in the clean mop box and the first direction.

[0045] In an embodiment, when the mopping module is switched from the first state to the second state, the driving mechanism drives the mopping module to lift by a preset distance in a direction perpendicular to the working surface and then flip toward the first direction.

[0046] In an embodiment, the base station includes: a platform for carrying the cleaning robot, a first accommodating groove is provided on the platform, the control

module is configured to control the driving module to drive the mopping module to switch from the first state to the second state when the cleaning robot moves to a stop position, and in at least a part of a process of switching the mopping module from the first state to the second state, at least a part of the mopping module is accommodated in the first accommodating groove.

[0047] In an embodiment, the cleaning system further includes: an in-place detection apparatus configured to detect whether the cleaning layer removal mechanism and/or the mopping module reaches an alignment position, where the alignment position is a position when the cleaning layer removal mechanism and the mopping module are in an alignment state.

[0048] In an embodiment, the cleaning system further includes: an in-place detection apparatus configured to detect whether the dirty mop box and/or the mopping module reaches an alignment position, where the alignment position is a position when the cleaning layer removal mechanism and the mopping module are in an alignment state.

[0049] In an embodiment, the cleaning system further includes: an in-place detection apparatus configured to detect whether the clean mop box and/or the mopping module reaches an alignment position, where the alignment position is a position when the clean mop box and the mopping module are in an alignment state.

[0050] In an embodiment, the cleaning system has a cleaning layer removal position and a cleaning layer mounting position that cooperate with the mopping module for removing the cleaning layer and mounting the cleaning layer;

the cleaning layer replacement mechanism includes: a dirty mop box configured to accommodate the cleaning layer, a clean mop box configured to accommodate a cleaning layer to be mounted on the mopping module, a second movable mechanism configured to drive the dirty mop box to move to the cleaning layer removal position, a third movable mechanism configured to drive the clean mop box to move to the cleaning layer mounting position, and a cleaning layer removal mechanism; and the cleaning layer removal mechanism is configured to grab the cleaning layer on the mopping module at the cleaning layer removal position.

[0051] In an embodiment, the cleaning layer removal position and the cleaning layer mounting position are a same preset position.

[0052] In an embodiment, the control module is at least configured to control the driving module to drive the mopping module to switch from the second state back to the first state after replacement of the cleaning layer is completed.

[0053] The present disclosure further provides a control method for a robot cleaning system, applicable to the robot cleaning system, where the method includes: when a cleaning layer needs to be replaced, controlling, by a control module, a driving module to drive a mopping module to switch from a first state to a second state; and when

the mopping module is in the second state, operably acting, by a cleaning layer replacement mechanism, on the cleaning layer and/or a mopping base, to replace the cleaning layer for the mopping module.

[0054] Compared with the prior art, according to the robot cleaning system and the control method thereof provided in the present invention, when the cleaning robot works for a period of time and a mop becomes dirty, the mop can be conveniently and automatically replaced, and the replacement of the mop is quick and quiet and does not cause pollution to an environment or the base station, thereby improving reliability and work efficiency of the cleaning robot and increasing a satisfaction degree of a user for the robot cleaning system.

BRIEF DESCRIPTION OF THE DRAWINGS

[0055] To describe the technical solutions in embodiments of the present invention or in the related art more clearly, the following briefly describes the accompanying drawings required for describing the embodiments or the related art. Apparently, the accompanying drawings in the following description show merely some embodiments of the present invention, and a person of ordinary skill in the art may derive other drawings from these accompanying drawings without creative efforts.

FIG. 1 is a schematic diagram of a robot cleaning system according to an implementation of the present invention;

FIG. 2 is a schematic diagram when a mopping module of a robot cleaning system is in a first state according to an implementation of the present invention;

FIG. 3 is a schematic diagram when a mopping module of a robot cleaning system is in a second state according to an implementation of the present invention;

FIG. 4 is a schematic diagram when a mopping module of a robot cleaning system is in a second state according to an implementation of the present invention;

FIG. 5 is a schematic diagram when a cleaning robot of a robot cleaning system is in a lifting state according to an implementation of the present invention;

FIG. 6 is a schematic diagram when a cleaning robot of a robot cleaning system is in a lifting state according to an implementation of the present invention;

FIG. 7 is a schematic diagram in which a mopping module of a robot cleaning system returns a base station when being in a second state according to an implementation of the present invention;

FIG. 8 is a schematic diagram in which a robot cleaning system picks up an old mop according to an implementation of the present invention;

FIG. 9 is a schematic diagram in which a robot cleaning system exits a dirty mop box after removing an old mop according to an implementation of the present invention;

FIG. 10 is a schematic diagram in which a robot cleaning system obtains a new mop according to an implementation of the present invention;

FIG. 11 is a schematic diagram in which a mopping module of a robot cleaning system is in a base station when being in a first state according to an implementation of the present invention;

FIG. 12 is a schematic diagram in which the mopping module of the robot cleaning system shown in FIG. 11 is in the base station when being in a second state;

FIG. 13 is a schematic diagram in which the robot cleaning system shown in FIG. 11 replaces a mop in the base station;

FIG. 14 is a schematic diagram in which a dirty mop box and a clean mop box of a robot cleaning system are arranged at an angle according to an implementation of the present invention;

FIG. 15 is a schematic diagram in which a flipping mechanism enables a mopping module to flip to a second state according to an implementation of the present invention;

FIG. 16 is a schematic diagram of a flipping mechanism according to an implementation of the present invention;

FIG. 17 is a schematic diagram of a driving mechanism according to an implementation of the present invention;

FIG. 18 is a schematic diagram in which a driving mechanism lifts a mopping module according to an embodiment of the present invention;

FIG. 19 is a schematic diagram in which a driving mechanism flips a mopping module according to an implementation of the present invention;

FIG. 20 is a schematic diagram of a robot cleaning system according to the present invention;

FIG. 21 is a schematic diagram when a flipping member is in a closed state according to an implementation of the present invention;

FIG. 22 is a schematic diagram when a flipping member is in an open state according to an implementation of the present invention;

FIG. 23 is a schematic diagram when a flipping member is in another open state according to an implementation of the present invention;

FIG. 24 is a schematic diagram when a mopping base moves to a clean mop box to obtain a cleaning layer according to an implementation of the present invention;

FIG. 25(a) is a schematic diagram in which a cleaning layer removal mechanism reaches a cleaning layer removal position according to an implementation of the present invention;

FIG. 25(b) is a schematic diagram in which a cleaning layer removal mechanism removes a cleaning layer according to an implementation of the present invention;

FIG. 26(a) is a schematic diagram in which a mopping module moves to a dirty mop box and a flipping member is in a closed state according to an implementation of the present invention;

FIG. 26(b) is a schematic diagram of a driving apparatus drives a flipping member to open according to an implementation of the present invention;

FIG. 26(c) is a schematic diagram when a hook removes a cleaning layer according to an implementation of the present invention; and

FIG. 26(d) is a schematic diagram in which a mopping module leaves a dirty mop box according to an implementation of the present invention.

DETAILED DESCRIPTION

[0056] To make the objectives, technical solutions, and advantages of the present invention clearer and more comprehensible, the present invention is further described in detail below with reference to the specific embodiments and the accompanying drawings.

[0057] It should be noted that unless otherwise defined, the technical terms or scientific terms used in the embodiments of the present invention should have general meanings understood by a person of ordinary skill in the field of the present invention. The "first", the "second" and similar terms used in the embodiments of the present invention do not indicate any order, quantity or significance, but are used to only distinguish different components. A similar term such as "include" or "including" means that an element or an item appearing in front of the term covers an element or an item and equivalents

thereof listed behind the term, but does not exclude another element or item. A similar term such as "connect" or "connection" is not limited to a physical or mechanical connection, but may include an electrical connection, whether direct or indirect. "Up", "down", "left", "right", and the like are merely used for indicating relative positional relationships. When absolute positions of described objects change, the relative positional relationships may correspondingly change.

[0058] In addition, that a position is fixed mentioned in the present disclosure refers to non-active movement. Therefore, it may be understood that the position is unchanged or the position is basically unchanged, and that the position is basically unchanged means, for example, that the position is slightly changed due to an action of an external force.

[0059] Currently, for how to maintain a cleaning robot having a mopping and wiping function in the prior art, after the cleaning robot works for a period of time and returns to a base station, the cleaning robot is cleaned by using an automatic cleaning system arranged in the base station. Although such an automatic washing solution for the cleaning robot reduces manual intervention, a cleaning effect of a mop is not ideal, and the mop and the base station also have sewage residue after cleaning. In addition, when the mop is cleaned, noise is also relatively large, affecting user experience.

[0060] In view of this, the present invention provides a robot cleaning system. After a cleaning robot returns to a base station, a mop may be replaced for the cleaning robot, to clean the cleaning robot, which eliminates a process of automatically cleaning the cleaning robot in the prior art, thereby avoiding sewage residue and a noise problem generated in at least a part of the cleaning process, and improving the user experience.

[0061] The robot cleaning system includes: a cleaning robot, and a base station for the cleaning robot to stop.

[0062] The cleaning robot includes: a main body, including a front end; a walking module, arranged on the main body and driving the cleaning robot to move on a working surface; a mopping module, including a mopping base, where the mopping base may be, for example, a mopping plate, the mopping base is for a replaceable cleaning layer to attach to form a cleaning surface, and the cleaning surface is configured to clean the working surface, especially clean the working surface when the cleaning robot works; the mopping module includes at least a first state and a second state, and the mopping module is movably connected to the main body to switch between the first state and the second state; in the first state, the cleaning surface is fitted to the working surface; and in the second state, the cleaning surface is separated from the working surface; a driving module, configured to drive the mopping module to switch between the first state and the second state; and a control module, configured to at least control the driving module to drive the mopping module to switch from the first state to the second state when the cleaning layer needs to be replaced.

[0063] Certainly, in another embodiment, when the cleaning robot is in another scenario such as obstacle crossing, carpet cleaning, or returning a base station, the control module may also control the driving module to drive the mopping module to switch from the first state to the second state. In the second state, the mopping module is configured to not hinder movement of the cleaning robot.

[0064] The cleaning system further includes: a cleaning layer replacement mechanism. When the mopping module is in the second state, the cleaning layer replacement mechanism is configured to operably act on the cleaning layer and/or the mopping base, to replace the cleaning layer for the mopping module.

[0065] It should be noted that the cleaning layer replacement mechanism may be arranged on the cleaning robot, for example, the cleaning layer replacement mechanism includes a cleaning layer removal mechanism such as a flipping member arranged on the cleaning robot and configured to remove the cleaning layer; or may be arranged on the base station, for example, the cleaning layer replacement mechanism includes a cleaning layer removal mechanism such as a hook arranged on the base station and configured to remove the cleaning layer; or certainly may be partially arranged on the cleaning robot and partially arranged on the base station, for example, the cleaning layer removal mechanism includes both a flipping member arranged on the cleaning robot and a hook arranged on the base station. Certainly, in another embodiment, the cleaning layer replacement mechanism may further include, for example, a dirty mop bin for accommodating a dirty mop and/or a clean mop bin for accommodating a new mop, where the dirty mop bin and/or the clean mop bin is arranged on the base station. The cleaning layer removal mechanism is arranged on the cleaning robot or arranged on the base station. It may be understood that the mechanisms with different functions may be arranged according to a requirement (for example, a space layout). This is not specifically limited in the present disclosure.

[0066] It should be noted that the replacement should be understood as removal and mounting, that is, replacement of a cleaning layer (for example, a mop) includes at least one of removal and mounting of the cleaning layer. For example, when there is no mop on the mopping base (for example, the mopping plate), in this case, replacing a cleaning layer means mounting an unused cleaning layer. If there is a cleaning layer on the mopping plate, replacing a mop may include removing the cleaning layer on the mopping plate and mounting an unused cleaning layer. The cleaning layer on the mopping plate generally means a used cleaning layer, that is, a dirty cleaning layer, and the unused cleaning layer generally means a new and clean cleaning layer. Whether the cleaning robot needs to replace the mop may be determined by detecting a dirtiness degree of the cleaning layer, obtaining a working duration of the cleaning robot using the cleaning layer or a cleaning area cleaned by

using the cleaning layer, receiving a replacement instruction from a user, or the like. Details are not described in this embodiment. In addition, both the removal and the mounting of the cleaning layer or the removal and mounting of the cleaning layer may be determined according to a user requirement or may be determined by detecting whether the mopping plate has a cleaning layer according to a program when the cleaning robot needs to replace the mop. This is not limited in this embodiment.

[0067] The removal of the cleaning layer and the mounting of the cleaning layer on the mopping module (especially, the mopping plate) are respectively described below by using the mopping base as the mopping plate.

1. Removal of the cleaning layer:

[0068] To implement the removal of the cleaning layer from the mopping plate, the cleaning layer replacement mechanism includes: a cleaning layer removal mechanism configured to remove the cleaning layer (for example, a mop paper).

[0069] In an embodiment, the cleaning layer removal mechanism is arranged on the base station. Further, the cleaning layer removal mechanism includes a hook. The hook is arranged on the base station.

[0070] For example, when the cleaning layer removal mechanism includes a dirty mop box described in the following, the hook may be arranged on the dirty mop box. Certainly, in another embodiment, the hook may alternatively be arranged outside the dirty mop box, for example, the hook is located between the mopping plate and the dirty mop box. An arrangement position of the hook may be determined according to an actual requirement and is subject to facilitate removal.

[0071] In an embodiment, the mopping plate has a removal region. The removal region may match the cleaning layer removal mechanism, to remove the cleaning layer from the mopping plate.

[0072] In an embodiment, the removal region is not connected to the cleaning layer.

[0073] Further, the removal region includes a mop removal groove. An outer edge of the mopping plate is recessed toward the inside of the mopping plate, to form the mop removal groove. The cleaning layer removal mechanism includes a hook. The hook may match the mop removal groove, to remove the cleaning layer from the mopping plate. The mop removal groove may be, for example, a removal through hole matching the hook.

[0074] The cleaning layer has a part covering the mop removal groove. The hook may pass through the mop removal groove and hook the part of the cleaning layer covering the mop removal groove, to remove the cleaning layer from the mopping plate.

[0075] Considering a problem that how the removal region and the cleaning layer removal mechanism cooperate with each other for removal, on one hand, the mopping module and the cleaning layer removal mechanism

may move to a same preset position. On the other hand, a state of the mopping module needs to match a state of the cleaning layer removal mechanism, for example, an inclination angle of the removal region needs to match an inclination angle of the cleaning layer removal mechanism.

[0076] For a first aspect, in an embodiment, the cleaning system includes a cleaning layer removal position for separating or removing the cleaning layer from the mopping plate. The cleaning layer removal mechanism is configured to pick up the cleaning layer on the mopping module at the cleaning layer removal position. The picking up may be understood, for example, that the cleaning layer removal mechanism is in contact with the cleaning layer and facilitates removal of the cleaning layer.

[0077] For example, when the hook and the mopping plate are located at the cleaning layer removal position, the hook may be in contact with the mop removal groove, and the hook and the mop removal groove are displaced, to remove the cleaning layer from the mopping plate. Specifically, at the cleaning layer removal position, the hook may pass through the mop removal groove and hook the part of the cleaning layer covering the mop removal groove, and then the hook and the mop removal groove further generate a relative displacement, to remove the cleaning layer from the mopping plate.

[0078] To enable the mopping plate and the cleaning layer removal mechanism to generate the relative displacement, for example, enable at least one of the mopping plate and the cleaning layer removal mechanism to reach the cleaning layer removal position and generate the relative displacement at the cleaning layer removal position, in an embodiment, the cleaning system includes a first transmission mechanism. The first transmission mechanism is configured to drive at least one of the cleaning layer removal mechanism and the mopping module (especially, the mopping plate) to move, so that the mopping module and the cleaning layer removal mechanism generate a relative displacement, to separate the cleaning layer on the mopping module from the mopping module.

[0079] For example, the first transmission mechanism is configured to drive at least one of the cleaning layer removal mechanism and the mopping module (especially, the mopping plate) to move to reach the cleaning layer removal position; and further drive at least one of the cleaning layer removal mechanism and the mopping module (especially, the mopping plate) to move when the mopping plate and the cleaning layer removal mechanism are located at the cleaning layer removal position, to separate the cleaning layer on the mopping module from the mopping module.

[0080] The first transmission mechanism may be, for example, a mechanical arm driving the cleaning layer removal mechanism to move, a movable member (for example, a telescopic mechanism) driving the mopping module to move, or the walking module driving the cleaning robot to move to drive the mopping module to move.

[0081] It should be noted that the cleaning layer removal position may be set according to a requirement, for example, the mopping plate in the second state is exactly located at the cleaning layer removal position. Certainly, the cleaning layer removal mechanism may be pre-arranged at the cleaning layer removal position. In this way, movement of the first transmission mechanism is simplified during removal.

[0082] A manner in which the cleaning layer removal mechanism or the mopping plate generates the relative displacement may be that the cleaning layer removal mechanism moves and the mopping module (especially, the mopping plate) does not move; or may be that the cleaning layer removal mechanism does not move and the mopping module moves; or may be that both the cleaning layer removal mechanism and the mopping module move. The movement of the mopping module may be passive movement caused by movement of the cleaning robot, or may be active movement of the mopping module driven by an additional active motion mechanism (for example, a movable member). That is, the mopping module may actively move relative to the cleaning robot, or may be fixed at a position relative to the cleaning robot and driven by the cleaning robot to passively move. This is not limited in the present disclosure.

[0083] For example, the first transmission mechanism includes a first movable mechanism configured to drive the cleaning layer removal mechanism to move. In at least a part of a process of separating the cleaning layer on the mopping module from the mopping module, positions of the cleaning robot and the mopping module are fixed, and the first movable mechanism drives the cleaning layer removal mechanism to move, so that the cleaning layer removal mechanism is displaced relative to the mopping module.

[0084] For example, the first movable mechanism is, for example, a mechanical arm for driving the cleaning layer removal mechanism to move.

[0085] For another example, the first transmission mechanism includes a movable member arranged on the cleaning robot and configured to drive the mopping module to move. In the at least a part of the process of separating the cleaning layer on the mopping module from the mopping module, positions of the cleaning robot and the cleaning layer removal mechanism are fixed, and the movable member drives the mopping module to move, so that the mopping module is displaced relative to the cleaning layer removal mechanism.

[0086] Certainly, in another embodiment, the first transmission mechanism includes the walking module. In the at least a part of the process of separating the cleaning layer on the mopping module from the mopping module, a position of the cleaning layer removal mechanism is fixed, and a position of the mopping module relative to the cleaning robot is fixed. The walking module drives the cleaning robot to move, so that the mopping module is displaced relative to the cleaning layer removal mechanism. For example, the walking module drives the

cleaning robot to move to the cleaning layer removal position, so that the cleaning layer removal mechanism picks up the cleaning layer on the mopping module at the cleaning layer removal position. Further, the walking module drives the cleaning robot to continuously move, so that the cleaning layer removal mechanism removes the cleaning layer from the mopping module or the mopping plate, to separate the cleaning layer from the mopping module.

[0087] The cleaning robot moves to drive the mopping module to move, thereby simplifying a system structure and reducing costs.

[0088] For a second aspect, in an embodiment, the cleaning layer removal mechanism is a hook. The removal region includes a mop removal groove, and at the cleaning layer removal position, the hook can pass through the corresponding mop removal groove.

[0089] Further, there are two hooks, which are respectively arranged on two opposite side walls of the dirty mop box. There are two mop removal grooves, which are provided on two sides of the mopping plate. A connecting line between centers of the two hooks is parallel to a connecting line between centers of the two mop removal grooves; or a connecting line between centers of the hooks is parallel to the attachment surface of the mopping base or parallel to the cleaning surface of the cleaning layer.

[0090] Considering a problem of recycling a removed cleaning layer, in an embodiment, the cleaning layer replacement mechanism includes a dirty mop box configured to accommodate the cleaning layer separated from the mopping module.

[0091] The removed cleaning layer may be, for example, a used sheet-like mop or a dirty sheet-like mop. In addition, in some embodiments, the sheet-like mop may alternatively be a disposable paper mop.

[0092] To ensure that the removed cleaning layer can accurately fall into the dirty mop box, this can be implemented in at least one of the following manners.

[0093] Manner A: The dirty mop box is arranged on a moving path of a separated cleaning layer.

[0094] Manner B: The cleaning layer removal position is located in the dirty mop box.

[0095] Manner C: The cleaning layer removal mechanism is located on the dirty mop box or in the dirty mop box.

[0096] Therefore, in an embodiment, the dirty mop box is arranged on a moving path of the cleaning layer separated from the mopping module, so that the cleaning layer falls into the dirty mop box.

[0097] In another embodiment, the cleaning layer removal mechanism (for example, the hook) is arranged on the dirty mop box.

[0098] The cleaning layer removal mechanism is mounted on the dirty mop box, so that the removed cleaning layer directly falls into the dirty mop box.

[0099] In still another embodiment, the cleaning layer removal position is set in the dirty mop box, so that the

cleaning layer can also fall into the dirty mop box.

[0100] It should be noted that in an embodiment, a maintaining part configured to support the removed cleaning layer may alternatively be arranged in the dirty mop box, so that the removed cleaning layer can maintain a state when being removed, and a removed path is guided. The maintaining part may be, for example, a step or a slop. This is not limited in this embodiment.

[0101] Certainly, in another embodiment, an additional picking mechanism may alternatively be arranged to pick up and send the separated cleaning layer to the dirty mop box, or the separated cleaning layer is artificially picked up and placed into the dirty mop box.

[0102] In an embodiment, the dirty mop box is provided with a first opening. The first opening is configured to allow the mopping module to extend into and allow the cleaning layer to be left in the dirty mop box when the mopping module leaves. For example, the dirty mop box includes a bottom portion and at least two opposite side walls. The side walls are connected to the bottom portion, and the side walls and the bottom portion may form the first opening. The first opening is opposite to the bottom portion.

[0103] It may be understood that at the cleaning layer removal position or when the mopping module is in the second state, the first opening of the dirty mop box faces a second direction. A first direction is a direction in which the cleaning robot enters the base station, for example, a direction in which the cleaning robot points to the base station. The second direction is opposite to the first direction. That is, the second direction is an exit direction of the cleaning robot, for example, a direction in which the base station points to the cleaning robot or a direction in which the cleaning robot is away from the base station. Therefore, the mopping module may extend into the dirty mop box through the first opening and match the cleaning layer removal mechanism, so that the cleaning layer is left in the dirty mop box when the mopping module leaves the first opening.

[0104] To recycle more cleaning layers, further, the cleaning layer removal position or the cleaning layer removal mechanism is arranged at the first opening of the dirty mop box.

[0105] When the cleaning layer removal mechanism is arranged on the dirty mop box (for example, arranged on one end of the side wall of the dirty mop box away from the bottom portion) or in the dirty mop box (for example, arranged at a preset position of the side wall of the dirty mop box, movement of the cleaning layer removal mechanism may be implemented through movement of the dirty mop box. Therefore, the manner in which the cleaning layer removal mechanism or the mopping module (especially, the mopping plate) generates the relative displacement includes that the dirty mop box moves, to drive the cleaning layer removal mechanism to passively move, and the cleaning robot and the mopping plate do not move; the dirty mop box does not move, in this case, the cleaning layer removal mechanism also

does not move, and the cleaning robot and/or the mopping plate moves; and the dirty mop box moves, to drive the cleaning layer removal mechanism to passively move, and at least one of the cleaning robot and the mopping plate also moves.

[0106] Therefore, in an embodiment, the first transmission mechanism includes a second movable mechanism configured to drive the dirty mop box to move. In at least a part of a process of separating the cleaning layer on the mopping module from the mopping module, a position of the cleaning layer removal mechanism relative to the dirty mop box is fixed, a position of the cleaning robot is fixed, and a position of the mopping module relative to the cleaning robot is fixed. The second movable mechanism drives the dirty mop box to move, to drive the cleaning layer removal mechanism to move, so that the cleaning layer removal mechanism is displaced relative to the mopping module.

[0107] For example, when the cleaning layer removal mechanism is mounted at a position of the side wall of the dirty mop box with a preset distance from the opening and has a specific distance to the bottom portion, the second movable mechanism drives the dirty mop box to move toward the mopping module, so that the mopping module extends into the dirty mop box through the first opening and reaches a position (for example, the cleaning layer removal position) that is in contact with the cleaning layer removal mechanism, and further moves, to separate the cleaning layer from the mopping module. Then, the second movable mechanism drives the dirty mop box to move in an opposite direction (a direction away from the mopping module), so that the mopping module leaves the first opening, and when the mopping module leaves, the cleaning layer falls into or has fallen into the dirty mop box.

[0108] For another example, when the cleaning layer removal mechanism is mounted at the first opening of the dirty mop box (that is, mounted at a position of one end of the side wall away from the bottom portion and with distance from the first opening being 0 or basically being 0), the second movable mechanism drives the dirty mop box to move toward the mopping module, so that the mopping module reaches a position that is in contact with the cleaning layer removal mechanism and further moves to extend into the dirty mop box through the first opening, for example, moves to a position with a distance from the bottom portion being 0, to separate the cleaning layer from the mopping module. Then, the second movable mechanism drives the dirty mop box to move in an opposite direction (a direction away from the mopping module) by a preset distance, and when the mopping module leaves the first opening, the cleaning layer falls into or has fallen into the dirty mop box.

[0109] In another embodiment, the first transmission mechanism is at least configured to drive the mopping module to move in at least a part of a process of separating the cleaning layer on the mopping module from the mopping module. In the at least a part of the process

of separating the cleaning layer on the mopping module from the mopping module, a position of the dirty mop box is fixed.

[0110] An implementation of the movement of the mopping module includes at least one of the following.

[0111] For example, the first transmission mechanism includes the walking module.

[0112] In the at least a part of the process of separating the cleaning layer on the mopping module from the mopping module, a position of the dirty mop box is fixed, a position of the cleaning layer removal mechanism relative to the dirty mop box is fixed, and a position of the mopping module relative to the cleaning robot is fixed. The walking module drives the cleaning robot to move toward the dirty mop box, to drive the mopping module to move, so that the mopping module and the cleaning layer removal mechanism generate relative displacement.

[0113] For another example, in another embodiment, the first transmission mechanism includes a movable member arranged on the cleaning robot and configured to drive the mopping module to move.

[0114] In at least a part of a process of separating the cleaning layer on the mopping module from the mopping module, a position of the dirty mop box is fixed, a position of the cleaning layer removal mechanism relative to the dirty mop box is fixed, and a position of the cleaning robot is fixed. The movable member drives the mopping module to move toward the dirty mop box, so that the mopping module and the cleaning layer removal mechanism generate the relative displacement.

[0115] It should be noted that the manner for implementing the relative displacement of the cleaning layer removal mechanism or the mopping module is merely an example and should not be understood as a limitation on the present disclosure.

[0116] To enable a replacement process of the cleaning layer to be programmatic and simplicity, in an embodiment, a motion relationship during removal matches a motion relationship during mounting. During removal, the mopping module moves, and the dirty mop box does not move; and during mounting, the mopping module moves, and the clean mop box does not move; or during removal, the mopping module does not move, and the dirty mop box moves; and during mounting, the mopping module does not move, and the clean mop box moves.

[0117] In an embodiment, during removal, the first transmission mechanism includes a movable member arranged on the cleaning robot. In the at least a part of the process of separating the cleaning layer on the mopping module from the mopping module, the movable member drives the mopping module to move toward the dirty mop box (or the cleaning layer removal mechanism), so that the mopping module and the dirty mop box (or the cleaning layer removal mechanism) generate relative displacement. During mounting, a second transmission mechanism includes a movable member arranged on the cleaning robot. In at least a part of a process of mounting the cleaning layer in the clean mop box on the mopping

module, the movable member drives the mopping module to move toward the clean mop box. Therefore, the mopping module and the clean mop box generate relative displacement.

[0118] For example, the cleaning layer removal mechanism is arranged on the dirty mop box. During removal, the first transmission mechanism includes a movable member arranged on the cleaning robot. In the at least a part of the process of separating the cleaning layer on the mopping module from the mopping module, the movable member drives the mopping module to move toward the dirty mop box, so that the mopping module and the cleaning layer removal mechanism generate the relative displacement. In the at least a part of the process of separating the cleaning layer on the mopping module from the mopping module, a position of the dirty mop box is fixed, a position of the cleaning layer removal mechanism relative to the dirty mop box is fixed, and a position of the mopping module relative to the cleaning robot is fixed. During mounting, a second transmission mechanism includes a movable member arranged on the cleaning robot. In the at least a part of the process of mounting the cleaning layer in the clean mop box on the mopping module, the movable member drives the mopping module to move toward the clean mop box. Therefore, the mopping module and the clean mop box generate the relative displacement. In the at least a part of the process of mounting the cleaning layer in the clean mop box on the mopping module, positions of the cleaning robot and the clean mop box are fixed.

[0119] In another embodiment, during removal, the first transmission mechanism includes the walking module arranged on the cleaning robot. In the at least a part of the process of separating the cleaning layer on the mopping module from the mopping module, the walking module drives the cleaning robot to move, to drive the mopping module toward the dirty mop box (or the cleaning layer removal mechanism), so that the mopping module and the dirty mop box (or the cleaning layer removal mechanism) generate the relative displacement. During mounting, the second transmission mechanism includes the walking module. In the at least a part of the process of mounting the cleaning layer in the clean mop box on the mopping module, the walking module drives the cleaning robot to move, to drive the mopping module to move toward the clean mop box, so that the mopping module and the clean mop box generate the relative displacement.

[0120] For example, the cleaning layer removal mechanism is arranged on the dirty mop box. During removal, the first transmission mechanism includes the walking module arranged on the cleaning robot. In the at least a part of the process of separating the cleaning layer on the mopping module from the mopping module, the walking module drives the cleaning robot to move, to drive the mopping module to move toward the dirty mop box. In the at least a part of the process of separating the cleaning layer on the mopping module from the mopping

module, a position of the cleaning layer removal mechanism relative to the dirty mop box is fixed, and a position of the mopping module relative to the cleaning robot is fixed.

[0121] During mounting, the second transmission mechanism includes the walking module. In the at least a part of the process of mounting the cleaning layer in the clean mop box on the mopping module, the walking module drives the cleaning robot to move, to drive the mopping module to move toward the clean mop box. In the at least a part of the process of mounting the cleaning layer in the clean mop box on the mopping module, a position of the mopping module relative to the cleaning robot is fixed, and a position of the clean mop box is fixed.

[0122] In still another embodiment, during removal, the first transmission mechanism includes a second movable mechanism at least configured to drive the dirty mop box to move in the at least a part of the process of separating the cleaning layer on the mopping module from the mopping module, so that the cleaning layer removal mechanism is displaced relative to the mopping module. In the at least a part of the process of separating the cleaning layer on the mopping module from the mopping module, a position of the cleaning layer removal mechanism relative to the dirty mop box is fixed, a position of the cleaning robot is fixed, and a position of the mopping module relative to the cleaning robot is fixed.

[0123] During mounting, the second transmission mechanism includes a third movable mechanism at least configured to drive the clean mop box to move toward the mopping module in the at least a part of the process of mounting the cleaning layer in the clean mop box on the mopping module. In the at least a part of the process of mounting the cleaning layer in the clean mop box on the mopping module, positions of the cleaning robot and the mopping module are fixed.

[0124] Certainly, in another embodiment, a motion relationship during removal may not match a motion relationship during mounting. For example, during removal, the mopping module moves, and the dirty mop box does not move; and during mounting, the mopping module does not move, and the clean mop box moves; or during removal, the mopping module does not move, and the dirty mop box moves; and during mounting, the mopping module moves, and the clean mop box does not move. In this case, difficulty of control is increased, and the motion mechanism is increased, which is conducive to cost reduction.

[0125] It should be noted that the process of separating the cleaning layer on the mopping module from the mopping module includes at least a process in which at least one of the dirty mop box (or the cleaning layer removal mechanism) and the mopping module moves to the cleaning layer removal position, a process in which the cleaning layer on the mopping module is in contact with the cleaning layer removal mechanism, a process in which the cleaning layer removal mechanism and the cleaning layer on the mopping module further generate

displacement, and the like.

[0126] It should be noted that the process of mounting the cleaning layer in the clean mop box on the mopping module includes at least a process in which at least one of the clean mop box or the mopping module moves to a cleaning layer mounting position, a process in which the cleaning layer is in contact with the mopping module, a process in which an action force is generated between the cleaning layer and the mopping module, and the like.

[0127] To determine whether the cleaning layer removal mechanism or the mopping plate reaches a specified position, further, the base station further includes an in-place detection apparatus configured to obtain a position of the mopping plate, the cleaning layer removal mechanism, or the dirty mop box, to determine whether the mopping plate, the cleaning layer removal mechanism, or the dirty mop box moves into place, to implement removal of the mopping plate.

[0128] In an embodiment, the in-place detection apparatus includes, for example, a position sensor group or a limiting mechanism.

[0129] For example, the dirty mop box may move. The base station includes: a first in-place detection apparatus configured to detect whether the dirty mop box reaches the cleaning layer removal position, to determine whether a subsequent removal operation on the cleaning layer is performed.

[0130] For another example, when the dirty mop box (or the cleaning layer removal mechanism arranged on the dirty mop box) and the mopping module are not in an alignment state, the dirty mop box is configured to move to an alignment position corresponding to the alignment state under the driving of the second movable mechanism, so that the cleaning layer removal mechanism and the mopping module are in the alignment state. The alignment position may be implemented through the sensor or the limiting mechanism on the base station.

[0131] In an embodiment, the movable member may be, for example, a telescopic mechanism and may drive the mopping module (especially, the mopping base) to extend and contract. Further, the telescopic mechanism may be, for example, a telescopic rod, and this structure is easy to implement.

[0132] It should be noted that in addition to the telescopic mechanism, the movable member may be further a mechanical hand or another mechanical mechanism provided that the movable member can drive the mopping module to move. This is not limited in this embodiment.

[0133] To implement removal of the cleaning layer, in another embodiment, referring to FIG. 21 and FIG. 22, the cleaning layer replacement mechanism includes a cleaning layer removal mechanism. The cleaning layer removal mechanism is arranged on the cleaning robot and is configured to separate the cleaning layer on the mopping module from the mopping module. Further, the cleaning layer removal mechanism includes a flipping member 500. The flipping member is arranged on the

cleaning robot.

[0134] In an embodiment, the flipping member 500 is arranged on the mopping module (especially, the mopping base 1011).

[0135] In an embodiment, the flipping member may be a clamping mechanism, and the clamping mechanism may be, for example, a mechanical claw.

[0136] In an embodiment, the flipping member 500 has an open state and a closed state. When the flipping member is in the open state, the cleaning layer 101 may be separated from the mopping module. When the flipping member 500 is in the closed state, the cleaning layer is mounted on the mopping module.

[0137] It should be noted that when the flipping member is in the open state, a first angle is formed between the flipping member and the attachment surface. When the flipping member is in the closed state, a second angle is formed between the flipping member and the attachment surface. The first angle is different from the second angle.

[0138] In an embodiment, referring to FIG. 21 and FIG. 22, the cleaning system includes a motion mechanism, and the motion mechanism is configured to drive the cleaning layer removal mechanism (for example, the flipping member 500) to move, so that the cleaning layer removal mechanism and the mopping module generate relative displacement, to separate the cleaning layer on the mopping module from the mopping module. In at least a part of a process of separating the cleaning layer on the mopping module from the mopping module, positions of the cleaning robot and the mopping module are fixed.

[0139] The motion mechanism may be, for example, a driving apparatus 601 that drives the flipping member to open and close, so that the flipping member is switched between the open state and the closed state. The driving apparatus 601 includes, for example, a driving motor, and the driving motor drives the flipping member 500 to rotate around a shaft 602.

[0140] For example, to implement removal of the cleaning layer, referring to FIG. 25(a) and FIG. 25(b), the motion mechanism includes a driving apparatus 601. The driving apparatus is configured to drive the flipping member 500 to switch from the closed state to the open state, so that the cleaning layer 101 on the mopping module is separated from the mopping module (especially, the mopping base 1011).

[0141] In an embodiment, the mopping base (for example, the mopping plate) has a removal region. The removal region may match the cleaning layer removal mechanism, to remove the cleaning layer from the mopping plate.

[0142] For example, to implement mounting of the cleaning layer, according to a sequence of FIG. 24 and FIG. 21, the motion mechanism includes a driving apparatus 601. The driving apparatus 601 is configured to drive the flipping member 500 to switch from the open state to the closed state, so that the cleaning layer 101 in the clean mop box 402 is mounted on the mopping

module (especially, the mopping base 1011).

[0143] In an embodiment, the removal region is not connected to the cleaning layer.

[0144] In an embodiment, when being in the closed state, the flipping member applies an action force to the removal region, so that the cleaning layer is mounted on the mopping module. When the flipping member is in the open state, the flipping member is separated from the removal region, so that the cleaning layer is separated from the mopping module.

[0145] In an embodiment, the cleaning system includes a cleaning layer removal position for removing the cleaning layer from the mopping module. Further, the cleaning layer removal mechanism is configured to separate the cleaning layer on the mopping module from the mopping module at the cleaning layer removal position.

[0146] When the cleaning layer removal mechanism is not at the cleaning layer removal position, for a problem that how the cleaning layer removal mechanism reaches the cleaning layer removal position, in an embodiment, the cleaning robot includes a first transmission mechanism configured to drive the mopping module to move, to drive the cleaning layer removal mechanism to move to the cleaning layer removal position.

[0147] For example, the first transmission mechanism includes a movable member arranged on the cleaning robot and configured to drive the mopping module to move to the cleaning layer removal position, so that the cleaning layer removal mechanism moves to the cleaning layer removal position, and then the motion mechanism further drives the cleaning layer removal mechanism to move to separate the cleaning layer from the mopping module.

[0148] For another example, the first transmission mechanism includes the walking module configured to drive the mopping module to move to the cleaning layer removal position, so that the cleaning layer removal mechanism moves to the cleaning layer removal position, and then the motion mechanism further drives the cleaning layer removal mechanism to open to separate the cleaning layer from the mopping module.

[0149] The cleaning robot moves to drive the mopping module to move, thereby simplifying a system structure and reducing costs.

[0150] It should be noted that the cleaning layer removal position may be set according to a requirement, for example, the mopping plate in the second state is exactly located at the cleaning layer removal position. In this case, the control module may control the flipping member to switch from the closed state to the open state, to release the cleaning layer, so that the cleaning layer is separated from the mopping module. Certainly, in another embodiment, a button for controlling open and close of the flipping member may be arranged on the mopping module, and open and close of the flipping member is implemented through artificial or automatic control. Details are not described herein again.

[0151] Considering a problem of recycling a removed

cleaning layer, in an embodiment, the cleaning layer replacement mechanism includes a dirty mop box 403 configured to accommodate the cleaning layer 101 separated from the mopping module.

[0152] To ensure that the removed cleaning layer can accurately fall into the dirty mop box, this can be implemented in at least one of the following manners.

[0153] Manner A: The dirty mop box is arranged on a falling path of a separated cleaning layer.

[0154] Therefore, in an embodiment, the dirty mop box is arranged on a moving path of the cleaning layer separated from the mopping module, so that the cleaning layer falls into the dirty mop box.

[0155] Manner B: The cleaning layer removal position is located in the dirty mop box.

[0156] Therefore, in an embodiment, the cleaning layer removal position is set in the dirty mop box, so that the cleaning layer removal mechanism (for example, the flipping member) performs removal at the cleaning layer removal position, and the cleaning layer may fall into the dirty mop box.

[0157] Considering that when the cleaning layer removal mechanism (for example, the flipping member) is not at the cleaning layer removal position, the cleaning layer removal mechanism needs to move to the cleaning layer removal position, for a problem that how the cleaning layer removal mechanism moves to the cleaning layer removal position, in an embodiment, the first transmission mechanism is at least configured to drive the mopping module to move to the cleaning layer removal position. In at least a part of a process in which the first transmission mechanism drives the mopping module to move to the cleaning layer removal position, a position of the dirty mop box is fixed.

[0158] Specifically, an implementation of movement of the mopping module includes at least one of the following.

[0159] For example, the first transmission mechanism includes the walking module. In the at least a part of the process in which the mopping module moves to the cleaning layer removal position, a position of the dirty mop box is fixed, a position of the cleaning layer removal mechanism relative to the mopping module is fixed, and a position of the mopping module relative to the cleaning robot is fixed. The walking module drives the cleaning robot to move toward the dirty mop box, to drive the mopping module to move, so that the cleaning layer removal mechanism moves to the cleaning layer removal position.

[0160] For another example, in another embodiment, the first transmission mechanism includes a movable member arranged on the cleaning robot and configured to drive the mopping module to move.

[0161] In the at least a part of the process in which the mopping module moves to the cleaning layer removal position, a position of the dirty mop box is fixed, and a position of the cleaning robot is fixed. The movable member drives the mopping module to move toward the dirty mop box, so that the cleaning layer removal mechanism moves to the cleaning layer removal position.

[0162] It should be noted that the manner in which the cleaning layer removal mechanism moves to the cleaning layer removal position is merely an example and should not be understood as a limitation on the present disclosure.

[0163] Manner C: The cleaning layer removal mechanism is located in the dirty mop box.

[0164] Therefore, in an embodiment, the cleaning layer removal mechanism in the second state is exactly in the dirty mop box. Certainly, in another embodiment, when the cleaning layer removal mechanism is not in the dirty mop box, the cleaning layer removal mechanism (for example, the flipping member) extends into the dirty mop box.

[0165] For a problem that how the cleaning layer removal mechanism extends into the dirty mop box, the dirty mop box may move, the mopping module (especially, the mopping plate) and the cleaning layer removal mechanism on the mopping module do not move; or the dirty mop box may not move, and the mopping module moves (to drive the cleaning layer removal mechanism on the mopping module to move); or both the mopping module and the dirty mop box move. The movement of the mopping module may be passive movement caused by movement of the cleaning robot, or may be active movement of the mopping module driven by an additional active motion mechanism (for example, a movable member). That is, the mopping module may actively move relative to the cleaning robot, or may be fixed at a position relative to the cleaning robot and driven by the cleaning robot to passively move. This is not limited in the present disclosure.

[0166] For example, the first transmission mechanism includes a second movable mechanism configured to drive the dirty mop box to move. In at least a part of a process in which the cleaning layer removal mechanism on the mopping module extends into the dirty mop box, positions of the cleaning robot and the mopping module are fixed, a position of the cleaning layer removal mechanism on the mopping module is also fixed, and the first movable mechanism drives the dirty mop box to move, so that the cleaning layer removal mechanism extends into the dirty mop box. When the cleaning layer removal mechanism extends into the dirty mop box, the cleaning layer removal mechanism moves relative to the mopping module under the driving of the motion mechanism (for example, the driving apparatus), to switch from the closed state to the open state, so as to remove the cleaning layer from the mopping module, and the removed cleaning layer falls into the dirty mop box.

[0167] The second movable mechanism includes, for example, a guide rail and a driving motor that drive the dirty mop box to move.

[0168] For another example, the first transmission mechanism includes a movable member arranged on the cleaning robot and configured to drive the mopping module to move. In the at least a part of the process in which the cleaning layer removal mechanism extends into the

dirty mop box, positions of the cleaning robot and the dirty mop box are fixed, and the movable member drives the mopping module to move, to drive the cleaning layer removal mechanism on the mopping module to extend into the dirty mop box.

[0169] Certainly, in another embodiment, the first transmission mechanism includes the walking module. In the at least a part of the process in which the cleaning layer removal mechanism extends into the dirty mop box, a position of the dirty mop box is fixed, and a position of the mopping module relative to the cleaning robot is fixed. The walking module drives the cleaning robot to move, to drive the mopping module to move, so that the cleaning layer removal mechanism on the mopping module extends into the dirty mop box.

[0170] The cleaning robot moves to drive the mopping module to move, thereby simplifying a system structure and reducing costs.

[0171] Certainly, in another embodiment, an additional picking mechanism may alternatively be arranged to pick up and send the separated cleaning layer to the dirty mop box, or the separated cleaning layer is artificially picked up and placed into the dirty mop box, or when there is no dirty mop box, the separated cleaning layer may be manually recycled.

[0172] It may be understood that the dirty mop box is provided with a first opening. The first opening is configured to allow the mopping module to extend into and allow the cleaning layer to be left in the dirty mop box when the mopping module leaves. In an embodiment, for example, the dirty mop box includes a bottom portion and at least two opposite side walls. The side walls are connected to the bottom portion, and the side walls and the bottom portion may form the first opening. The first opening is opposite to the bottom portion.

[0173] It may be understood that at the cleaning layer removal position or when the mopping module is in the second state, the first opening of the dirty mop box faces a second direction, so that the mopping module may extend into the dirty mop box through the first opening. In this case, the motion mechanism drives the cleaning layer removal mechanism (for example, the flipping member) to switch from the closed state to the open state, so that the cleaning layer is separated from the mopping module, to achieve an effect of leaving the cleaning layer in the dirty mop box when the mopping module leaves the first opening.

[0174] To recycle more cleaning layers, further, the cleaning layer removal position is set to a position close to the bottom portion of the dirty mop box.

[0175] To determine whether the mopping plate, the cleaning layer removal mechanism, or the dirty mop box reaches a specified position, further, the base station further includes an in-place detection apparatus configured to obtain a position of the mopping plate, the cleaning layer removal mechanism, or the dirty mop box, to determine whether the mopping plate, the cleaning layer removal mechanism, or the dirty mop box moves into

place, to implement removal of the cleaning layer.

[0176] In an embodiment, the in-place detection apparatus includes, for example, a position sensor group or a limiting mechanism.

5 **[0177]** For example, the mopping plate may move. The base station includes: an in-place detection apparatus configured to detect whether the mopping plate reaches the cleaning layer removal position, to determine whether a subsequent removal operation on the cleaning layer is performed.

10 **[0178]** For another example, when the mopping plate (or the cleaning layer removal mechanism arranged on the mopping plate) and the dirty mop box are not in an alignment state, the mopping plate is configured to move to an alignment position corresponding to the alignment state under the driving of the first transmission mechanism, so that the cleaning layer removal mechanism and the mopping module are aligned. The alignment position may be implemented through the sensor or the limiting

20 mechanism on the cleaning robot or the base station. **[0179]** Referring to FIG. 26(a) to FIG. 26(d), in an embodiment, to improve firmness of the cleaning layer and prevent the cleaning layer from falling in a moving process of the cleaning robot or the mopping plate, further, the mopping base 1011 includes an adhesion region that can be adhered to the cleaning layer.

25 **[0180]** Certainly, in another embodiment, to improve firmness of the cleaning layer, the flipping member 500 is provided with an adhesion surface that can be adhered to the cleaning layer.

30 **[0181]** Further, the removal region includes a mop removal groove. An outer edge of the mopping plate is recessed toward the inside of the mopping plate, to form the mop removal groove. The cleaning layer removal mechanism includes a hook 404 arranged on the base station (especially, the dirty mop box 403). The hook may match the mop removal groove, to remove the cleaning layer from the mopping plate. The mop removal groove may be, for example, a removal through hole matching the hook.

35 **[0182]** The cleaning layer has a part covering the mop removal groove. The hook may pass through the mop removal groove and hook the part of the cleaning layer covering the mop removal groove, to remove the cleaning layer from the mopping plate. The hook is especially suitable for the mopping plate with the adhesion region, which can improve reliability of removal.

40 **[0183]** It should be noted that the cleaning layer removal mechanism further includes a hook arranged on the base station (especially, the dirty mop box). When the mopping base includes an adhesion region that can be adhered to the cleaning layer, in an embodiment, before the hook acts on the cleaning layer or the hook is in contact with the cleaning layer, the motion mechanism drives the cleaning layer removal mechanism (for example, the flipping member) arranged on the cleaning robot (especially, the mopping module), to enable the flipping member to be in the open state. For example, when the

hook 404 is arranged at the opening of the dirty mop box 403, before the mopping module extends into the dirty mop box, the motion mechanism (for example, the driving apparatus 601) drives the cleaning layer removal mechanism (for example, the flipping member 500) arranged on the cleaning robot (especially, the mopping module), to enable the flipping member to be in the open state. Then, the hook 404 on the dirty mop box operates the cleaning layer 101 to complete subsequent removal, so that the cleaning layer 101 falls into the dirty mop box 403.

[0184] In addition, when the cleaning layer removal mechanism includes a hook arranged on the base station, for a process in which the hook removes the cleaning layer, reference may be made to the foregoing related description. Details are not described herein again.

[0185] Certainly, in another embodiment, in addition to the hook (for example, a paper removal hook) and the flipping member (for example, the clamping mechanism), the cleaning layer removal mechanism may be further a mechanical hand or another mechanism provided that mop removal can be implemented.

2. Mounting of the cleaning layer:

[0186] To implement connection between the mopping plate and the cleaning layer, this can be implemented in at least one of the following manners.

(1) The mopping base is provided with a connection region for connecting the cleaning layer.

(2) The cleaning layer removal mechanism on the cleaning robot is provided with a connection region for connecting the cleaning layer.

[0187] Therefore, in an embodiment, the mopping base (for example, the mopping plate) is provided with a connection region for connecting the cleaning layer.

[0188] Further, the connection region includes an adhesion region, and the cleaning layer may be adhered to the adhesion region. Specifically, the adhesion region includes an adhesion portion. The cleaning layer may be adhered to the adhesion portion, to connect the mopping plate and the cleaning layer. The adhesion region may be, for example, a hook-and-loop fastener.

[0189] For another example, in another embodiment, when the cleaning layer removal mechanism is a flipping member, the cleaning region for connecting the cleaning layer may be provided on the flipping member.

[0190] Further, the flipping member includes an adhesion surface that can be adhered to a cleaning medium, and the connection region includes the adhesion surface.

[0191] Certainly, in another embodiment, when the cleaning layer removal mechanism is the flipping member, cleaning regions for connecting the cleaning layer may be provided on both the flipping member and the mopping base.

[0192] Considering a storage problem of the cleaning

layer, in an embodiment, the cleaning system (especially, the cleaning layer replacement mechanism) in this application includes a clean mop box configured to accommodate a cleaning layer to be mounted on the mopping module.

[0193] In an embodiment, the cleaning layer is a sheet-like mop. When there are at least two sheet-like mops, the at least two sheet-like mops are arranged in the clean mop box in a stacking manner.

[0194] It should be noted that "stacking" mentioned in this specification may be partially overlapping or may be completely overlapping, that is, when there are at least two first sheet-like mops, the first sheet-like mops at least partially overlap during arrangement. It may be understood that when the cleaning layers partially overlap, the mopping plate adaptively adjusts a connection position when being connected to a cleaning layer, to connect to a corresponding cleaning layer. That is, the cleaning layer may have different placing positions, the mopping plate may have different connection positions, and the connection positions correspond to the placing positions, so as to pick out the corresponding cleaning layer. Preferably, the cleaning layers completely overlap when being stacked, on one hand, a space occupied by the cleaning layers is reduced, for example, a space of the clean mop box may be reduced, on the other hand, because the cleaning layer may be connected at a same position each time, it is simple and convenient to pick the cleaning layer each time.

[0195] Considering an alignment problem between the mopping module (especially, the mopping plate) and the clean mop box, on one hand, a cleaning layer mounting position may be preset, and the mopping module and the clean mop box move to the mounting position, to facilitate alignment. On the other hand, a state of the mopping module needs to match a state of the clean mop box. For example, a state such as an inclination angle of the mopping module (when being connected to an unused cleaning layer, for example, in the second state) relative to a direction in which the cleaning robot enters the base station needs to match a state such as an orientation of the opening of the clean mop box and an inclination angle of the cleaning layer in the clean mop box.

[0196] For a first aspect, in an embodiment, the cleaning system includes a cleaning layer mounting position for mounting the cleaning layer on the mopping plate. In other words, the mopping plate is configured to be connected to the cleaning layer in the clean mop box at the cleaning layer mounting position.

[0197] For example, when the clean mop box and the mopping plate are located at the cleaning layer mounting position, the mopping plate may be in contact with the cleaning layer, to mount the cleaning layer on the mopping plate. Further, the cleaning layer is firmly mounted on the mopping plate through an action force generated between the mopping plate and the cleaning layer.

[0198] It should be noted that in an embodiment, when the cleaning layer includes a cleaning layer removal

mechanism arranged on the cleaning robot, for example, a flipping member arranged on the mopping module, to mount the cleaning layer on the mopping plate, a connection region for connecting the cleaning layer is provided on the mopping plate or the flipping member. Considering that when the connection region for connecting the cleaning layer is provided on neither the mopping plate nor the flipping member, to fixedly mount the cleaning layer on the mopping plate, when the cleaning layer is in contact with the mopping plate or at the cleaning layer mounting position, the motion mechanism (for example, the driving apparatus) drives the cleaning layer removal mechanism (especially, the flipping member) arranged on the cleaning robot (especially, the mopping base) to move, so that the cleaning layer removal mechanism (especially, the flipping member) is switched to the closed state, to mount the cleaning layer on the mopping module.

[0199] Certainly, in another embodiment, for example, the connection region (for example, the adhesion region) for connecting the cleaning layer is provided on the mopping plate or the connection region (for example, the adhesion surface) for connecting the cleaning layer is provided on the flipping member. After the mopping plate may be in contact with the cleaning layer, in addition to a manner of further applying an action force perpendicular to the cleaning surface to the cleaning layer to firmly mount the cleaning layer on the mopping plate, there may be further the following manner: when the mopping plate or the flipping member is in contact with the cleaning layer or at the cleaning layer mounting position, the motion mechanism (for example, the driving apparatus) drives the cleaning layer removal mechanism (especially, the flipping member) arranged on the cleaning robot (especially, the mopping base) to move, so that the cleaning layer removal mechanism (especially, the flipping member) is switched to the closed state. In this case, the cleaning layer removal mechanism can achieve a function of mounting or fixing.

[0200] Further, in an embodiment, in at least a part of a process in which the motion mechanism drives the cleaning layer removal mechanism (especially, the flipping member) arranged on the cleaning robot (especially, the mopping base) to move, so that the cleaning layer removal mechanism (especially, the flipping member) is switched to the closed state, the clean mop box has an operation space for the cleaning layer removal mechanism to move. Alternatively, after the cleaning layer is connected to the mopping module, outside the clean mop box, the motion mechanism drives the cleaning layer removal mechanism (especially, the flipping member) arranged on the cleaning robot (especially, the mopping base) to move, so that the cleaning layer removal mechanism (especially, the flipping member) is switched to the closed state, to improve the firmness of the cleaning layer.

[0201] To enable the mopping plate and the clean mop box to generate relative displacement, for example, en-

able at least one of the mopping plate and the clean mop box to reach the cleaning layer mounting position and generate the relative displacement at the cleaning layer mounting position, in an embodiment, the cleaning system includes a second transmission mechanism. The second transmission mechanism is configured to drive at least one of the clean mop box and the mopping module (especially, the mopping plate) to move, so that the mopping plate and the clean mop box generate the relative displacement, to mount the cleaning layer on the mopping module on the mopping module.

[0202] For example, the second transmission mechanism is configured to drive at least one of the clean mop box and the mopping module (especially, the mopping plate) to move, to reach the cleaning layer mounting position, so as to mount the cleaning layer in the clean mop bin on the mopping module; and further drive at least one of the clean mop box and the mopping module (especially, the mopping plate) to move when the mopping plate and the clean mop box are located at the cleaning layer mounting position, to mount the cleaning layer in the clean mop box on the mopping module.

[0203] It should be noted that the cleaning layer mounting position may be set according to a requirement, for example, the mopping plate in the second state is exactly located at the cleaning layer mounting position. Certainly, the clean mop box may be pre-arranged at the cleaning layer mounting position. In this way, movement of the second transmission mechanism is simplified during mounting.

[0204] The following several implementations for the clean mop box and the mopping plate to generate the relative displacement may be that: the clean mop box may move, and the mopping module (especially, the mopping plate) does not move; the clean mop box does not move, and the mopping module moves; or both the mopping module and the clean mop box move. The movement of the mopping module may be passive movement caused by movement of the cleaning robot, or may be active movement of the mopping module driven by an additional active movable mechanism (for example, a movable member). That is, the mopping module may actively move relative to the cleaning robot; or may be fixed at a position relative to the cleaning robot and driven by the cleaning robot to passively move. This is not limited in the present disclosure.

[0205] Therefore, in an embodiment, the second transmission mechanism includes a third movable mechanism configured to drive the clean mop box to move. In at least a part of a process of mounting the cleaning layer in the clean mop box on the mopping module, positions of the cleaning robot and the mopping module are fixed, and the third movable mechanism drives the clean mop box to move, so that the clean mop box is displaced relative to the mopping module.

[0206] In another embodiment, the second transmission mechanism includes a movable member arranged on the cleaning robot and configured to drive the mopping

module to move. In the at least a part of the process of mounting the cleaning layer in the clean mop box on the mopping module, positions of the cleaning robot and the clean mop box are fixed, and the movable member drives the mopping module to move, so that the mopping module is displaced relative to the clean mop box.

[0207] Certainly, in another embodiment, the second transmission mechanism includes the walking module. In the at least a part of the process of mounting the cleaning layer in the clean mop box on the mopping module, a position of the clean mop box is fixed, and a position of the mopping module relative to the cleaning robot is fixed. The walking module drives the cleaning robot to move, so that the mopping module is displaced relative to the clean mop box. For example, the walking module drives the cleaning robot to move to the cleaning layer mounting position, so that the mopping module is connected to the cleaning layer in the clean mop box at the cleaning layer mounting position. Further, the walking module drives the cleaning robot to continuously move, so that the mopping module generates an action force on the cleaning layer, to achieve reliability of connection between the cleaning layer and the mopping module.

[0208] The cleaning robot moves to drive the mopping module to move, thereby simplifying a system structure and reducing costs.

[0209] To determine whether the clean mop box or the mopping plate reaches a specified position, further, the base station further includes an in-place detection apparatus configured to obtain a position of the mopping plate or the clean mop box, to determine whether the mopping plate or the clean mop box moves into place, to mount the cleaning layer.

[0210] For example, the clean mop box may move. The base station includes: a second in-place detection apparatus configured to detect whether the clean mop box reaches the cleaning layer mounting position, to determine whether a subsequent mounting operation on the cleaning layer is performed.

[0211] For a second aspect, in an embodiment, the mopping base (for example, the mopping plate) includes a connection surface or an attachment surface. The connection surface is located on a lower surface of the mopping base and is configured to be connected to the cleaning layer.

[0212] The cleaning layer (for example, a mop or a mop paper) includes a cleaning surface and a non-cleaning surface. When being in contact with ground, the cleaning surface is configured to perform cleaning work. The non-cleaning surface is a surface that is connected to/attached to the mopping plate or the non-cleaning surface is a surface that is opposite to the cleaning surface.

[0213] In an embodiment, before the mopping plate is connected to the cleaning surface of the cleaning layer in the clean mop box, the connection surface or the attachment surface of the mopping base is parallel to the cleaning surface of the cleaning layer in the clean mop box. Alternatively, before the mopping plate is connected

to the cleaning surface of the cleaning layer in the clean mop box, an angle formed between the cleaning surface of the cleaning layer in the clean mop box and a first direction is equal to an angle formed between the connection surface (or the attachment surface) of the mopping base and the first direction. The first direction is a direction in which the cleaning robot points to the base station, for example, the direction is a horizontal direction parallel to a horizontal plane.

[0214] For example, in the second state, the connection surface (or the attachment surface) of the mopping plate is parallel to the cleaning surface of the cleaning layer in the clean mop box; or in the second state, the angle formed between the cleaning surface of the cleaning layer in the clean mop box and the first direction is equal to the angle formed between the connection surface (or the attachment surface) of the mopping plate and the first direction. The first direction is the direction in which the cleaning robot points to the base station.

[0215] That is, when the cleaning layer is replaced, a placement angle of the cleaning layer in the clean mop box matches an angle of the mopping plate in the second state.

[0216] For example, in the second state, when the angle formed between the connection surface of the mopping plate and the first direction is any value greater than or equal to 30 degrees and less than or equal to 90 degrees, the angle formed between the cleaning surface of the cleaning layer in the clean mop box and the first direction is also any value greater than or equal to 30 degrees and less than or equal to 90 degrees. Otherwise, when the angle formed between the cleaning surface of the cleaning layer in the clean mop box and the first direction is any value greater than or equal to 30 degrees and less than or equal to 90 degrees, the control module is at least configured to control the driving module to drive the mopping module to switch from the first state to the second state when the cleaning layer needs to be replaced, so that the angle formed between the connection surface of the mopping plate and the first direction is also any value greater than or equal to 30 degrees and less than or equal to 90 degrees. To facilitate mounting of the cleaning layer, in an embodiment, when the mopping module is in the second state, the connection surface of the mopping module is perpendicular to the first direction; and the cleaning surface of the cleaning layer in the clean mop box is perpendicular to the first direction, that is, in the clean mop box, the cleaning layer is vertically placed.

[0217] Considering that inclined placement of the cleaning layer is difficult to maintain due to an effect of gravity, further, in an embodiment, a support part is arranged in the clean mop box and is configured to support the cleaning layer, so that the angle is formed between the cleaning surface of the cleaning layer accommodated in the clean mop box and the first direction, for example, the angle with a value greater than or equal to 30 degrees and less than or equal to 90 degrees is formed between the cleaning surface of the cleaning layer accommodated

in the clean mop box and the first direction. For another example, the support part includes a fixing apparatus configured to fix the cleaning layer, so that the angle is formed between the cleaning surface of the cleaning layer accommodated in the clean mop box and the first direction.

[0218] Considering a gravity factor, to maintain a state of the cleaning layer in the clean mop box, while reducing the costs and complexity of hardware design, further, a value of the angle formed between the cleaning surface of the cleaning layer in the clean mop box and the first direction is any value greater than or equal to 45 degrees and less than or equal to 60 degrees. Correspondingly, when the mopping module is in the second state, the angle formed between the connection surface of the mopping module and the first direction is also any value greater than or equal to 45 degrees and less than or equal to 60 degrees.

[0219] Certainly, in another embodiment, a support part such as a slop or a step may be arranged in the clean mop box and is configured to assist in maintaining a state of the cleaning layer and guide a user to place the cleaning layer. The slop or the step is especially suitable for placing the cleaning surface of the cleaning layer in the clean mop box at an acute angle with the first direction, for example, a value of the acute angle is greater than or equal to 30 degrees and less than or equal to 60 degrees.

[0220] In addition, when the mopping plate is connected to the cleaning layer, the mopping plate needs to extend into the clean mop box.

[0221] In an embodiment, the clean mop box is provided with a second opening. The second opening is configured to allow the mopping module to extend into. For example, the clean mop box includes a bottom portion and at least two opposite side walls. The side walls of the clean mop box are connected to the bottom portion of the clean mop box, and the side walls of the clean mop box and the bottom portion of the clean mop box may form the second opening. The second opening of the clean mop box is opposite to the bottom portion of the clean mop box. In other words, the clean mop box includes the bottom portion that is opposite to the second opening. A direction in which the opening of the clean mop box points to the bottom portion is parallel to a working surface (or a horizontal plane), and the second opening faces the cleaning robot or the mopping module.

[0222] It may be understood that at the cleaning layer mounting position or when the mopping module is in the second state, the second opening of the clean mop box faces a second direction. The first direction is a direction in which the cleaning robot points to the base station. The second direction is opposite to the first direction. That is, the second direction is a direction in which the base station points to the cleaning robot or a direction in which the cleaning robot is away from the base station. Therefore, the mopping module may extend into the clean mop box through the second opening and is con-

nected to the cleaning layer in the clean mop box, to mount the cleaning layer on the mopping module.

[0223] It should be noted that the cleaning system may further include an alignment position. For example, when a to-be-worked position of the dirty mop box is not aligned with the alignment position, the dirty mop box needs to be moved from a first to-be-worked position to the alignment position that is aligned with the mopping module, and in-place detection is performed on the dirty mop box. The alignment position is a position at which the cleaning layer removal mechanism or the dirty mop box and the mopping module are in an alignment state.

[0224] Certainly, a second to-be-worked position is generally set at the alignment position. In this way, operation steps of the dirty mop box can be simplified. In this case, before the cleaning layer is removed, if the dirty mop box does not at the second to-be-worked position, the dirty mop box further needs to be moved to the second to-be-worked position, and in-place detection is performed on the dirty mop box by using the in-place detection apparatus.

[0225] In addition, after the cleaning layer is removed, the dirty mop box is reset (moves back to the second to-be-worked position), and in-place detection is performed on the dirty mop box by using the in-place detection apparatus, to prepare for next replacement.

[0226] Similarly, before the cleaning layer starts to be mounted, if the clean mop box does not at the first to-be-worked position, the dirty mop box further needs to be moved to the first to-be-worked position, and in-place detection is performed on the clean mop box.

[0227] After the cleaning layer is mounted, the clean mop box needs to be reset (moves to the first to-be-worked position), and in-place detection is performed on the clean mop box by using the in-place detection apparatus.

[0228] It should be noted that the in-place detection apparatus includes one or more sensors, which may be configured to separately perform in-place detection on corresponding components (for example, the dirty mop box, the clean mop box, the mopping plate, and the cleaning layer removal mechanism), to complete replacement of the cleaning layer.

[0229] Further, after completing replacement of the cleaning layer, the cleaning robot adjusts the mopping module back to the first state, to clean to-be-cleaned ground.

[0230] In an embodiment, the control module is configured to at least control the driving module to drive the mopping module to switch from the second state back to the first state after replacement of the cleaning layer is completed.

[0231] For how to switch states of the mopping module, in an embodiment, referring to FIG. 15 and FIG. 16, a driving mechanism may be, for example, a flipping mechanism (for example, a pivoting mechanism) and flips the mopping module, to enable the mopping module to be switched between the first state and the second state.

The flipping mechanism includes a rotating rod 2011 and a rotating motor 2011 configured to drive the rotating rod 2011 to rotate around a rotating shaft 2013. One end of the rotating rod is connected to the mopping module, and an other end of the rotating rod is connected to an output shaft of the rotating motor.

[0232] In an embodiment, further, in the second state, the angle is formed between the attachment surface (or the connection surface) and the first direction. The first direction is the direction in which the cleaning robot points to the base station.

[0233] For example, when the mopping module is in the second state, the angle formed between the attachment surface (or the connection surface) and the first direction is greater than or equal to 0 degrees and less than or equal to 90 degrees.

[0234] From a perspective of removal and mounting of the cleaning layer, further, when the mopping module is in the second state, an angle formed between a cleaning connection surface of the cleaning layer of the mopping module and the first direction is greater than or equal to 30 degrees and less than or equal to 90 degrees.

[0235] To facilitate removal and mounting of the cleaning layer, when the mopping module is in the second state, the attachment surface (or the connection surface) of the mopping base is perpendicular to the first direction. That is, in the second state, the angle formed between the attachment surface (or the connection surface) and the first direction is equal to 90 degrees.

[0236] Impact of the gravity factor on the mounting and removal of the cleaning layer is considered, and the costs and complexity of hardware design are reduced. In an embodiment, the angle formed between the attachment surface (or the connection surface) and the first direction is greater than or equal to 45 degrees and less than or equal to 60 degrees.

[0237] It may be understood that the angle may be formed between the connection surface of the mopping module and the first direction through the flipping mechanism.

[0238] Certainly, in another embodiment, a slop or a step may be arranged in the clean mop bin, to guide placement of the cleaning layer.

[0239] For how to switch states of the mopping module, in another embodiment, a driving mechanism 200 may be, for example, a lifting mechanism and lifts the mopping module, to enable the mopping module to be switched between the first state and the second state.

[0240] An example in which the removal position and the mounting position are a same set position, and the set position are located below the lifted mopping module is used to briefly describe replacement of the cleaning layer.

[0241] After the mopping module is lifted, a space is reserved for the dirty mop box (or the clean mop box), so that the dirty mop box (or the clean mop box) may move below the mopping module in the second state, and the mopping module extends into the dirty mop box

(or the clean mop box) to implement removal (or mounting) of the cleaning layer. That is, a lifting height enables the dirty mop box and the clean mop box to enter.

[0242] In an embodiment, the cleaning robot enters the base state and stops at a stop position.

[0243] The lifting mechanism drives the mopping module to rise, the mopping module is switched to the second state, and the dirty mop box moves from the second to-be-worked position to the set position (the removal position). Then the mopping module falls in a vertical direction (for example, the mopping module may falls through the lifting mechanism) and extends into the dirty mop box, and matches the cleaning layer removal mechanism on the dirty mop box (first moves to the bottom portion of the dirty mop box by a specific distance and then moves to the opening of the dirty mop box), the cleaning layer on the mopping module is removed, and the cleaning layer falls into the dirty mop box under the action of gravity. The mopping module returns back to a lifting position (a position in the second state).

[0244] The dirty mop box is reset, to leave a space for the clean mop box.

[0245] The clean mop box moves from the first to-be-worked position to the set position, and the mopping module falls in the vertical direction (for example, may fall through the lifting mechanism) and extends into the clean mop box, and is connected to the cleaning layer in the clean mop box. The mopping module returns back to the lifting position (the position in the second state) again.

[0246] The clean mop box is reset, the mopping module falls (which may fall through the lifting mechanism), and the mopping module is switched from the second state back to the first state.

[0247] The cleaning robot leaves the base station.

[0248] In at least a part of the process, the removal and the mounting of the cleaning layer are completed in the vertical direction.

[0249] Certainly, in another embodiment, referring to FIG. 17 to FIG. 19, a driving mechanism includes, for example, a lifting mechanism 202 and a flipping mechanism 201. That is, the driving mechanism may lift the mopping module 100 and also may flip the mopping module. The mopping module may be first lifted through the lifting mechanism and then the mopping module is flipped through the flipping mechanism, or the mopping module may be first flipped through the flipping mechanism and then the mopping module is lifted through the lifting mechanism. The lifting and the flipping may be set according to an actual requirement. This is not limited in this embodiment. The flipping mechanism is driven by a motor to flip, and the flipping mechanism may be further linked with the lifting mechanism. The lifting mechanism may be a steel wire rope traction mechanism or may be another linear movable mechanism. This is not limited in this embodiment. Similarly, the flipping mechanism may alternatively be a mechanical structure in another form provided that flipping can be implemented. Details are not described in this embodiment.

[0250] In addition, the driving mechanism may further include the movable member, to expand and contract the mopping module. The driving module enables the mopping module to have a multi-directional movement capability, which is beneficial to improving replacement flexibility of the mopping module and adaptability to a complex environment.

[0251] To prevent a problem that flipping is obstructed, in an embodiment, the base station includes: a platform for carrying the cleaning robot, a first accommodating groove is provided on the platform, the control module is configured to control the driving module to drive the mopping module to switch from the first state to the second state when the cleaning robot moves to a stop position, and in at least a part of a process of switching the mopping module from the first state to the second state, at least a part of the mopping module is accommodated in the first accommodating groove.

[0252] The first accommodating groove is provided to provide a space for flipping.

[0253] To provide a flipping space, in another embodiment, when the mopping module is switched from the first state to the second state, the driving mechanism drives the mopping module to lift by a preset distance in a direction perpendicular to the working surface and then flip toward the first direction or toward an outer side of the cleaning robot (for example, a direction of the base station).

[0254] Before being flipped, the mopping module rises by a specific distance and then is flipped, to avoid the problem that flipping is obstructed.

[0255] To reduce complexity of a mop replacement operation, for example, replacement is implemented with fewer motion mechanisms and a volume and costs of the motion mechanism occupying the cleaning robot are reduced. In an embodiment, after the driving mechanism drives the mopping module to switch to the second state, the mopping module is aligned by the clean mop box or the dirty mop box, without arranging a motion mechanism that drives the mopping module to actively align the mopping module (which is beneficial to reduce a volume of the cleaning robot). That is, after the clean mop box (which is driven by the third movable mechanism) or the dirty mop box (which is driven by the second movable mechanism) is driven by a corresponding movable mechanism to move to a corresponding position (for example, the cleaning layer mounting position or the cleaning layer removal position) to achieve alignment, the clean mop box or the dirty mop box is further driven by the transmission mechanism to move or the cleaning robot moves (that is, the walking module drives the cleaning robot to move) to achieve replacement of the cleaning layer.

[0256] In an embodiment, the cleaning layer mounting position and the cleaning layer removal position are a same position (which is referred to as the alignment position or a cleaning layer replacement position). In this case, the clean mop box or dirty mop box may move to the position to implement mounting of a new (or clean)

cleaning layer or removal of an old (or dirty) cleaning layer.

[0257] To prevent the movement of the clean mop box and the dirty mop box from being blocked, correspondingly, the clean mop box has a first-to-be-worked position, and the dirty mop box has a second-to-be-worked position. The first-to-be-worked position is different from the second-to-be-worked position.

[0258] It should be noted that, because the cleaning layer mounting position and the cleaning layer removal position are the same position, when the cleaning layer replacement operation includes both the removal of the cleaning layer and the mounting of the cleaning layer, after the removal of the cleaning layer is completed or before the mounting of the cleaning layer is performed, the dirty mop box needs to be reset, for example, the dirty mop box is returned to the second-to-be-worked position to provide an operation space for the mounting of the cleaning layer.

[0259] In addition, the second movable mechanism or the third movable mechanism may move either in a horizontal direction (left and right) or in a vertical direction (up and down). For example, a specific implementation structure of the second movable mechanism or the third movable mechanism is that the movement in a corresponding direction is implemented by arranging a corresponding guide rail (a horizontal guide rail) and the driving mechanism. Details are not described in this embodiment.

[0260] It should be noted that the base station is provided with a control unit as a control center to obtain corresponding information, for example, detection information of a sensor group (detecting whether the cleaning robot stops in place, whether the dirty mop box is in place, whether the clean mop box is in place, or the like) to control a corresponding mechanism to perform a corresponding action. For example, the control unit may be configured to control the second movable mechanism to drive the dirty mop box to move; and control the third movable mechanism to drive the clean mop box to move, and the like.

[0261] To reduce complexity of moving paths of the dirty mop box and the clean mop box, in an embodiment, this is implemented through arrangement positions of the dirty mop box and the clean mop box. For example, the second-to-be-worked position of the dirty mop box and the mopping module in the second state are in the alignment state, that is, the second-to-be-worked position and the cleaning layer replacement position are on a same horizontal line, and the mopping module and the dirty mop box are respectively located at two sides of the cleaning layer replacement position.

[0262] The first-to-be-worked position of the clean mop box and the cleaning layer replacement position are on a same vertical line, and the first-to-be-worked position is located above the cleaning layer replacement position.

[0263] In this case, the dirty mop box only needs to move in the horizontal direction (that is, the second mov-

able mechanism moves only in the horizontal direction) to implement the removal of the cleaning layer. The clean mop box only needs to move in the vertical direction (that is, the third movable mechanism only moves in the vertical direction) to implement the mounting of the cleaning layer. The complexity of arrangement of the movable mechanism and the replacement operation is simplified.

[0264] For another example, in another embodiment, the first to-be-worked position of the clean mop box and the mopping module in the second state are in the alignment state, that is, the first to-be-worked position and the cleaning layer replacement position are on the same horizontal line, and the mopping module and the clean mop box are respectively located at two sides of the cleaning layer replacement position.

[0265] The second to-be-worked position of the dirty mop box and the cleaning layer replacement position are on the same vertical line, and the second to-be-worked position is located above the cleaning layer replacement position.

[0266] In this case, the dirty mop box only needs to move in the vertical direction (that is, the second movable mechanism moves only in the vertical direction) to implement the removal of the cleaning layer. The clean mop box only needs to move in the horizontal direction (that is, the third movable mechanism only moves in the horizontal direction) to implement the mounting of the cleaning layer. The complexity of arrangement of the movable mechanism and the replacement operation is simplified.

[0267] Certainly, in another embodiment, the dirty mop box and the clean mop box are arranged up and down, and the dirty mop box is above the clean mop box, and the dirty mop box and the clean mop box only move up and down in the vertical direction. In this case, the second movable mechanism and the third movable mechanism are a same movable mechanism (for example, a vertical guide rail). The mopping module (or the mopping plate) only moves in the horizontal direction under the driving of the cleaning robot, and the cleaning layer can also be removed and replaced. For details, reference may be made to FIG. 7 and FIG. 12, and details are not described herein.

[0268] In an embodiment, the robot cleaning system has a cleaning layer removal position and a cleaning layer mounting position that cooperate with the mopping module for removing the cleaning layer and mounting the cleaning layer. The cleaning layer replacement mechanism includes: a dirty mop box configured to accommodate the cleaning layer, a clean mop box configured to accommodate a cleaning layer to be mounted on the mopping module, a cleaning layer removal mechanism, a second movable mechanism configured to drive the dirty mop box to move, and a third movable mechanism configured to drive the clean mop box to move. The cleaning layer removal mechanism is configured to grab the cleaning layer on the mopping module at the cleaning layer removal position.

[0269] Further, the cleaning layer removal position and

the cleaning layer mounting position are a same preset position.

[0270] Further, the cleaning layer removal mechanism is arranged at an opening of the dirty mop box.

5 **[0271]** Further, an opening of the dirty mop box and an opening of the clean mop box face a connection surface of the mopping plate at a preset position, to allow the mopping plate to extend into.

10 **[0272]** Further, the second to-be-worked position of the dirty mop box and the mopping module in the second state are in the alignment state, that is, the second to-be-worked position and a cleaning layer replacement position are on a same horizontal line, and the mopping module and the dirty mop box are respectively located at two sides of the cleaning layer replacement position. The first to-be-worked position of the clean mop box and the cleaning layer replacement position are on a same vertical line, and the first to-be-worked position is located above the cleaning layer replacement position.

15 **[0273]** A replacement process of the cleaning layer mainly includes the following steps.

[0274] When the cleaning layer needs to be replaced, the cleaning robot returns to the base station and stops at the stop position.

20 **[0275]** The control module controls the driving module to drive the mopping module to switch from the first state to the second state.

[0276] The second movable mechanism drives the dirty mop box to move to a preset position.

30 **[0277]** The cleaning layer removal mechanism picks up the cleaning layer on the mopping module.

[0278] The walking module drives the cleaning robot to move in a direction close to the preset position by a specific distance, to separate the cleaning layer on the mopping module from the mopping module.

35 **[0279]** The walking module drives the cleaning robot to return to the stop position.

[0280] The second movable mechanism drives the dirty mop box to leave the preset position, for example, return to the second to-be-worked position.

40 **[0281]** The third movable mechanism drives the clean mop box to move to the preset position.

[0282] The walking module drives the cleaning robot to move toward the clean mop box, so that the mopping module is connected to the cleaning layer in the clean mop box.

45 **[0283]** The walking module drives the cleaning robot to return to the stop position.

[0284] The control module controls the driving module to drive the mopping module to switch from the second state to the first state.

50 **[0285]** In an embodiment, for example, the cleaning layer is a mop. This application provides a control method for a robot cleaning system, and the control method includes the following steps.

55 1. A host enters a base station and stops at a stop position.

2. The host drives a mopping plate to move, to switch the mopping plate from a first state to a second state.

3. Move a dirty mop box to a mop removal position, where the mopping plate is aligned with an opening of the dirty mop box.

4. Remove a dirty mop on the mopping plate through relative movement of the mopping plate and a paper removal hook (a hook) on the dirty mop box (first close, then away). For example, in at least a part of a removal process, the dirty mop box does not move actively, and the cleaning robot drives the mopping module to actively move toward the dirty mop box and move away from the dirty mop box, thereby implementing removal.

5. The removed dirty mop falls into the dirty mop box.

6. Move the dirty mop box to a non-working position (for example, a second to-be-worked position), to leave an operation space for a clean mop box.

7. Move the clean mop box to a mop mounting position, where an opening of the clean mop box is aligned with the mopping plate.

8. Mount a new mop on the mopping plate through relative movement of the mopping plate and the clean mop box.

9. Move and reset the clean mop box; and move and reset the dirty mop box.

10. The host (which is referred to as a cleaning robot) drives the mopping plate to move, so that the mopping plate is returned to the first state. The host leaves the base station.

[0286] Further, the mounting position and the removal position are a same position.

[0287] It should be noted that an implementation of the relative movement may be that the mopping plate moves, and the box (the clean mop box or the dirty mop box) does not move, or may be that the box moves, and the mopping plate does not move; or both the mopping plate and the box move. That the mopping plate moves may be that the host moves to drive the mopping plate to move; or may be that a motion mechanism is arranged on the host to drive the mopping plate to move.

[0288] A sequence of step 8 and step 9 is adjustable, and step 8 and step 9 may be performed simultaneously or may be performed sequentially.

[0289] This should not be construed as a limitation on the present disclosure.

[0290] To provide an operation space for replacement of the cleaning layer, in an embodiment, the base station includes a platform for carrying the cleaning robot, where

a height of a working position of the cleaning layer replacement mechanism is a height of the platform.

[0291] For placement of the dirty mop box and the clean mop box, in an embodiment, the dirty mop box and the clean mop box are arranged in the base station up and down, and occupy a small space relative to left and right arrangement.

[0292] For ease of understanding, the following describes the present disclosure with reference to the accompanying drawings as follows.

[0293] FIG. 1 and FIG. 20 are schematic diagrams of a robot cleaning system according to an implementation of the present invention. The robot cleaning system includes: a cleaning robot 1100 and a base station 1400 for the cleaning robot to stop. Referring to FIG. 9, the cleaning robot 1100 includes: a main body 10, including a front end; a walking module 300, arranged on the main body 10 and driving the cleaning robot 1100 to move on a working surface; a mopping module 100, movably connected to the main body and including a replaceable cleaning layer 101, where the cleaning layer 101 has a cleaning surface and is configured to clean the working surface; the mopping module 100 has a connection surface configured as a connection cleaning layer; and the mopping module 100 includes at least a first state and a second state, where in the first state, the cleaning layer 101 is fitted to the working surface, and in the second state, the cleaning layer 101 is separated from the working surface; a driving mechanism 200, configured to drive the mopping module 100 to switch between the first state and the second state; and a control module, configured to at least control the driving mechanism 200 to drive the mopping module 100 to switch from the first state to the second state when the cleaning layer 101 needs to be replaced.

[0294] The main body 10 forms a basic contour of the cleaning robot, for example, a circle, a D shape, or a square, and includes the front end to define a forward movement direction.

[0295] The walking module 300 includes a driving motor and at least one driving wheel. The driving wheel is driven by the driving motor to drive the cleaning robot to move. The walking module 300 may drive the cleaning robot to perform autonomous movement under the control of the control module. It should be noted that a plurality of driving wheels may be driven by one driving motor, or may be driven by driving motors respectively connected to the plurality of driving wheels. This is not limited in the present invention.

[0296] The mopping module 100 includes a mopping plate and the replaceable cleaning layer 101. The mopping plate is detachably connected to the cleaning layer 101.

[0297] The cleaning layer 101 used by the cleaning robot 1100 may be a component having a cleaning function, for example, a sponge, a rag, a cleaning paper, a mop, or a mop paper (that is, a paper mop). The cleaning layer 101 may be disposable, for example, a disposable

mop paper. The cleaning layer 101 may alternatively be repeatedly used, for example, a mop that can be repeatedly used through cleaning. The cleaning layer 101 may be sheet-like, for example, a sheet-like mop, or roll-like, for example, a roll-like mop. The sheet-like mop may be understood as a mop sheet that can be directly used after being cut. The roll-like mop may be understood as film-like mop. It should be noted that the roll-like mop may be unfolded and cut to obtain a sheet-like mop. In an example, the cleaning layer 101 is a sheet-like mop, preferably, the sheet-like mop is a disposable mop paper.

[0298] In an example, the mopping plate and the cleaning layer 101 are detachably connected through bonding. An implementation of the bonding includes, but not limited to, a hook-and-loop fastener, a magnetic sticker, and the like.

[0299] The control module is a common control module in the field of automatic robots, and the control module is arranged inside the main body, which is not shown in the figure, and may be associated with the driving mechanism 200 through an electrical connection or an electrical signal connection. The control module may include an embedded digital signal processor (DSP), a microprocessor unit (MPU), an application-specific integrated circuit (ASIC), a programmable logic device (PLD), a system on chip (SOC), a central processing unit (CPU), a field programmable gate array (FPGA), or the like. The control module may control working of the cleaning robot 1100 according to a preset condition or according to an instruction received by the cleaning robot 1100. Specifically, the control module may control the walking module to walk in a working region of the cleaning robot 1100 according to a preset walking path, and the walking module drives the cleaning robot 1100 to walk while the mopping module performs mopping work, to clean dirt on a surface of the working region. The walking module drives the cleaning robot 1100 to walk along the preset path. When the mopping module completes cleaning work, the control module may control the cleaning robot 1100 to stop working and control walking of the walking module, so that the walking module drives the cleaning robot 1100 to leave the working region and return to the base station for maintenance. When the mopping module needs to be cleaned or replaced, the control module may control the cleaning robot 1100 to clean or replace the mopping module or replace a consumable of the mopping module in a preset manner. The control module may alternatively perform the preset operation based on satisfaction of a user or a specific situation. The working mode or the walking path of the cleaning robot 1100 may be preset in the control module and executed by the walking module or another module controlled by the control module.

[0300] The cleaning layer used by the cleaning robot 1100 may be a plurality of components having a cleaning function, for example, a rag, a mop, and a cleaning paper, but are not limited thereto. The cleaning layer is detachably fixed to a surface of the mopping module by a hook-and-loop fastener or a magnetic sticker or the like, but is

not limited thereto.

[0301] Specifically, in a specific implementation of the present invention, referring to FIG. 2, the first state is a working state of the cleaning robot 1100. In this state, the cleaning layer 101 of the mopping module 100 is fitted to the working surface, and when the cleaning robot 1100 walks, the cleaning layer is driven to rub against the working surface, and dirt on the working surface is wiped off and taken away. The second state is a non-working state of the cleaning robot 1100 or a state in which the cleaning robot 1100 needs to perform a cleaning layer 101 replacement operation. In this state, the cleaning layer 101 is at least partially separated from the working surface, for example, at least partially no contact with or completely separated from the working surface.

[0302] The cleaning layer 101 may cover only a surface (for example, a connection surface) of the mopping module that is connected to the working surface, or may cover a plurality of surfaces of the mopping module, so that cleaning work can be performed left and right, up and down, and in a movement direction of the cleaning robot during cleaning.

[0303] The driving mechanism 200 may be in an electric or another power form, and can drive the mopping module 100 to move or rotate in a predetermined direction, and the driving mechanism 200 and the mopping module 100 may be in transmission association through a general transmission part.

[0304] Specifically, during work, the walking module 300 is started to drive the cleaning robot 1100 to walk on the working surface. The cleaning layer 101 of the mopping module 100 is adhered to the working surface, and the cleaning layer 101 and the working surface rub to take away substances that need to be cleaned from the working surface. After the cleaning robot 1100 works for a period of time, by detecting a degree of contamination of the cleaning layer 101, it is necessary to replace the cleaning layer 101 of the cleaning robot 1100 when the cleaning layer 101 is seriously contaminated and cannot effectively carry away the substances on the working surface. The mopping module 100 changes from the first state to the second state. In this case, the cleaning layer 101 is manually replaced or automatically replaced in cooperation with the intelligent base station.

[0305] In the second state, the cleaning layer 101 needs to form a removal space with the working surface, so that a working surface of the cleaning layer 101 is exposed, and the cleaning layer removal mechanism can be in contact with the cleaning layer 101. The cleaning layer 101 may simply be vertically raised, preferably, to better cooperate with the cleaning layer removal mechanism, a plane on which the cleaning layer 101 is located is arranged at an angle to the working surface.

[0306] Specifically, in this embodiment, the mopping module 100 rotates in a predetermined direction, so that an angle between the plane on which the cleaning layer 101 is located and the working surface may be set to any value between 0 degrees and 90 degrees. In at least a

part of the operation process, the cleaning layer 101 may stay anywhere within the angular range, depending on an actual situation. The angle is formed between the plane on which the cleaning layer 101 is located and the working surface, and the cleaning layer can be replaced automatically or manually.

[0307] Referring to FIG. 3 and FIG. 4, when the mopping module is switched from the first state to the second state, the driving mechanism 200 drives the mopping module 100 to lift in a direction perpendicular to the working surface, and drives the mopping module 100 to flip toward an outer side of the main body.

[0308] Specifically, to facilitate replacement of the cleaning layer 101, the mopping module 100 needs to be switched into the second state for convenient for replacement, and the second state has a plurality of different switching manners. In an implementation of the present invention, the mopping module 100 moves upward in the direction perpendicular to the working surface under the driving of the driving mechanism to reach a lifting state, so that close contact between the cleaning layer and the working surface is separated, and an artificial or automatic device can conveniently remove the cleaning layer from the mopping module or mount a new cleaning layer.

[0309] In another implementation of the present invention, the mopping module 100 is directly flipped toward a preset direction under the driving by the driving mechanism 200, so that the cleaning layer is at least partially out of close contact with the working surface. Preferably, the mopping module 100 is flipped toward an outer side of the cleaning robot, especially toward a rear portion of the cleaning robot in a walking direction, and in the second state, a surface of the cleaning layer faces the rear portion of the cleaning robot in the walking direction. The second state is a state in which the mopping module 100 is flipped toward an outer side of the main body, and there is an angle greater than 0 degrees between the cleaning layer and the working surface, which may be 90 degrees in this specific implementation.

[0310] In the second state, manual or intelligent automatic replacement of the cleaning layer 101 is facilitated. In addition, to prevent the mopping module 100 from being interfered by the working surface in at least a part of a process of switching from the first state to the second state, causing the switching to be blocked, it is necessary for the driving mechanism 200 to drive the mopping module 100 to lift in the direction perpendicular to the working surface, and to drive the mopping module 100 to flip toward the outer side of the main body 10. The direction perpendicular to the working surface herein represents a point-to-point displacement and does not represent a motion trajectory.

[0311] The cleaning layer 101 of the mopping module is away from the working surface. Then, under the driving of the driving mechanism 200, the mopping module 100 is flipped toward a direction outside the main body 10, to reach the second state.

[0312] In another implementation of the present invention, referring to FIG. 5 and FIG. 6, the main body 10 is integrally lifted by using the walking mechanism 300, so that the cleaning layer 101 is away from the working surface and reaches the second state. Further, after the entire main body 10 is lifted up, under the driving of the driving mechanism 200, the mopping module 100 is flipped toward the outer side of the main body 10 to reach the second state. Finally, the walking mechanism 300 lowers the main body. Herein, the main body 10 may be inclined at any angle, and it is only necessary to maintain the balance through counterweight and ensure that the cleaning layer is away from the working surface.

[0313] Further, the walking mechanism 300 is provided with at least three walking wheel parts, which are arranged back and forth. In this case, a front portion of the main body is lifted up by a walking wheel part at the front portion in a cleaning direction, so that the cleaning layer 101 can also reach the second state away from the working surface. The technical solution provided by this implementation avoids the interference of the ground to a moving track of the mopping module in the at least a part of the process of switching the mopping module from the first state to the second state, so that the state switching of the mopping module is more reliable and quick, and is not easily damaged.

[0314] In the specific implementation of the present invention, the driving mechanism 200 includes a linear transmission mechanism. The linear transmission mechanism includes a common guide rail, a gear meshing mechanism, or a chain transmission mechanism and is configured to drive the mopping plate loaded with the cleaning layer to move in a linear direction. The driving mechanism 200 also includes a pivoting mechanism. The pivoting mechanism drives mopping plate loaded with the cleaning layer to pivot around a pivot shaft. Further, the cleaning layer can be moved with the mopping plate up and down in the direction perpendicular to the working surface and the mopping plate can be flipped toward the outer side of the main body. In the specific implementation of the present invention, the driving mechanism may include a motor and a transmission member, and the transmission member may be a gear, a chain, or the like. The transmission member provides power for the movement of the mopping plate under the driving of the motor.

[0315] Further, the base station 1400 of the robot cleaning system of the present invention includes: a platform 401 carrying the cleaning robot, a dirty mop box 403 configured to accommodate the cleaning layer, a clean mop box 402 configured to accommodate a cleaning layer to be mounted to the mopping module 100, and a lifting mechanism configured to drive the dirty mop box 403 and the clean mop box 402 to move in a direction perpendicular to the working surface. The dirty mop box 403 and the clean mop box 402 are stacked up and down in a direction perpendicular to the platform 401. The lifting mechanism is fixedly connected to the dirty mop box 403 and the clean mop box 402 respectively. The lifting mech-

anism drives the dirty mop box 403 and the clean mop box 402 to move up and down. The dirty mop box 403 and the clean mop box 402 are provided with openings for the cleaning layer to pass through when the cleaning layer is replaced. The openings can facilitate access to dirty cleaning layers and clean cleaning layers. The opening can also match the mopping module to facilitate entering and exiting of the mopping module and the cleaning layer from the opening.

[0316] The lifting mechanism includes a motor and a transmission element (the transmission element may be a transmission chain or a transmission belt) 407, and the transmission element 407 reciprocates up and down under the driving of the motor. The dirty mop box 403 and the clean mop box 402 are fixedly connected to the transmission element 407, and move reciprocally up and down under the driving of the transmission element 407. In this specific implementation, the motor and the transmission element 407 are connected through a transmission gear 408, the motor drives the transmission gear 408 to rotate, and the transmission gear 408 drives the transmission element 407 to move reciprocally.

[0317] Further, the base station 1400 includes a cleaning layer removal mechanism. When replacing the cleaning layer, the cleaning layer removal mechanism is configured to hold the cleaning layer, and the cleaning robot moves in a direction away from the cleaning layer removal mechanism to remove the cleaning layer from the mopping module.

[0318] Referring to FIG. 7 to FIG. 10, in a specific implementation, at least one cleaning layer removal mechanism is arranged inside or at the opening of the dirty mop box 403, and the cleaning layer removal mechanism is configured to separate the cleaning layer of the cleaning robot from a surface of the mopping module.

[0319] Specifically, the cleaning layer removal mechanism includes a hook 404, an elastic member 406, and a rail 405. The rail 405 is fixed at the opening of the dirty mop box 403, the hook 404 moves reciprocally in the rail 405, the elastic member 406 moves telescopically in the rail 405, and the hook 404 is reset under the support of the elastic member 406. A surface of the hook 404 facing the outside of the dirty mop box 403 is an inclined surface.

[0320] When cleaning layer replacement is performed on the mopping module, the mopping module abuts against the hook 404, and the surface of the hook 404 facing the outside of the dirty mop box 403 is the inclined surface. Under the action of a force exerted by the cleaning layer on the inclined surface, the hook 404 is retracted into the rail 405. After the cleaning layer slides over the hook 404, the hook 404 is ejected and reset under the action of the elastic member 406. When the cleaning robot retracts, the hook 404 is hooked and locked under the action of the elastic member 406, so that the cleaning layer 101 is separated from the mopping module 100.

[0321] To better separate the cleaning layer from the mopping module, it is necessary to provide a recess or a groove matching the hook on a front portion of the mop-

ping module in a forward movement direction of the cleaning robot behind the cleaning layer. When the cleaning layer is separated from the mopping module, the hook first enters the recess or the groove and appears behind the cleaning layer 101. When the mopping module 100 is retracted, the hook can hook the cleaning layer 101.

[0322] Preferably, when the mopping module 100 is in the second state, a plane on which the cleaning layer 101 is located is perpendicular to the working surface. In this vertical manner, it is more convenient for the mopping module to enter and exit the dirty mop box 403 and the clean mop box 402, so as to reduce the interference between the mopping module 100 and the opening of the dirty mop box 403 and the clean mop box 402. In addition, it is also convenient for a first hook or a second hook 404 to hook the cleaning layer, so that the cleaning layer 101 is removed from the mopping module.

[0323] The base station 1400 includes a cleaning layer removal mechanism. The cleaning layer removal mechanism is movably arranged on the base station. When replacing the cleaning layer, the cleaning layer removal mechanism holds the cleaning layer and moves toward a direction away from the mopping module, to remove the cleaning layer from the mopping module.

[0324] Optionally, the cleaning layer removal mechanism includes a hook and an elastic member, and the hook and the dirty mop box are elastically connected through the elastic member. The hook rotates in the dirty mop box in a single direction, and is reset under the action of a first elastic member.

[0325] Such a cleaning layer removal mechanism is similar to an elastic door hinge, so that the first hook has the ability to elastically rotate. When the cleaning robot replaces the cleaning layer, the mopping module rotates toward the dirty mop box against the hook. After the cleaning layer slides over the hook, the hook is reset under the action of the elastic member. When the mopping module is retracted, the first hook is locked and kept stationary, and the dirty cleaning layer is hooked, so that the cleaning layer is separated from the mopping module.

[0326] When the cleaning robot needs to replace the cleaning layer 101, the mopping module reaches the second state under the driving of the driving mechanism and starts to return for the first time. In an initial state, the dirty mop box 403 is at a position corresponding to the mopping module when the cleaning robot returns, the mopping module and the cleaning layer 101 enter the first opening, and the dirty cleaning layer 101 is stored in the dirty mop box 403. Then, the mopping module starts to return for the second time. In this case, the clean mop box 402 is driven by the lifting mechanism to transport the clean mop box 402 to the position corresponding to the mopping module, and when the cleaning robot returns for the second time, the clean cleaning layer is taken out and mounted on the mopping module.

[0327] In an optional implementation, when the cleaning layer 101 is removed and mounted, the clean mop box 402 and the dirty mop box 403 do not move. When

the cleaning layer is removed, the driving module drives the mopping module to move to a position corresponding to the dirty mop box. When the cleaning layer is mounted, the driving module drives the mopping module to move to a position corresponding to the clean mop box.

[0328] In an optional implementation, the dirty mop box 403 and the clean mop box 402 are stacked up and down in the direction perpendicular to the working surface.

[0329] Specifically, referring to FIG. 14, the dirty mop box and the clean mop box are arranged at an angle α , and a preferred range of the angle α may be any value between 0 degrees and 90 degrees. When the cleaning layer 101 is removed, the driving module drives the mopping module to pivot to a position corresponding to the dirty mop box. When the cleaning layer is mounted, the driving module drives the mopping module to pivot to a position corresponding to the clean mop box.

[0330] Optionally, the mopping module does not rotate, and the dirty mop box 403 and the clean mop box 402 are arranged on a rotating shaft arranged on the base station. When the cleaning layer needs to be replaced, the mopping module first enters the first opening of the dirty mop box 403 and leaves the dirty cleaning layer; and exits the first opening. The dirty mop box and the clean mop box rotate. The clean mop box 402 rotates to a matching position at which the mopping module in the second state is located, the mopping module enters the second opening of the clean mop box 402, and a clean cleaning layer is mounted.

[0331] In another implementation of the present invention, referring to FIG. 11 to FIG. 13. The base station 1400 of the robot cleaning system of the present invention includes: a platform 401 carrying the cleaning robot. The platform 401 is provided with a first accommodating groove 601, and the mopping module 100 is at least partially accommodated in the first accommodating groove in at least a part of a process of switching from the first state to the second state.

[0332] In this implementation, especially when the cleaning robot continuously performs cleaning until reaching the base station to replace the cleaning layer 101, the cleaning layer 101 is always in the first state. In this case, it is necessary to switch the cleaning layer 101 from the first state to the second state, and interference between the cleaning layer 101 and the platform 401 may occur in the at least a part of the switching process, so that the switching is blocked. A solution is provided by using the first accommodating groove 601. In this case, the mopping module moves above the first accommodating groove 601 for giving a space for the mopping module to rotate, and a portion of the mopping module 100 that may have been previously interfered with by the platform 401 passes through a notch of the first accommodating groove. The technical solution provided by this implementation avoids the interference of the ground to a moving track of the mopping module in the at least a part of the process of switching the mopping module from the first state to the second state, so that the state switch-

ing of the mopping module is more reliable and quick, and is not easily damaged.

[0333] In a further implementation, a sensor may also be arranged on the base station for sensing a position of the cleaning robot.

[0334] Specifically, when the cleaning robot enters the base station for the first time, and is sensed by the sensor when entering a detection position of the platform 401 of the base station, the cleaning robot enables the mopping module to extend into the first opening of the dirty mop box, and the cleaning layer on the surface of the mopping module abuts against the second hook 404. Because the surface of the second hook 404 facing the outside of the dirty mop box 403 is the inclined surface, under the action of the force exerted by the cleaning layer on the inclined surface, the second hook 404 is retracted into the rail 406. After the cleaning layer slides over the second hook 405, the second hook 404 is ejected and reset under the action of the second elastic member 405, and falls into or passes through the groove or recess on the cleaning layer 101. When being retracted, the cleaning robot is sensed by the sensor, and the second hook 404 is locked and kept stationary under the action of the second elastic member 405. The second hook 404 just directly hooks the dirty cleaning layer, so that the cleaning layer is separated from the surface of the mopping module. Automatic separation and collection of the dirty cleaning layer are completed.

[0335] When a clean cleaning layer is to be mounted, the cleaning robot enters the maintenance base station again and is sensed by the sensor for the second time. In this case, the lifting mechanism of the base station 1400 is started, and the motor is started, and drives the transmission gear, to drive the transmission chain or the transmission belt to move upward, to drive the dirty mop box 403 and the clean mop box 402 to move upward, so that the second opening of the clean mop box 402 moves to a matching position of the mopping module, the mopping module extends into the second opening, and the cleaning layer is adsorbed on the surface of the mopping module, and then the mopping module exits. When the sensor detects that the cleaning robot exits the maintenance base station for the second time, the lifting mechanism is started, the motor is started, and the transmission chain or the transmission belt is driven to reset downward.

[0336] Further, the base station further includes a charging interface. The charging interface is configured to enable the cleaning robot to replenish electric energy at the base station when the cleaning robot replaces the cleaning layer or after the cleaning robot replaces the cleaning layer. In an optional implementation, when the cleaning layer is replaced, projections of the charging interface and the mopping module on a plane perpendicular to a direction in which the cleaning robot enters the base station do not overlap.

[0337] Specifically, the charging interface may be configured to charge the cleaning robot, and a position of

the charging interface may be set on a bottom portion or a side portion of the base station, but is not set at a position at which the dirty mop box and the clean mop box are located. It can prevent the cleaning robot from interfering with the dirty mop box and the clean mop box during charging, and when replacing the cleaning layer, the cleaning robot completes replenishment of electric energy.

[0338] Optionally, the base station includes a charging interface; a dirty mop box for removing the cleaning layer from the mopping module and accommodating the removed cleaning layer; a clean mop box for accommodating a cleaning layer to be mounted on the mopping module; and a conveying mechanism for conveying the dirty mop box or the clean mop box to a preset position. When the cleaning layer is replaced, at least a part of the dirty mop box or the clean mop box shields the charging interface. When replacement of the cleaning layer is completed, the conveying mechanism conveys the dirty mop box or the clean mop box to a position at which the charging interface is not shielded.

[0339] Specifically, the charging interface may be configured to charge the cleaning robot, and the charging interface is arranged at a tail position of the cleaning robot and any position of the base station, for example, a position covered by the dirty mop box or the clean mop box. When the cleaning layer is replaced, the dirty mop box or the clean mop box is moved to a position corresponding to the mopping module of the cleaning robot, to complete a replacement action of the cleaning layer. After replacement of the cleaning layer is completed, the dirty mop box or the clean mop box is moved to a side surface of the base station or another position that does not shield the charging interface, to expose a position of the charging interface to charge the cleaning robot.

[0340] Based on the foregoing, the cleaning robot provided in the present invention can achieve an effect of convenient replacement of the cleaning layer by controlling the mopping module. Alternatively, through cooperation of the cleaning robot and the base station, the dirty cleaning layer can be automatically recycled and the clean cleaning layer can be provided. A mop can be conveniently and automatically replaced, and replacement of the mop is quick and quiet and does not cause pollution to the environment or base station, thereby improving reliability and work efficiency of the cleaning robot and increasing a satisfaction degree of a user for the robot cleaning system.

[0341] It should be appreciated by a person skilled in the art that the discussion of any of the above embodiments is merely an example and is not intended to imply that the scope of the present disclosure (including claims) is limited to these examples. Under the ideas of the present disclosure, the technical features in the foregoing embodiments or different embodiments may also be combined, the steps may be performed in any order, and many other changes of different aspects of the embodiments of the present disclosure also exist as described

above, and these changes are not provided in detail for simplicity.

[0342] The embodiments of the present disclosure are intended to cover all such changes, modifications, and variants falling within the wide scope of the appended claims. Therefore, any omission, modification, equivalent replacement, or improvement made within the spirit and principle of the embodiments of the present disclosure shall be included in the protection scope of the present disclosure.

Claims

1. A robot cleaning system, comprising: a cleaning robot, and a base station for the cleaning robot to stop, **characterized in that** the cleaning robot comprises:

a main body, comprising a front end;
a walking module, arranged on the main body and driving the cleaning robot to move on a working surface;
a mopping module, comprising a mopping base, wherein the mopping base is for a replaceable cleaning layer to attach to form a cleaning surface, and the cleaning surface is configured to clean the working surface; the mopping module is movably connected to the main body to switch between a first state and a second state; and in the first state, the cleaning surface is fitted to the working surface, and in the second state, the cleaning surface is separated from the working surface;
a driving module, configured to drive the mopping module to switch between the first state and the second state; and
a control module, configured to at least control the driving module to drive the mopping module to switch from the first state to the second state when the cleaning layer needs to be replaced; and
the robot cleaning system comprises:

a cleaning layer replacement mechanism, wherein
when the mopping module is in the second state, the cleaning layer replacement mechanism is configured to operably act on the cleaning layer and/or the mopping base, to replace the cleaning layer for the mopping module.

2. The robot cleaning system according to claim 1, **characterized in that** the mopping base comprises an attachment surface attached to the cleaning layer, and in the second state, an angle is formed between the attachment surface and a first direction, wherein

the first direction is a direction in which the cleaning robot enters the base station.

3. The robot cleaning system according to claim 2, **characterized in that** when the mopping module is in the second state, the angle formed between the attachment surface and the first direction is greater than or equal to 30 degrees and less than or equal to 90 degrees.
4. The robot cleaning system according to claim 3, **characterized in that** when the mopping module is in the second state, the attachment surface is perpendicular to the first direction.
5. The robot cleaning system according to claim 3, **characterized in that** when the mopping module is in the second state, the angle formed between the attachment surface and the first direction is greater than or equal to 45 degrees and less than or equal to 60 degrees.
6. The robot cleaning system according to claim 2, **characterized in that** the cleaning layer replacement mechanism comprises a cleaning layer removal mechanism arranged on the base station; and

the cleaning system comprises a first transmission mechanism; and the cleaning system has a cleaning layer removal position for removing the cleaning layer on the mopping module, wherein
the cleaning layer removal mechanism is configured to pick up the cleaning layer on the mopping module at the cleaning layer removal position; and
the first transmission mechanism is configured to drive at least one of the cleaning layer removal mechanism and the mopping module to move, so that the cleaning layer removal mechanism and the mopping module generate relative displacement, to separate the cleaning layer on the mopping module from the mopping module.
7. The robot cleaning system according to claim 6, **characterized in that** the first transmission mechanism is at least configured to drive the mopping module to move in at least a part of a process of separating the cleaning layer on the mopping module from the mopping module, wherein in the at least a part of the process of separating the cleaning layer on the mopping module from the mopping module, a position of the cleaning layer removal mechanism is fixed.
8. The robot cleaning system according to claim 7, **characterized in that** the first transmission mechanism comprises the walking module, and the walking

module is at least configured to drive the cleaning robot to move toward the cleaning layer removal mechanism in the at least a part of the process of separating the cleaning layer on the mopping module from the mopping module, so that the mopping module and the cleaning layer removal mechanism generate the relative displacement, wherein in the at least a part of the process of separating the cleaning layer on the mopping module from the mopping module, a position of the mopping module relative to the cleaning robot is fixed.

9. The robot cleaning system according to claim 7, **characterized in that** the first transmission mechanism comprises a movable member arranged on the cleaning robot and at least configured to drive the mopping module to move toward the cleaning layer removal mechanism in the at least a part of the process of separating the cleaning layer on the mopping module from the mopping module, wherein in the at least a part of the process of separating the cleaning layer on the mopping module from the mopping module, a position of the cleaning robot is fixed.
10. The robot cleaning system according to claim 6, **characterized in that** the first transmission mechanism comprises a first movable mechanism at least configured to drive the cleaning layer removal mechanism to move in at least a part of a process of separating the cleaning layer on the mopping module from the mopping module, wherein in the at least a part of the process of separating the cleaning layer on the mopping module from the mopping module, positions of the cleaning robot and the mopping module are fixed.
11. The robot cleaning system according to claim 6, **characterized in that** the mopping base is detachably connected to the cleaning layer; the mopping base has a removal region; the cleaning layer removal mechanism comprises a hook; and when the hook and the mopping base are located at the cleaning layer removal position, the hook matches the removal region, to remove the cleaning layer from the mopping module, wherein the removal region is not connected to the cleaning layer.
12. The robot cleaning system according to claim 11, **characterized in that** the removal region comprises a mop removal groove configured for the hook to pass through.
13. The robot cleaning system according to claim 6, **characterized in that** the cleaning layer replacement mechanism comprises a dirty mop box configured to accommodate the cleaning layer separated from the mopping module.

14. The robot cleaning system according to claim 13, **characterized in that** the dirty mop box is arranged on a moving path of the cleaning layer separated from the mopping module, so that the cleaning layer falls into the dirty mop box.
15. The robot cleaning system according to claim 14, **characterized in that** the cleaning layer removal position is located in the dirty mop box.
16. The robot cleaning system according to any one of claims 13 to 15, **characterized in that** the cleaning layer removal mechanism is arranged on the dirty mop box;
the dirty mop box is provided with a first opening; and the first opening is configured to allow the mopping module to extend into and allow the cleaning layer to be left in the dirty mop box when the mopping module leaves.
17. The robot cleaning system according to claim 16, **characterized in that** the first opening of the dirty mop box faces a second direction at least at the cleaning layer removal position, wherein the second direction is a direction opposite to the first direction.
18. The robot cleaning system according to claim 16, **characterized in that** the first transmission mechanism comprises a second movable mechanism at least configured to drive the dirty mop box to move in at least a part of a process of separating the cleaning layer on the mopping module from the mopping module, so that the cleaning layer removal mechanism is displaced relative to the mopping module, wherein in the at least a part of the process of separating the cleaning layer on the mopping module from the mopping module, a position of the cleaning layer removal mechanism relative to the dirty mop box is fixed, a position of the cleaning robot is fixed, and a position of the mopping module relative to the cleaning robot is fixed.
19. The robot cleaning system according to claim 16, **characterized in that** the first transmission mechanism is at least configured to drive the mopping module to move in at least a part of a process of separating the cleaning layer on the mopping module from the mopping module, wherein in the at least a part of the process of separating the cleaning layer on the mopping module from the mopping module, a position of the dirty mop box is fixed.
20. The robot cleaning system according to claim 19, **characterized in that** the first transmission mechanism comprises the walking module at least configured to drive the cleaning robot to move toward the dirty mop box in the at least a part of the process of separating the cleaning layer on the mopping module from the mopping module, so that the mopping module is displaced relative to the cleaning layer removal mechanism, wherein in the at least a part of the process of separating the cleaning layer on the mopping module from the mopping module, a position of the cleaning layer removal mechanism relative to the dirty mop box is fixed, and a position of the cleaning robot is fixed.
21. The robot cleaning system according to claim 19, **characterized in that** the first transmission mechanism comprises a movable member arranged on the cleaning robot and at least configured to drive the mopping module to move toward the dirty mop box in the at least a part of the process of separating the cleaning layer on the mopping module from the mopping module, so that the mopping module is displaced relative to the cleaning layer removal mechanism, wherein in the at least a part of the process of separating the cleaning layer on the mopping module from the mopping module, a position of the cleaning layer removal mechanism relative to the dirty mop box is fixed, and a position of the cleaning robot is fixed.
22. The robot cleaning system according to claim 2, **characterized in that** the cleaning system has a cleaning layer removal position for removing the cleaning layer on the mopping module;

the cleaning layer replacement mechanism comprises a cleaning layer removal mechanism arranged on the cleaning robot and configured to separate the cleaning layer on the mopping module from the mopping module at the cleaning layer removal position; and
the cleaning system comprises a motion mechanism, and the motion mechanism is configured to drive the cleaning layer removal mechanism to move, so that the cleaning layer removal mechanism and the mopping module generate relative displacement, to separate the cleaning layer on the mopping module from the mopping module, wherein in at least a part of a process of separating the cleaning layer on the mopping module from the mopping module, positions of the cleaning robot and the mopping module are fixed.
23. The robot cleaning system according to claim 22, **characterized in that** the cleaning layer removal mechanism comprises a flipping member, and the flipping member comprises an open state and a closed state; when the flipping member is in the open state, the cleaning layer is separable from the mopping module; when the flipping member is in the closed state, the cleaning layer is mounted on the mopping module; and

the motion mechanism comprises a driving apparatus, and the driving apparatus is configured to drive the flipping member to switch from the closed state to the open state, so that the cleaning layer on the mopping module is separated from the mopping module.

24. The robot cleaning system according to claim 22 or 23, **characterized in that** the cleaning layer replacement mechanism comprises a dirty mop box configured to accommodate the cleaning layer separated from the mopping module.

25. The robot cleaning system according to claim 24, **characterized in that** the dirty mop box is arranged on a moving path of the cleaning layer separated from the mopping module, so that the cleaning layer falls into the dirty mop box.

26. The robot cleaning system according to claim 25, **characterized in that** the cleaning layer removal position is located in the dirty mop box.

27. The robot cleaning system according to claim 2, **characterized in that** the cleaning layer replacement mechanism comprises a clean mop box configured to accommodate a cleaning layer to be mounted on the mopping module;

the cleaning system has a cleaning layer mounting position; the cleaning layer mounting position is a position at which the cleaning layer in the clean mop box is mounted on the mopping module; and

the cleaning system comprises a second transmission mechanism configured to drive at least one of the clean mop box and the mopping module to move, to reach the cleaning layer mounting position, so as to mount the cleaning layer in the clean mop bin on the mopping module.

28. The robot cleaning system according to claim 27, **characterized in that** the second transmission mechanism is at least configured to drive the mopping module to move in at least a part of a process of mounting the cleaning layer in the clean mop box on the mopping module, wherein in the at least a part of the process of mounting the cleaning layer on the mopping module on the mopping module, a position of the clean mop box is fixed.

29. The robot cleaning system according to claim 28, **characterized in that** the second transmission mechanism comprises the walking module at least configured to drive the cleaning robot to move to drive the mopping module to move toward the clean mop box in the at least a part of the process of mounting the cleaning layer in the clean mop box on the

mopping module, wherein in the at least a part of the process of mounting the cleaning layer in the clean mop box on the mopping module, a position of the mopping module relative to the cleaning robot is fixed.

30. The robot cleaning system according to claim 28, **characterized in that** the second transmission mechanism comprises a movable member arranged on the cleaning robot and at least configured to drive the mopping module to move toward the clean mop box in the at least a part of the process of mounting the cleaning layer in the clean mop box on the mopping module, wherein in the at least a part of the process of mounting the cleaning layer in the clean mop box on the mopping module, a position of the cleaning robot is fixed.

31. The robot cleaning system according to claim 27, **characterized in that** the second transmission mechanism comprises a third movable mechanism at least configured to drive the clean mop box to move toward the mopping module in at least a part of a process of mounting the cleaning layer in the clean mop box on the mopping module, wherein in the at least a part of the process of mounting the cleaning layer in the clean mop box on the mopping module, positions of the cleaning robot and the mopping module are fixed.

32. The robot cleaning system according to claim 27, **characterized in that** the clean mop box is provided with a second opening; and the second opening is configured to allow the mopping module to extend into, to mount the cleaning layer on the mopping module.

33. The robot cleaning system according to claim 27, **characterized in that** the second opening of the clean mop box faces a second direction at least at the cleaning layer mounting position, wherein the second direction is a direction opposite to the first direction.

34. The robot cleaning system according to claim 27, **characterized in that** a cleaning surface of the cleaning layer in the clean mop box is parallel to the attachment surface; or an angle formed between a cleaning surface of the cleaning layer in the clean mop box and the first direction is equal to the angle formed between the attachment surface and the first direction.

35. The robot cleaning system according to claim 27, **characterized in that** the cleaning layer is a sheet-like mop; and when there are at least two sheet-like mops, the at least two sheet-like mops are arranged in the clean

mop box in a stacking manner.

36. The robot cleaning system according to claim 27, **characterized in that** the mopping base has an adhesion region; and the cleaning layer is adherable to the adhesion region.
37. The robot cleaning system according to claim 27 or 34, **characterized in that** a support part is arranged in the clean mop box and is configured to support the cleaning layer, so that the angle is formed between the cleaning surface of the cleaning layer accommodated in the clean mop box and the first direction.
38. The robot cleaning system according to claim 2, **characterized in that** when the mopping module is switched from the first state to the second state, the driving mechanism drives the mopping module to lift by a preset distance in a direction perpendicular to the working surface and then flip toward the first direction.
39. The robot cleaning system according to claim 2, **characterized in that** the base station comprises: a platform for carrying the cleaning robot, a first accommodating groove is provided on the platform, the control module is configured to control the driving module to drive the mopping module to switch from the first state to the second state when the cleaning robot moves to a stop position, and in at least a part of a process of switching the mopping module from the first state to the second state, at least a part of the mopping module is accommodated in the first accommodating groove.
40. The robot cleaning system according to claim 6, **characterized in that** the cleaning system further comprises: an in-place detection apparatus configured to detect whether the cleaning layer removal mechanism and/or the mopping module reaches an alignment position, wherein the alignment position is a position when the cleaning layer removal mechanism and the mopping module are in an alignment state.
41. The robot cleaning system according to claim 16, **characterized in that** the cleaning system further comprises: an in-place detection apparatus configured to detect whether the dirty mop box and/or the mopping module reaches an alignment position, wherein the alignment position is a position when the cleaning layer removal mechanism and the mopping module are in an alignment state.
42. The robot cleaning system according to claim 27, **characterized in that** the cleaning system further comprises: an in-place detection apparatus configured to detect whether the clean mop box and/or the mopping module reaches an alignment position, wherein the alignment position is a position when the clean mop box and the mopping module are in an alignment state.
43. The robot cleaning system according to claim 2, **characterized in that** the cleaning system has a cleaning layer removal position and a cleaning layer mounting position that cooperate with the mopping module for removing the cleaning layer and mounting the cleaning layer; the cleaning layer replacement mechanism comprises: a dirty mop box configured to accommodate the cleaning layer, a clean mop box configured to accommodate a cleaning layer to be mounted on the mopping module, a second movable mechanism configured to drive the dirty mop box to move to the cleaning layer removal position, a third movable mechanism configured to drive the clean mop box to move to the cleaning layer mounting position, and a cleaning layer removal mechanism; and the cleaning layer removal mechanism is configured to separate the cleaning layer on the mopping module from the mopping module at the cleaning layer removal position.
44. The robot cleaning system according to claim 43, **characterized in that** the cleaning layer removal position and the cleaning layer mounting position are a same preset position.
45. The robot cleaning system according to claim 1, **characterized in that** the control module is at least configured to control the driving module to drive the mopping module to switch from the second state back to the first state after replacement of the cleaning layer is completed.
46. A control method for a robot cleaning system, applicable to the robot cleaning system according to claim 1, **characterized in that** the method comprises:
when a cleaning layer needs to be replaced, controlling, by a control module, a driving module to drive a mopping module to switch from a first state to a second state; and
when the mopping module is in the second state, operably acting, by a cleaning layer replacement mechanism, on the cleaning layer and/or a mopping base, to replace the cleaning layer for the mopping module.

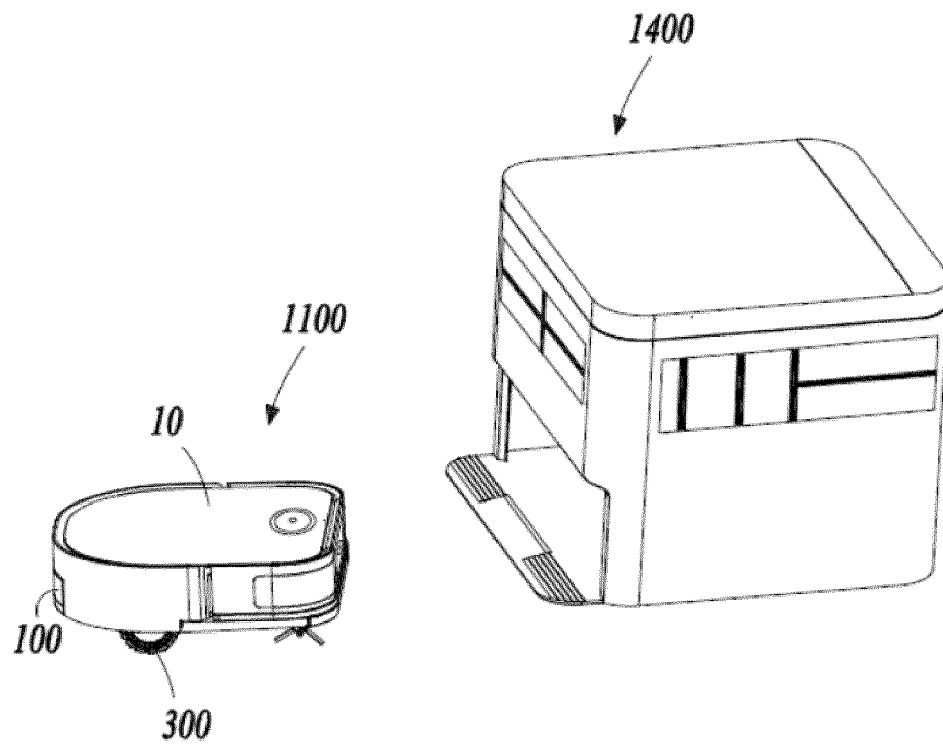


FIG. 1

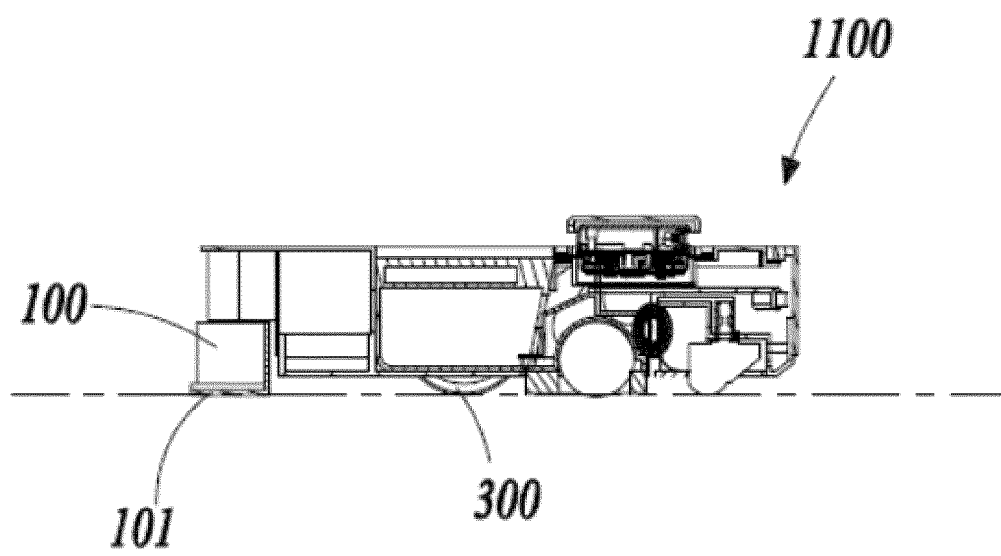


FIG. 2

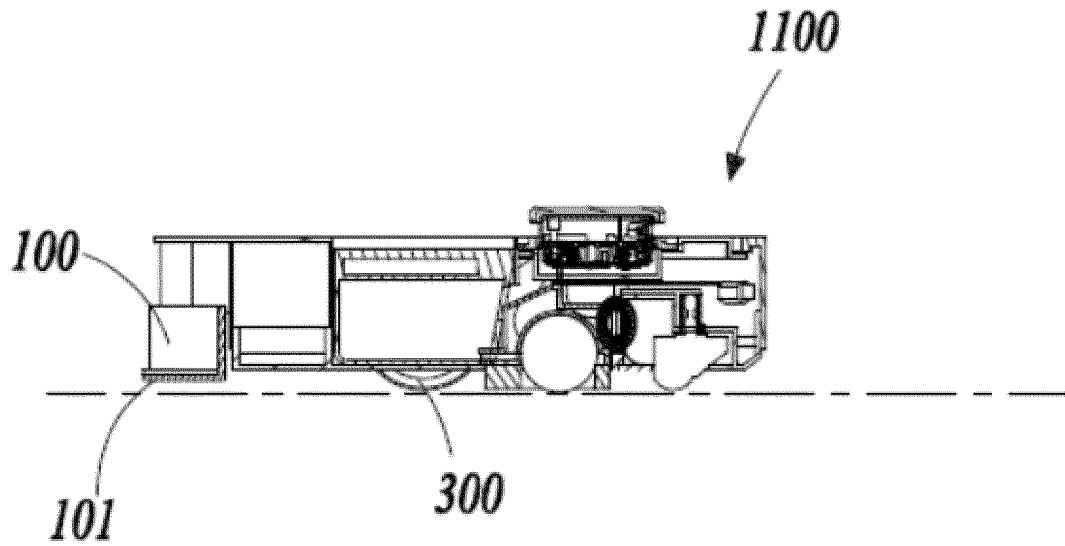


FIG. 3

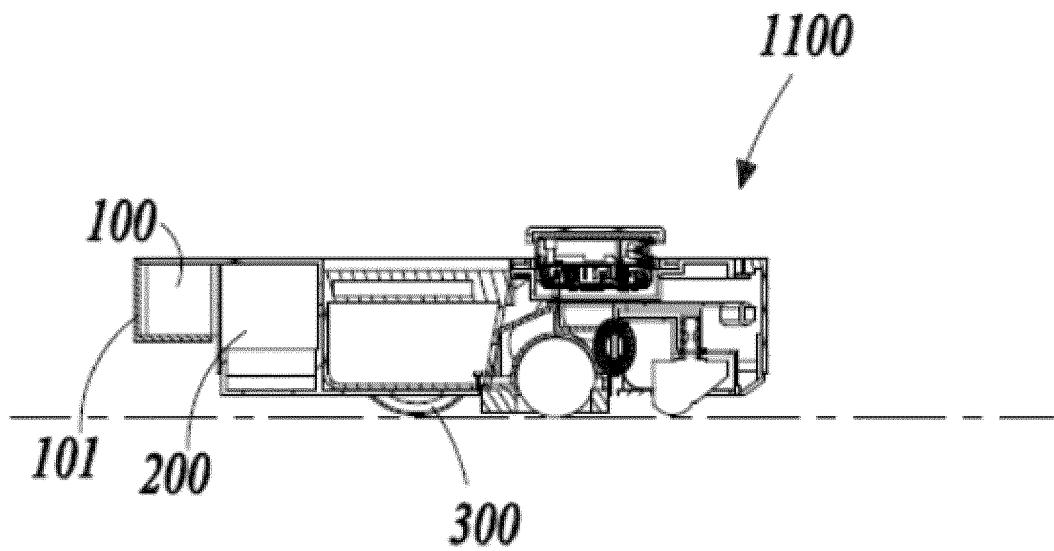


FIG. 4

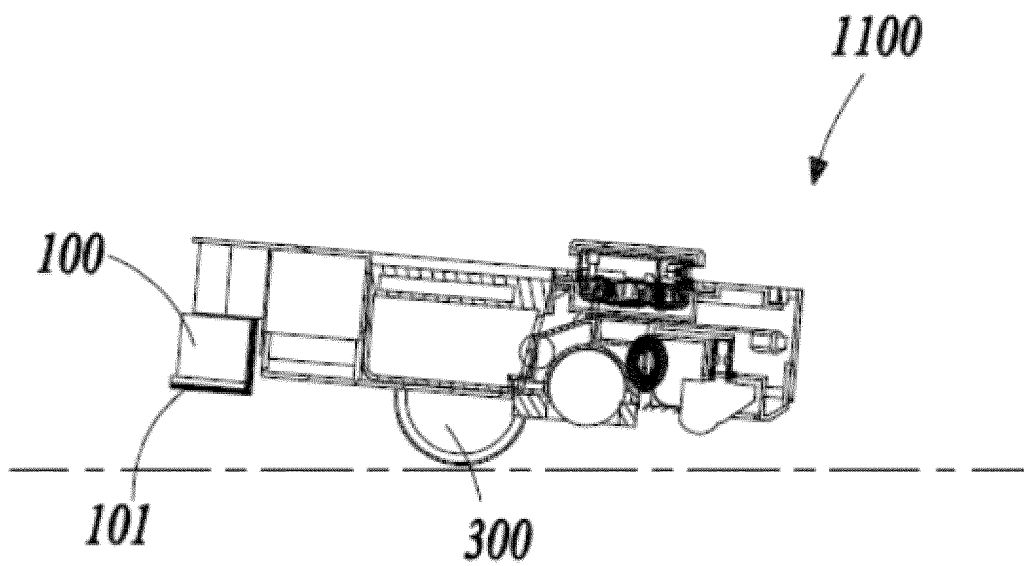


FIG. 5

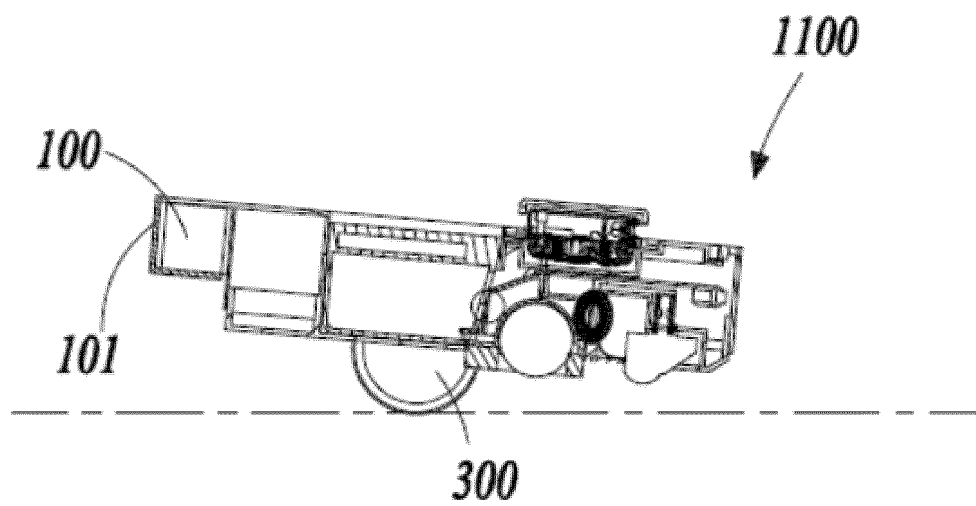


FIG. 6

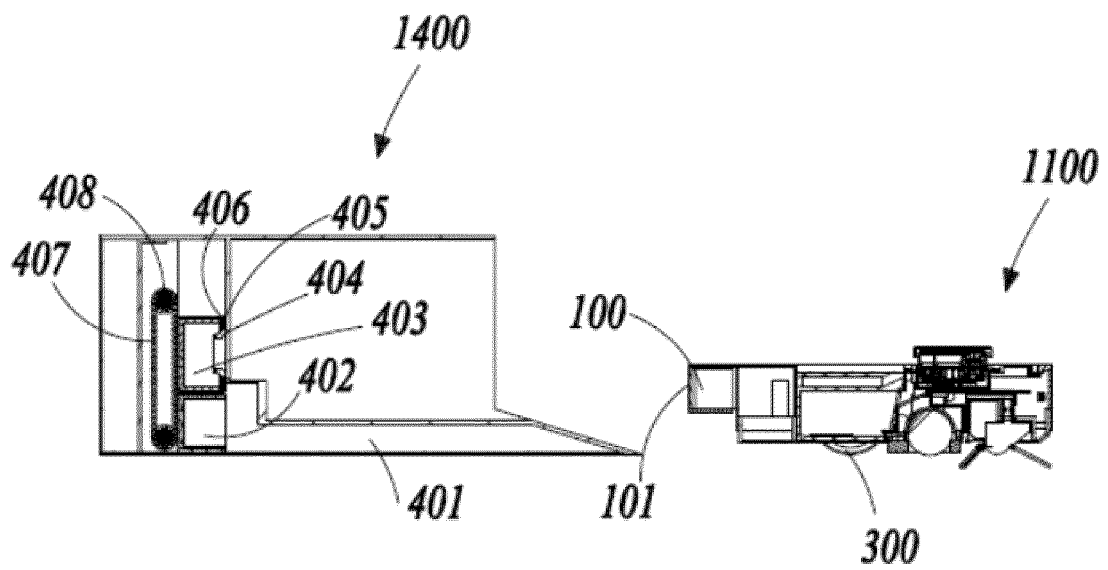


FIG. 7

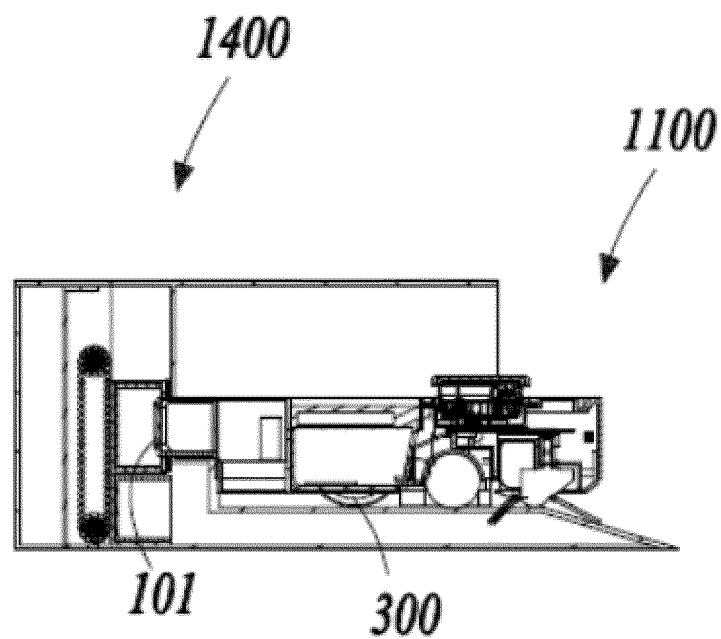


FIG. 8

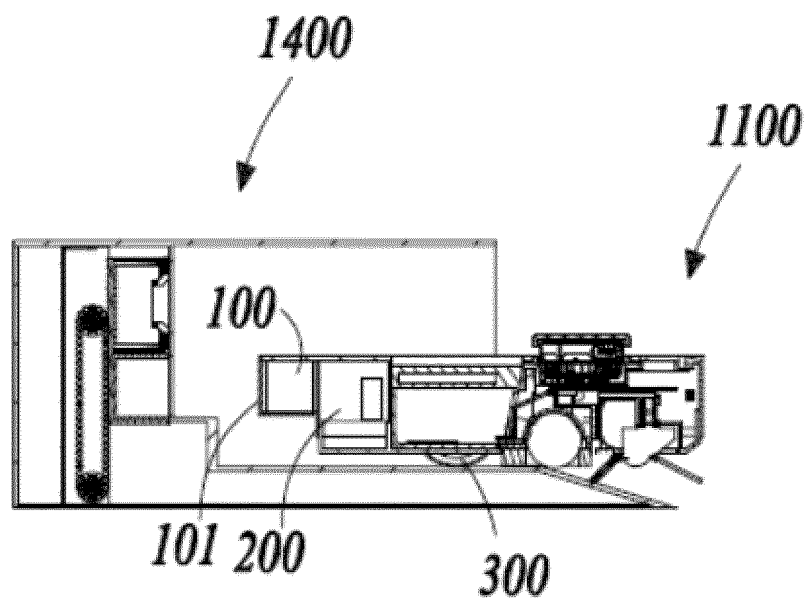


FIG. 9

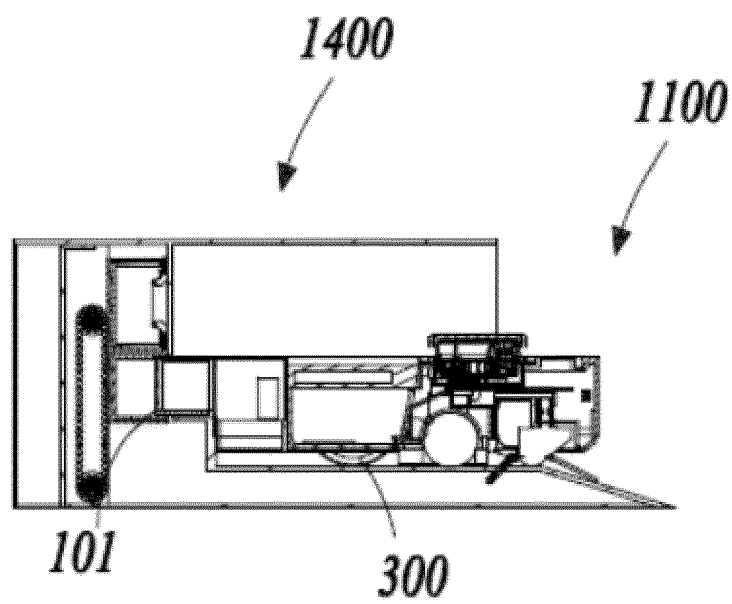


FIG. 10

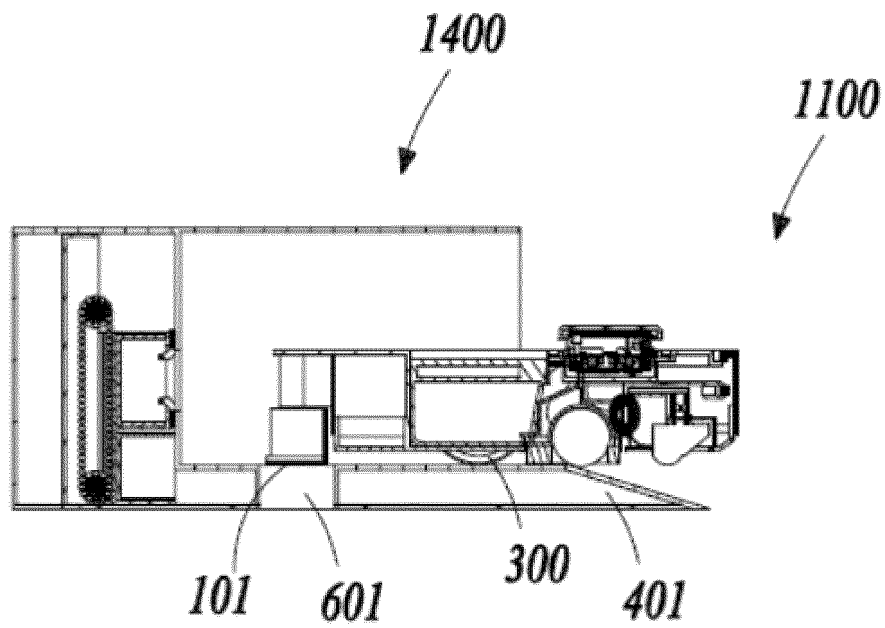


FIG. 11

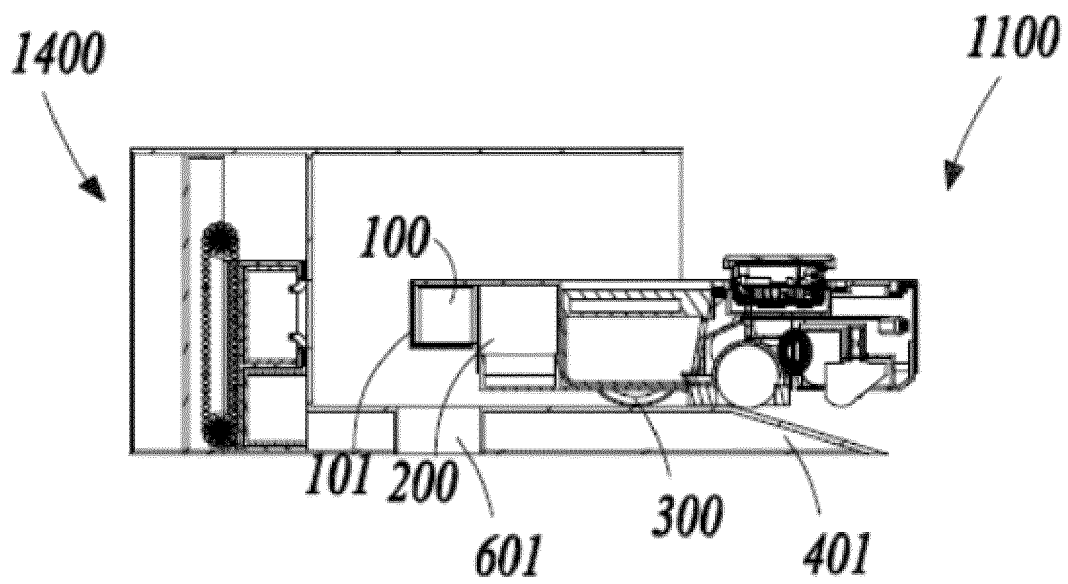


FIG. 12

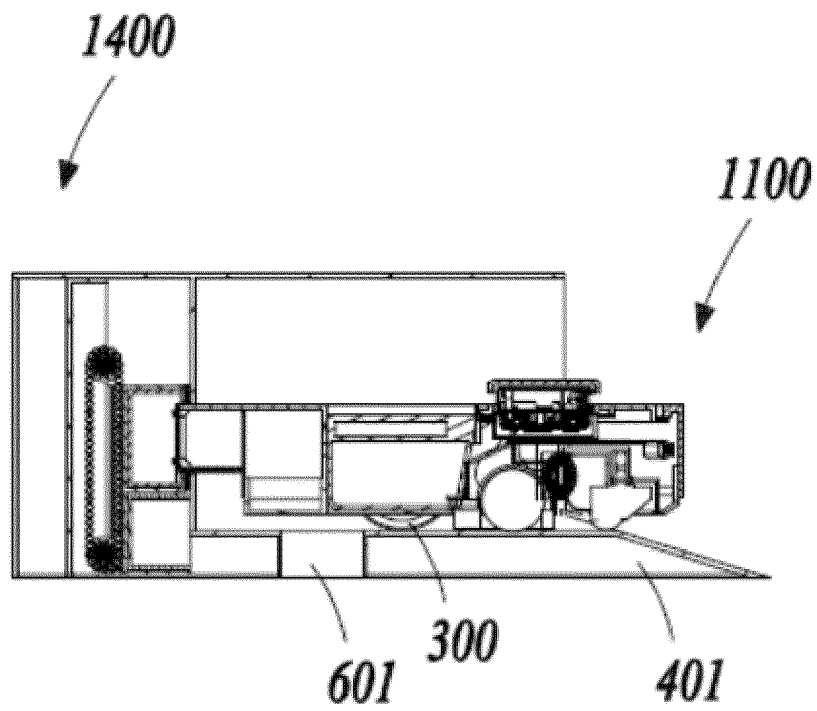


FIG. 13

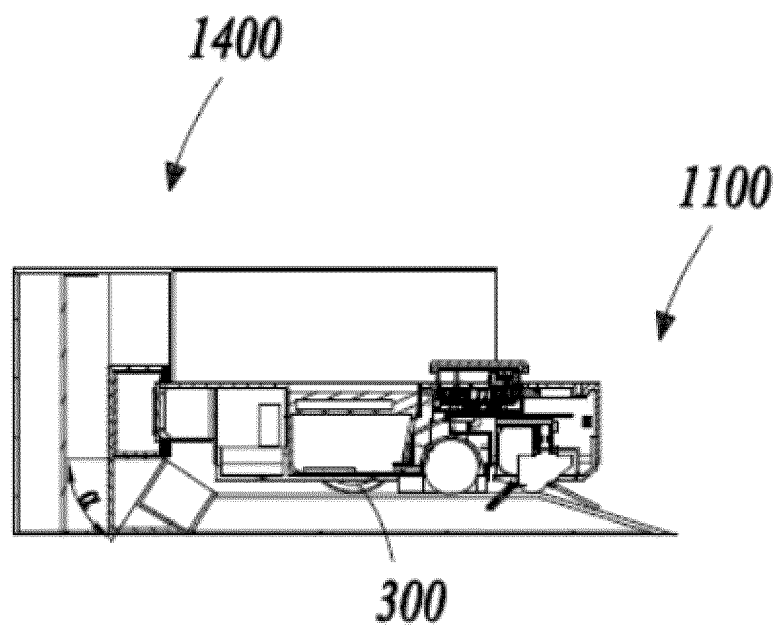


FIG. 14

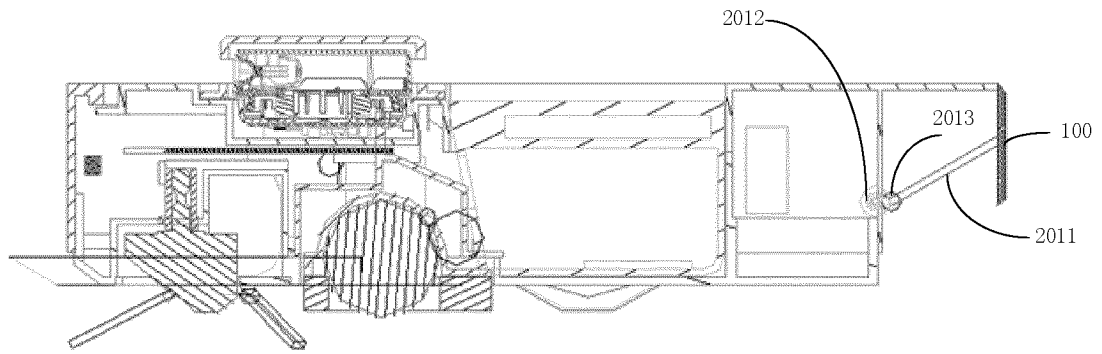


FIG. 15

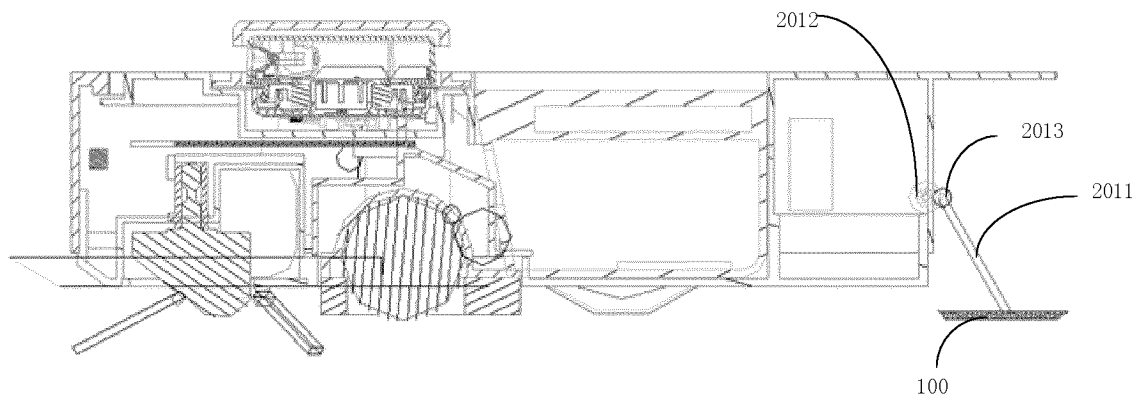


FIG. 16

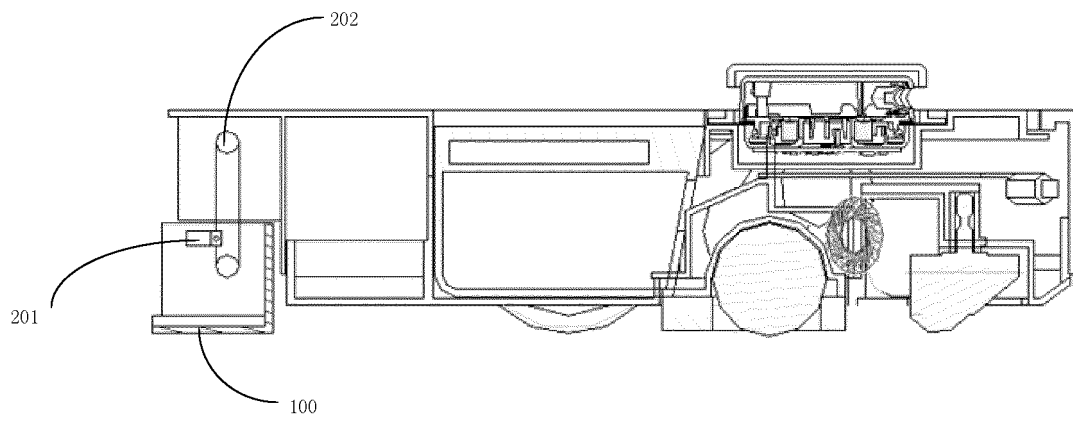


FIG. 17

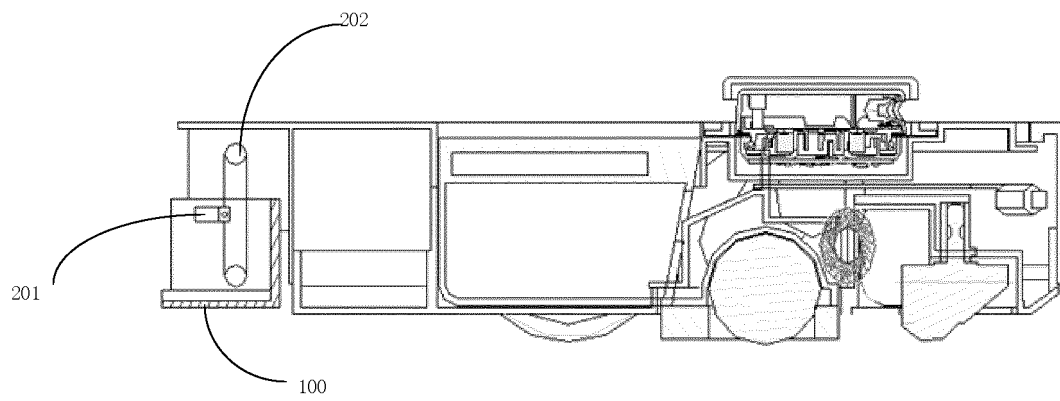


FIG. 18

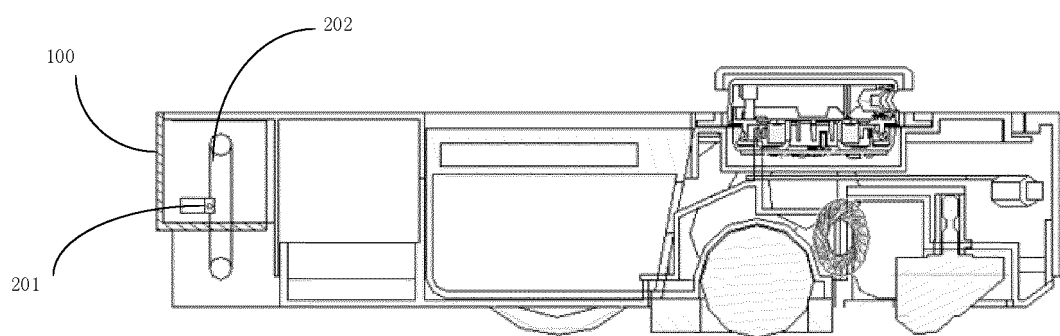


FIG. 19

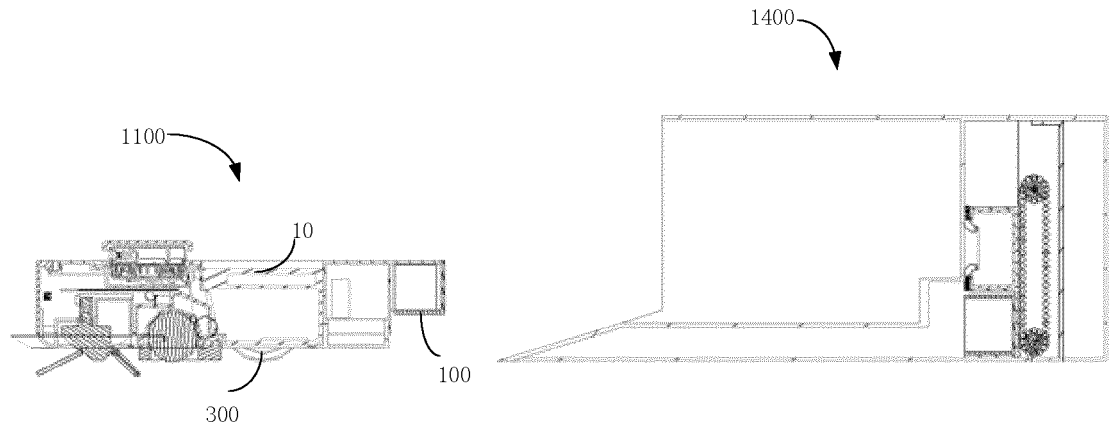


FIG. 20

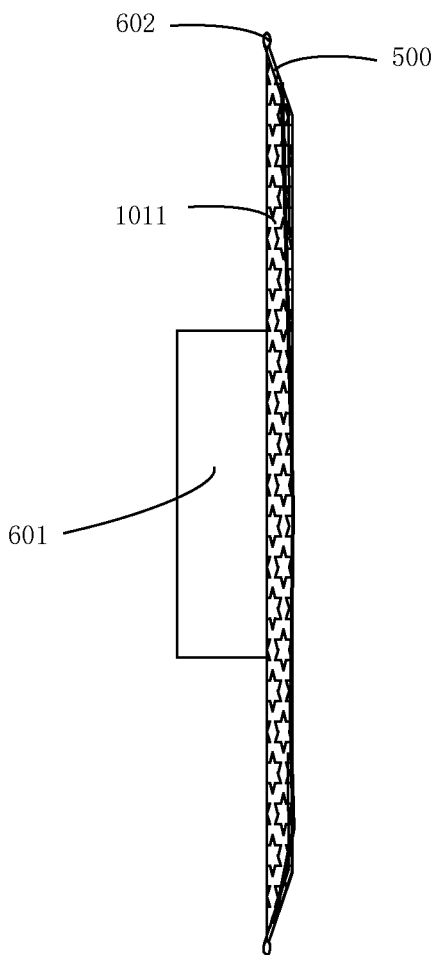


FIG. 21

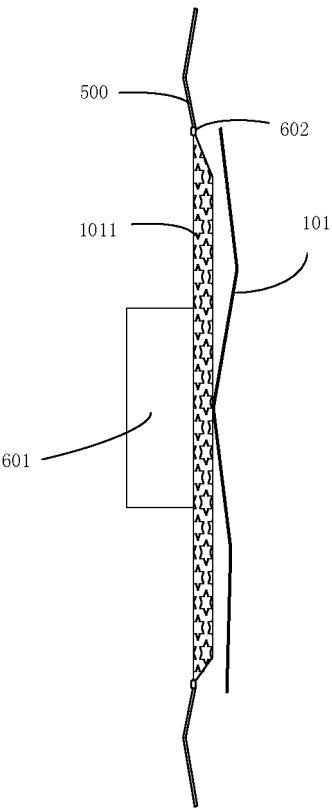


FIG. 22

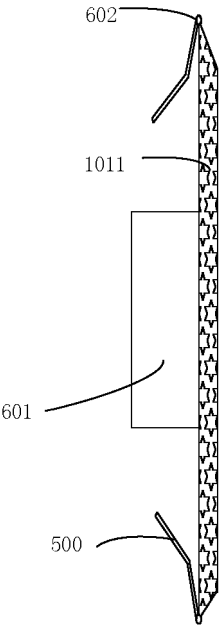


FIG. 23

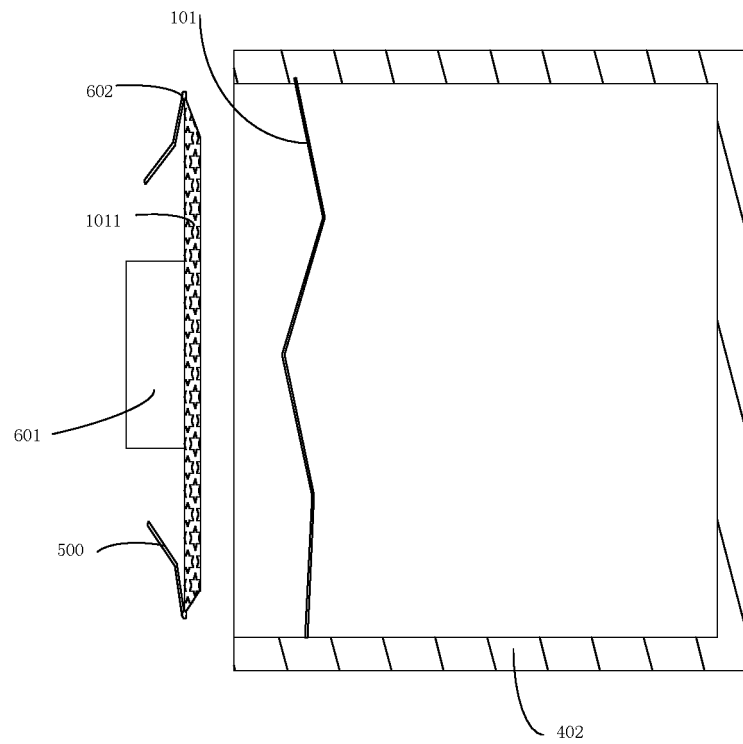


FIG. 24

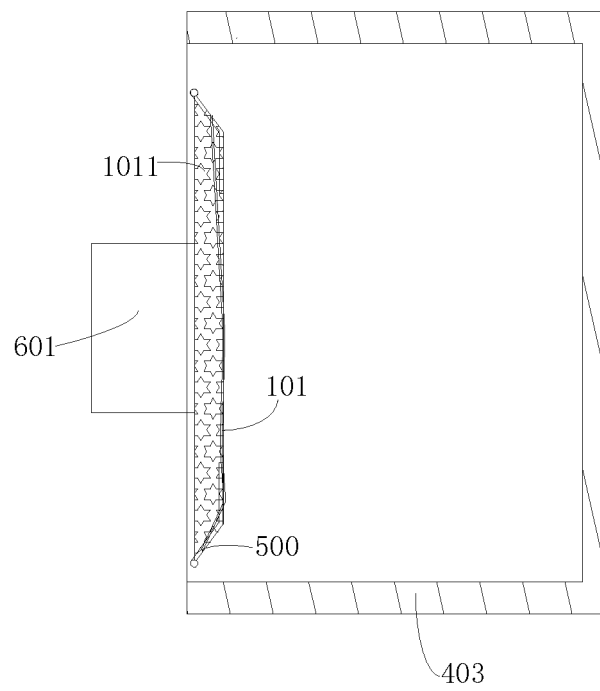


FIG. 25(a)

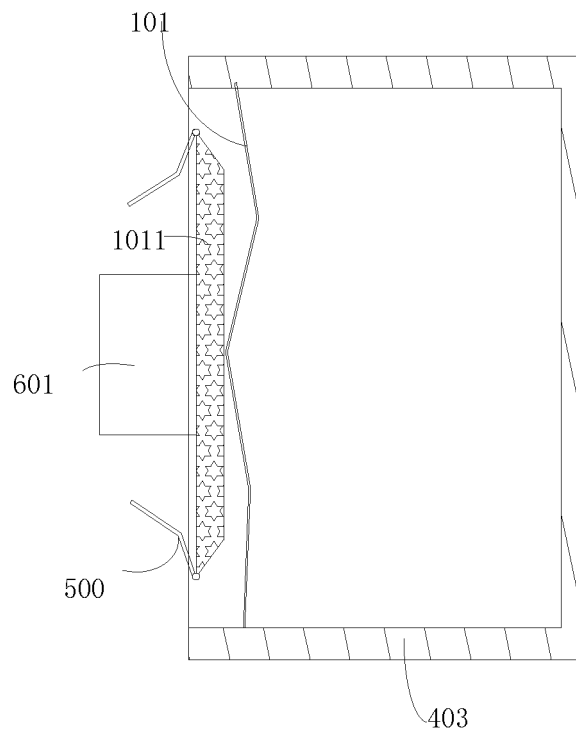


FIG. 25(b)

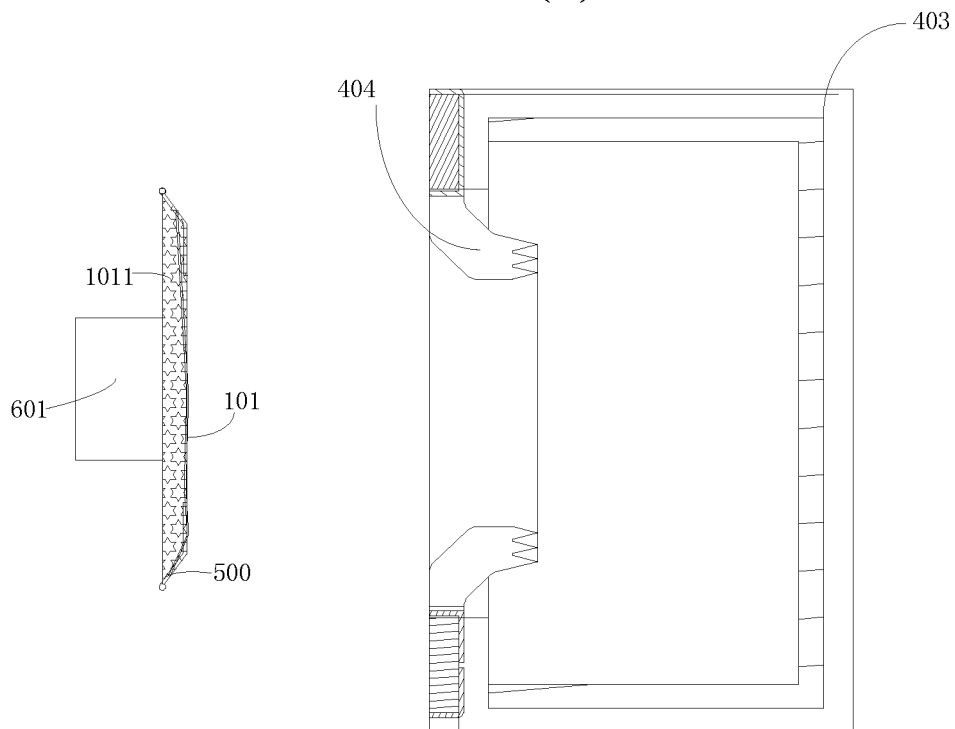


FIG. 26(a)

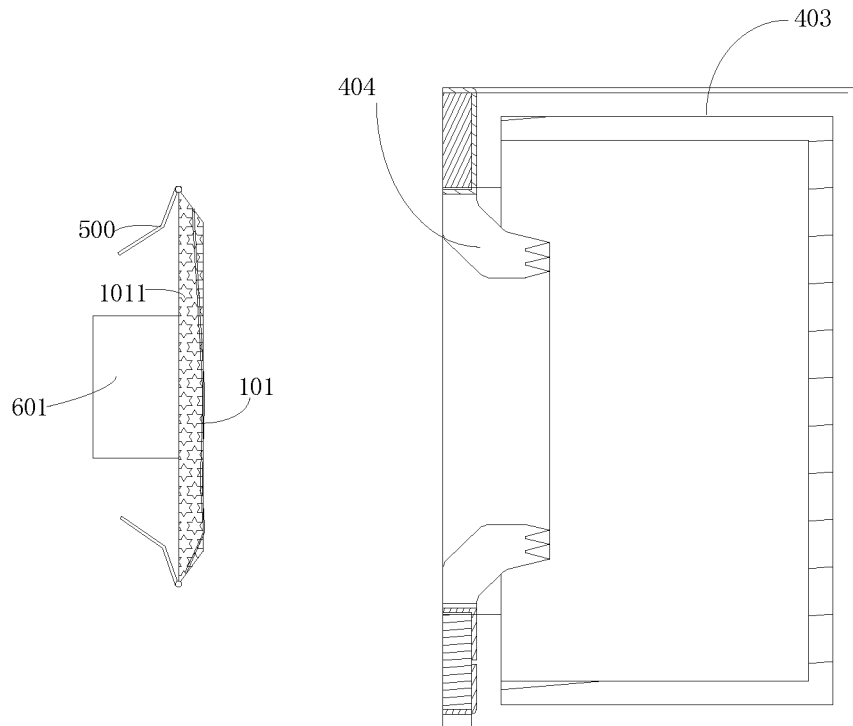


FIG. 26(b)

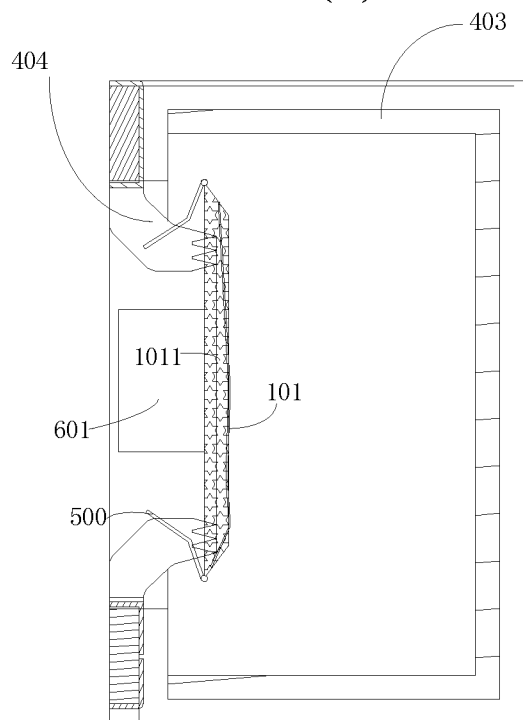


FIG. 26(c)

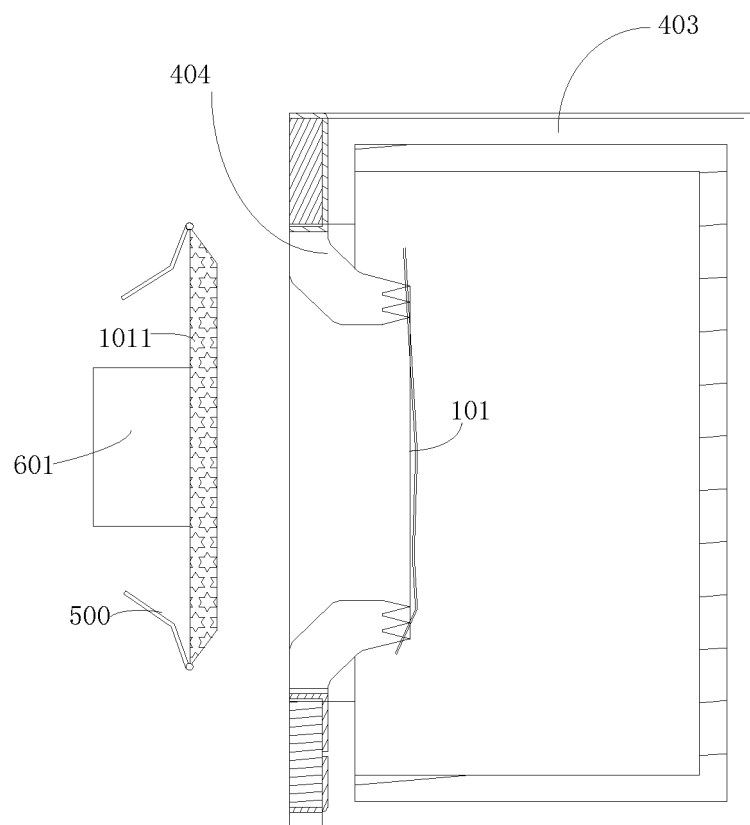


FIG. 26(d)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2022/129379

A. CLASSIFICATION OF SUBJECT MATTER A47L 11/24(2006.01)i; A47L 11/28(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) CNPAT, EPODOC, WPI, CNKI: 宝时得, 机器人, 扫地机, 清扫机, 拖地, 擦, 抹, 垫, 布, 换, 升, 抬, 高度, 第二, 位置, 拆卸, 分离, 基座, 基站, 角度, 转, 传动, POSITEC POWER, cleaner, robot, mop, wip+, pad, cloth, rise, lift, change, exchange, mount +, detach+, base, station, angle, rotate																		
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>WO 2020224542 A1 (POSITEC POWER TOOLS (SUZHOU) CO., LTD.) 12 November 2020 (2020-11-12) description, page 5, lines 27-32, page 8, line 29 to page 11, line 14, and page 12, line 23 to page 40, line 20, and figures 1-47</td> <td>1, 45-46</td> </tr> <tr> <td>Y</td> <td>WO 2020224542 A1 (POSITEC POWER TOOLS (SUZHOU) CO., LTD.) 12 November 2020 (2020-11-12) description, page 5, lines 27-32, page 8, line 29 to page 11, line 14, and page 12, line 23 to page 40, line 20, and figures 1-47</td> <td>2-44</td> </tr> <tr> <td>Y</td> <td>CN 110710931 A (SHANGHAI NANMU ROBOT TECHNOLOGY CO., LTD.) 21 January 2020 (2020-01-21) description, paragraphs 101-159, and figures 1-2 and 13-14</td> <td>2-44</td> </tr> <tr> <td>A</td> <td>CN 113171034 A (SHENZHEN SILVER STAR INTELLIGENT TECHNOLOGY CO., LTD.) 27 July 2021 (2021-07-27) entire document</td> <td>1-46</td> </tr> <tr> <td>A</td> <td>CN 110811448 A (DUAN SHUGUANG) 21 February 2020 (2020-02-21) entire document</td> <td>1-46</td> </tr> </tbody> </table>	Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	X	WO 2020224542 A1 (POSITEC POWER TOOLS (SUZHOU) CO., LTD.) 12 November 2020 (2020-11-12) description, page 5, lines 27-32, page 8, line 29 to page 11, line 14, and page 12, line 23 to page 40, line 20, and figures 1-47	1, 45-46	Y	WO 2020224542 A1 (POSITEC POWER TOOLS (SUZHOU) CO., LTD.) 12 November 2020 (2020-11-12) description, page 5, lines 27-32, page 8, line 29 to page 11, line 14, and page 12, line 23 to page 40, line 20, and figures 1-47	2-44	Y	CN 110710931 A (SHANGHAI NANMU ROBOT TECHNOLOGY CO., LTD.) 21 January 2020 (2020-01-21) description, paragraphs 101-159, and figures 1-2 and 13-14	2-44	A	CN 113171034 A (SHENZHEN SILVER STAR INTELLIGENT TECHNOLOGY CO., LTD.) 27 July 2021 (2021-07-27) entire document	1-46	A	CN 110811448 A (DUAN SHUGUANG) 21 February 2020 (2020-02-21) entire document	1-46
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Date of the actual completion of the international search 09 January 2023	Date of mailing of the international search report 18 January 2023																	
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.

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C. DOCUMENTS CONSIDERED TO BE RELEVANT		
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INTERNATIONAL SEARCH REPORT
Information on patent family members

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