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(54) **SELF-PROPELLED CLEANING MACHINE**

(57) The present invention discloses a self-propelled cleaning machine including a base, a walking module, a lift module, a cleaning device and a reciprocating device. The lift module includes a lift seat, which is provided below the base and is configured to move up and down relative to the base for the lift seat to approach or depart from the base. The reciprocating device is connected to the cleaning device. At least a portion of the reciprocating device is configured to be connected to the lift seat of the lift module, so that the at least a portion of the reciprocating device moves up and down along with up-and-down movements of the lift seat. Moreover, the reciprocating device is configured to enable the cleaning device to perform a reciprocating motion relative to the lift seat in a mopping mode to thereby mop the floor back and forth.

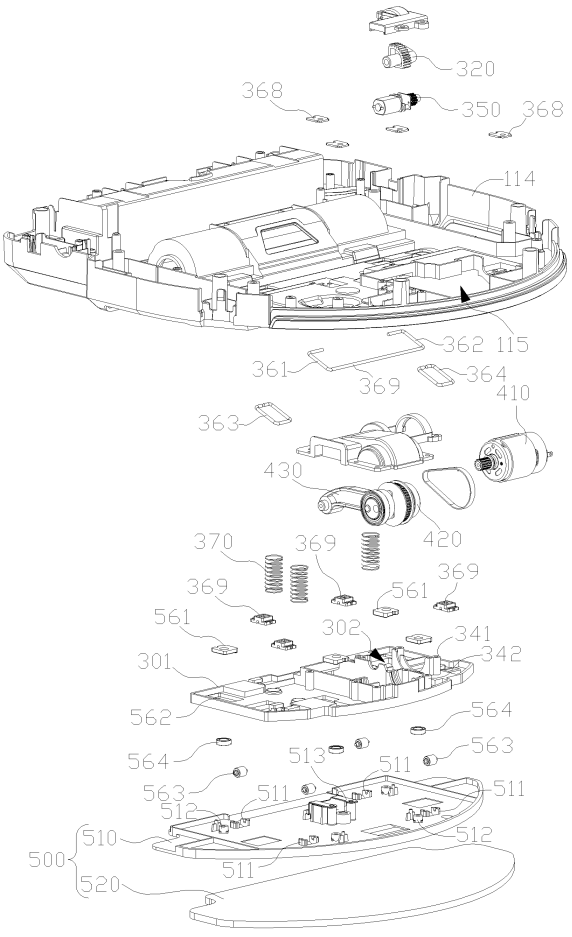

FIG.4

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Description

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority of No. 202210945808.1 filed in China on 2022/08/08, the entire content of which is hereby incorporated by reference.

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

[0002] The present invention relates to the technical field of cleaning devices and, more particularly, to embodiments of a self-propelled cleaning machine.

DESCRIPTION OF THE PRIOR ART

[0003] Sweeping robots are capable of realizing functions of automatic sweeping and vacuum cleaning and are thus extensively applied in households. However, in current sweeping robots, a piece of mopping cloth is mostly fixed at the bottom of the machine so as to mop the floor by means of the movement of the robots. Some sweeping robots, for example, those disclosed by the China Patent Publication Number 112842174A, are additionally provided with a lift module in order to adapt to surface shapes or materials of floors, enabling the mopping cloth to ascend and descend to adapt to the surface shapes or materials of the floors.

[0004] Moreover, there are other types of cleaning robots, for example, those disclosed by the China Patent Number 107510417B, which are provided with a reciprocating device to enable the mopping cloth to reciprocate back and forth to mop the floor. However, the above device with an enhanced cleaning effect is incapable of adapting to the surface shapes or materials of floors, such as by lifting the mopping cloth.

SUMMARY OF THE INVENTION

[0005] It is an object of the embodiments of the present invention to provide a self-propelled cleaning machine, which includes a reciprocating device to enable a mopping cloth to mop a floor back and forth and further includes a lift module to enable the mopping cloth to lift for adapting to changes of the floor, so as to solve the technical problems of a conventional sweeping robot that is incapable of adapting to surface shapes or materials of floors by such as lifting a mopping cloth while performing a reciprocating motion.

[0006] A self-propelled cleaning machine includes a base, a walking module, a lift module, a cleaning device and a reciprocating device. The walking module is neighboring on the base, and is configured to contact a floor when the self-propelled cleaning machine moves on the floor. The lift module includes a lift seat, wherein the lift seat is provided below the base and is configured to move up and down relative to the base for the lift seat to approach or depart from the base. The cleaning module is configured to contact the floor when the self-propelled cleaning machine is in a mopping mode for cleaning the floor. The reciprocating device is connected to the cleaning device. At least a portion of the reciprocating device is configured to be connected to the lift seat of the lift module, so that the at least a portion of the reciprocating device moves up and down along with up-and- - down movements of the lift seat. Moreover, the reciprocating device is configured to enable the cleaning device to perform a reciprocating motion in the mopping mode to thereby mop the floor back and forth.

[0007] The present invention has the following advantageous effects.

[0008] According to an embodiment of the present invention, the self-propelled cleaning machine includes the reciprocating device to enable the mopping cloth to mop the floor back and forth and further includes the lift module to enable the mopping cloth to adapt to changes of the floor.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009]

FIG. 1 is a perspective diagram of a self-propelled cleaning machine according to an embodiment of the present invention;

FIG. 2 is a bottom view of a self-propelled cleaning machine according to an embodiment of the present invention;

FIG. 3 is an exploded diagram of a self-propelled cleaning machine according to an embodiment of the present invention;

FIG. 4 is an exploded diagram of a portion of a self-propelled cleaning machine according to an embodiment of the present invention;

FIG. 5 is a perspective diagram of a lift module and a cleaning device in an assembled state according to an embodiment of the present invention; and

FIG. 6 is an exploded diagram of a portion of a self-propelled cleaning machine according to an embodiment of the present invention.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0010] FIG. 1 shows a perspective diagram of a self-propelled cleaning machine according to an embodiment of the present invention. FIG. 2 shows a bottom view of a self-propelled cleaning machine according to an embodiment of the present invention. FIG. 3 shows an exploded perspective diagram of a self-propelled cleaning machine according to an embodiment of the present invention. FIG. 4 shows an exploded diagram of a portion of a self-propelled cleaning machine according to an embodiment of the present invention. The operation principles of a self-propelled cleaning machine 100 disclosed

by the present invention can be better understood from the detailed description in combination with the above-mentioned drawings below.

[0011] The self-propelled cleaning machine 100 includes a base 114, a walking module 130, a lift module 300, a cleaning device 500 and a reciprocating device 400. The reciprocating device 400 is connected to the cleaning device 500. At least a portion of the reciprocating device 400 is configured to be connected to a lift seat 301 of the lift module 300, so that the at least a portion of the reciprocating device 400 moves up and down along with up-and-down movements of the lift seat 301. Moreover, the reciprocating device 400 is configured to enable the cleaning device 500 to perform a reciprocating motion relative to the lift seat 301 in a mopping mode to thereby mop the floor back and forth.

[0012] In one embodiment, the reciprocating device 400 includes a mopping motor 410, a mopping crankshaft 420 and a mopping crank arm 430. The mopping crankshaft 420 is configured to be driven and rotated by the mopping motor 410. A first end of the mopping crank arm 430 is connected to the mopping crankshaft 420, and a second end of the mopping crank arm 430 is connected to the cleaning device 500 and performs a reciprocating motion along with a rotation of the mopping crankshaft 420. In one embodiment, the mopping motor 410, the mopping crankshaft 420 and the mopping crank arm 430 of the reciprocating device 400 move up and down along with the up-and-down movements of the lift seat 301.

[0013] In one embodiment, referring to FIG. 1, the self-propelled cleaning machine 100 preferably further includes a bumper 120, a casing 112 and a casing cover 102. As shown in FIG. 1, in some embodiments, the self-propelled cleaning machine 100 further includes an operating panel 106 for a user to select an operating mode by means of touch control or pressing. The self-propelled cleaning machine 100 can freely move in different directions on a floor to be cleaned. For illustration purposes, the self-propelled cleaning machine 100 herein can move in a forward movement direction F and a backward movement direction B. The bumper 120 faces the forward movement direction F and serves as a front side of the self-propelled cleaning machine 100, and has a flat and straight appearance. The casing 112 faces the backward movement direction B and serves as a back side of the self-propelled cleaning machine 100, and has an arc appearance. However, the shapes of the bumper 120 and the casing 112 are not specifically defined in the present invention.

[0014] Referring to FIG. 2 and FIG. 3, the self-propelled cleaning machine 100 further includes various components, for example, a vacuum cleaning device 121, a walking module 130, a front wheel 132, a side brush device 150 and a water spray module 160. The vacuum cleaning device 121 is for cleaning the floor. The foregoing components are attached on the base 114, and extend outward or are exposed from a lower side of the base 114. For illustration purposes, the base 114 herein has an upper side and the lower side, which regard the orientation of the self-propelled cleaning machine 100 positioned in place on the floor to be cleaned as a reference point. The upper side refers to one side facing away from the floor to be cleaned, and the lower side refers to another side facing the floor to be cleaned. In one embodiment, the self-propelled cleaning machine 100 further includes a battery module 170 attached on the base 114. In this embodiment, the vacuum cleaning device 121 can include, for example, a first suction portion 122, a second suction portion 124 and a roller brush device 140. However, the vacuum cleaning device 121 is not limited by the present invention, and can include only one suction portion 122, or can include only the second suction portion 124 and the roller brush device 140. In addition, the roller brush device 140 is located in a suction port 125 of the second suction portion 124.

[0015] The walking module 130 is adjacent to the base 114, located on two opposite sides of the base 114, exposed to the outside from the lower side of the base 114, and located in a center region of the base 114, and comes into contact with the floor to be cleaned when the self-propelled cleaning machine 100 moves on the floor. The walking module 130 can include a pair of walking components and a driving device. The walking components can be moving members such as pulleys and rollers. The driving device can be a combination of a motor, a gear and other transmission devices. The walking components are driven by the driving device, and drive the self-propelled cleaning machine 100 to move forward, backward or turn on the floor to be cleaned. In the embodiment shown, each walking component of the walking module 130 is formed by a crawler belt, which includes a crawler and two driving wheels used to drive the crawler.

[0016] The front wheel 132 is located in a front region of the self-propelled cleaning machine 100, and is closer to the front side of the self-propelled cleaning machine 100 than the walking module 130. In some embodiments, the front wheel 132 serves as an auxiliary wheel of the walking module 130, assists in maintaining movement balance when the walking module 130 drives the self-propelled cleaning machine 100 to move, and thus is not necessarily provided with an ability of driving the self-propelled cleaning machine 100. Referring to FIG. 3, the self-propelled cleaning machine 100 further includes a dust box 200 and an air extraction module 180 located in the casing 112 above the base 114. The air extraction module 180 is in communication with the first suction portion 122 and the second suction portion 124 via the dust box 200. In one embodiment, the air extraction module 180 includes a pump. During an operation, air in the first suction portion 122 and the second suction portion 124 is extracted by the air extraction module 180, such that a negative pressure is formed inside the first suction portion 122 and the second suction portion 124 to thereby generate a suction force.

[0017] In one embodiment, the water spray module 160 is provided on the base 114 and can spray clear

water or other cleaning liquids to wet the floor to be cleaned, so that dirt attached on the floor can be more easily removed to thereby enhance a cleaning effect of the self-propelled cleaning machine 100. In one embodiment, the self-propelled cleaning machine 100 includes a water supply module, which can be formed by a water tank, a pump and a water pipe. The water tank holds water or a cleaning liquid that is transported to the water spray module 160 via the water pipe. The pump applies a pressure on the clear water or cleaning liquid in the water pipe. In one embodiment, a nozzle of the water spray module 160 extends from the lower side of the base 114 to the floor to be cleaned. In one embodiment, the water spray module 160 includes a water outlet, for example, a nozzle, and a water exit direction of the water spray module 160 can be controlled by adjusting a direction of the water outlet. Water or the cleaning liquid is sprayed from both sides of the base 114 toward the center region of the base 114, so that the clear water or cleaning liquid can be more effectively used by the cleaning cloth.

[0018] The base 114 is provided with the first suction portion 122. In one embodiment, the first suction portion 122 includes the frame formed by the base 114 and a plurality of sidewalls forming a first vacuum channel, which runs from the lower side of the base 114 to the upper side of the base 114. The first vacuum channel includes a first suction port 123 provided on the lower side of the base 114. The first suction portion 122 has the first suction port 123 on the lower side of the base 114. The portion of the first suction port 123 on the lower side of the first vacuum channel facing the floor has a larger area, and the first suction port 123 has a tapered shape when further extended to the upper side of the base 114. Accordingly, it is possible to capture a larger area of dust or debris by suctioning from the lower side. In one embodiment, the first suction portion 122 sucks dust or dirt on the ground from the first suction port 123 into the dust box 200 by means of the negative pressure provided by the air extraction module 180. In one embodiment, the first suction portion 122 or the first suction port 123 is not provided with an assembly such as bristles or a brush for cleaning. Thus, when trash sucked in has a long and thin shape (for example, hair, fine strings or pet hair, such type of trash) does not get stuck in the first vacuum channel or the first suction port 123, and so the first suction portion 122 does not need to be regularly cleaned and more maintenance time for the self-propelled cleaning machine 100 can be saved. The base 114 is further provided with the second suction portion 124. In one embodiment, the second suction portion 124 forms a second vacuum channel including the frame formed by the base 114 and a plurality of sidewalls. The second vacuum channel includes a second suction port 125 provided on the lower side of the base 114 and neighboring on the first suction port 123. In one embodiment, the second suction port 125 is positioned close to the first suction port 123, allowing the first suction port 123 to easily capture longer debris, such as hair. In one embodiment, the second suction port 125 and the first suction port 123 are spaced by a distance of less than 30 mm.

[0019] In one embodiment, the roller brush device 140 is provided on the base 114, is surrounded by the second suction portion 124 and is exposed to the outside from the lower side of the base 114. In one embodiment, the second suction portion 124 includes a roller brush lid 227 provided on the lower side of the base 114. The roller brush lid 227 may be annular and exposes the second suction port 125 therefrom. The roller brush lid 227 may be an openable and closable design. When the roller brush lid 227 is open, the roller brush device 140 can be taken out from the lower side of the base 114; when the roller brush lid 227 is closed, the roller brush device 140 is locked in the second suction port 125 on the base 114 by the roller brush lid 227, such that the roller brush device 140 can rotate steadily without swaying when a cleaning operation is performed.

[0020] As shown in FIG. 2, the roller brush device 140 includes a roller brush shaft and a roller brush provided on the roller brush shaft. In one embodiment, the roller brush shaft is shaped as a rod, has two securing ends on both sides of the rod, and is detachably engaged on the base 114. The roller brush shaft can be connected to the driving device, for example, a motor, via the securing ends, and rotates using power provided by the driving device. In one embodiment, the roller brush is made of a flexible material, and has a shape of a brush or bristles. The roller brush is attached to the roller brush shaft, and extends radially outward from the roller brush shaft regarded as a center. Accordingly, when the roller brush rotates, dust or dirt is scraped off from the ground by a rotational force.

[0021] In one embodiment, the second suction portion 124 sucks dust or dirt on the ground from the second suction port 125 by means of the negative pressure provided by the air extraction module 180. In one embodiment, the second suction portion 124 is provided with the roller brush device 140 in the second suction port 125. Thus, when the floor to be cleaned contains dust adhered thereon or heavy trash, the adhered dust or the heavy trash can be removed by means of a vacuum suction force of the air extraction module 180 and a rotational torque of the roller brush device 140, thereby sucking in through the second suction portion 124 the trash that cannot be completely cleaned by the first suction portion 122, hence enhancing the cleaning effect of the self-propelled cleaning machine 100.

[0022] Referring to FIG. 2, the side brush device 150 is provided on the lower side of the base 114. The side brush device 150 can be provided near any corner of the self-propelled cleaning machine 100 close to the front side, for example, the side brush device 150 can be provided between the front side and the first suction portion 122 of the self-propelled cleaning machine 100 and close to a side of the self-propelled cleaning machine 100 or the base 114. With the coordination of the movement of

the self-propelled cleaning machine 100 and the cleaning of the side brush device 150, dust or dirt on the ground can be pushed by the side brush device 150 further to be close to the position of the first suction port 123 or the second suction port 125, and can be more easily sucked into the first suction port 123 or the second suction port 125.

[0023] Referring to FIG. 1 to FIG. 3, in one embodiment, the self-propelled cleaning machine 100 includes a battery module 170, and the base 114 is further provided with a battery lid 172 located on the lower side of the base 114. The battery module 170 is mounted on the base 114, the battery lid 172 is configured to lock the battery module 170 in the base 114, and the battery module 170 can be replaced by means of opening the battery lid 172.

[0024] In one embodiment, a sidewall of the first suction portion 122 extends from the first suction port 123 toward the upper side of the base 114, and forms an opening 128 near the second suction portion 124. The opening 128 and the first suction port 123 are respectively located on the upper side of the base 114 and the lower side of the base 114, and serve as two openings of the first suction portion 122. In one embodiment, a sidewall of the second suction portion 124 forms, on the upper side of the base 114, an accommodating space for accommodating the roller brush device 140. In one embodiment, the accommodating space has a shape of a cylinder; however, the present invention does not define the shape of the accommodating space of the second suction portion 124, and other shapes are also included within the scope of the embodiments of the present invention. The sidewall of the second suction portion 124 forms an opening 129 on a side of the accommodating space close to the top. As shown in FIG. 2, the opening 129 and the second suction port 125 are respectively located on the upper side and the lower side of the base 114, and serve as two openings of the second suction portion 124. The roller brush device 140 is provided in the second suction port 125 and is located between the second suction port 125 and the opening 129.

[0025] In one embodiment, as shown in FIG. 3 and FIG. 4, the self-propelled cleaning machine 100 includes the lift module 300. A portion of the lift module 300 is provided on the base 114, and the lift seat 301 of the lift module 300 is provided below the base 114. The lift module 300 is connected to the base 114 and the cleaning device 500, and can drive the cleaning device 500 to move up and down relative to the base 114 for the cleaning device 500 to approach or depart from a surface to be cleaned. In one embodiment, the cleaning device 500 includes a cleaning cloth holder 510 and a cleaning cloth 520. The cleaning cloth holder 510 is disposed below the lift seat 301. The cleaning cloth 520 is provided on a bottom surface of the cleaning cloth holder 510 and is configured to contact the floor.

[0026] In one embodiment, the cleaning cloth holder 510 approaches the surface to be cleaned in a direction perpendicular to the surface to the cleaned, so that the cleaning cloth 520 is completely closely attached to the surface to be cleaned. In one embodiment, the cleaning cloth holder 510, in a direction perpendicular to the surface to be cleaned, lifts from the surface to be cleaned and is spaced from the ground by a distance, so that the cleaning cloth 520 is completely off or separated from the surface to be cleaned.

[0027] The above design of the cleaning device 500 or cleaning cloth holder 510 capable of moving up and down provides numerous advantages. When the self-propelled cleaning device 100 needs to cross over an obstacle (for example, a door sill), the cleaning device 500 may be lifted to increase the space on the lower side of the base 114, further enabling the self-propelled cleaning device 100 to more easily cross over the obstacle. In one embodiment, when the self-propelled cleaning device 100 completes cleaning, the cleaning cloth 520 at this point in time may be attached with dirt. Thus, lifting the cleaning device 500 can prevent secondary contamination when the self-propelled cleaning machine 100 passes through a region having been cleaned. In another embodiment, the self-propelled cleaning machine 100 passes ground surfaces of different properties, wherein part of the ground surfaces may be unsuitable for wet cleaning, for example, carpets. In this case, the self-propelled cleaning machine 100 is provided with a ground detector (not shown) configured to detect the property of the ground surface. Upon detecting a ground surface that is unsuitable for wet cleaning, the self-propelled cleaning machine 100 may lift the cleaning device 500 to avoid wetting the ground surface. In one embodiment, a current of the roller brush or a torque of a load of the roller brush may be used to determine whether to lift the cleaning device 500. In one embodiment, the ground detector may be a floor material sensor, which may be a sonic wave sensor, a light sensor or polarized light sensor that uses a sound, light or polarized light signal to determine the floor material. In one embodiment, upon sensing a charging signal, it is determined that the self-propelled cleaning machine 100 has returned to a charging dock, and so the cleaning device 500 is lifted to avoid wetting the floor.

[0028] FIG. 5 shows a perspective diagram of the lift module 300 and the cleaning device 500 in an assembled state according to an embodiment of the present invention. FIG. 6 shows an exploded diagram of a portion of a self-propelled cleaning machine according to an embodiment of the present invention.

[0029] Referring to FIG. 3 to FIG. 5, in one embodiment, the lift module 300 includes at least one rocker. A first end of the at least one rocker is rotatably connected to the base 114, and a second end of the at least one rocker is rotatably connected to the lift seat 301. Moreover, the at least one rocker is capable of swaying within a predetermined angle by using the first end or the second end thereof as an axis.

[0030] Referring to FIG. 6, the lift module 300 includes a crank device 320, an abutting portion 330 and a driving

device 350. In one embodiment, the lift module 300 further includes a mopping motor upper cover 340, and the abutting portion 330 is provided at the mopping motor upper cover 340. The abutting portion 330 crosses a portion of the crank device 320 and is connected to the lift seat 301. The driving device 350 is provided on the base 114 and is configured to drive the crank device 320 to rotate. The lift module 300 is configured to cause a portion (for example, an end of a force arm 324 to be described below) of the crank device 320 to apply a force on the abutting portion 330 via a rotation of the crank device 320, and more specifically, to cause the portion (for example, an end of a force arm 324 to be described below) of the crank device 320 to abut against the abutting portion 330 to further apply a force on the abutting portion 330, thereby lifting the lift seat 301 for the lift seat 301 to approach the base 114.

[0031] In one embodiment, preferably, the driving device 350 includes a gear 352 and a motor 354. The crank device 320 has a crankshaft 322, the force arm 324 and a tooth portion 326. The base 114 is provided with sidewalls to form a crankshaft support 310, and the crank device 320 leans on the crankshaft support 310 to rotate such that the end of the force arm 324 ascends or descends relative to the base 114 (or the crankshaft support 310). In one embodiment, the crankshaft support 310 forms an accommodating space for accommodating the crankshaft 322. The crankshaft support 310 may be a protrusion protruding from the base 114. In one embodiment, the self-propelled cleaning machine 100 further includes a driving upper cover 355. The driving upper cover 355 is fixed at the base 114, and an accommodating space is defined between the driving upper cover 355 and the base 114 to accommodate the gear 352 and the motor 354.

[0032] Referring to FIG. 6, in one embodiment, the position of the abutting portion 330 corresponds to the position of the force arm 324 of the crank device 320, such that at least a portion of the abutting portion 330 crosses over the force arm 324 of the crank device 320. The crankshaft 322 is provided at the crankshaft support 310 on the base 114. The force arm 324 is connected to the crankshaft 322, preferably, the force arm 324 extends from one side end of the crankshaft 322, and more preferably, the force arm 324 extends in a direction perpendicular to a long-axis direction of the crankshaft 322, and the abutting portion 330 crosses over the end of the force arm 324. The tooth portion 326 and the force arm 324 are located at different positions of the crankshaft 322, respectively. The tooth portion 326 is provided at the crankshaft 322 (preferably located at a long-axis portion of the crankshaft 322) and is coupled to the driving device 350, and thus the driving device 350 drives the tooth portion 326 to rotate in a clockwise or counterclockwise direction. In one embodiment, the motor 354 of the driving device 350 is controlled by a control current to output a rotational torque to drive the gear 352, and the tooth portion 326 of the crank device 320 is engaged with the gear 352 and hence rotates. The motor 354 may output a clockwise or counterclockwise torque according to different directions of the control current, and thus the motor 354 drives the gear 352 and the tooth portion 326 to rotate in the clockwise or counterclockwise direction such that the end of the force arm 324 of the crank device 320 ascends or descends. That is, the end of the force arm 324 is caused to move down or up. In one embodiment, the lift seat 301 can be lifted when the end of the force arm 324 moves up; the lift seat 301 can be applied with a downward pressure when the end of the force arm 324 moves down, so that the cleaning device 500 receives the downward pressure to better mop the floor with a greater force.

[0033] When the end of the force arm 324 ascends, the end of the force arm 324 is abutted against the abutting portion 330 and applies a force on the abutting portion 330 such that the abutting portion 330 also ascends. Thus, the lift seat 301 and the cleaning cloth holder 510 also ascend in a way that the cleaning cloth 520 departs from the surface to be cleaned. Conversely, when the end of the force arm 324 descends, the abutting portion 330 also descends. Thus, the lift seat 301 and the cleaning cloth holder 510 also descend in a way that the cleaning cloth 520 is attached on the surface to be cleaned. Preferably, in addition to moving up and down, the end of the force arm 324 also moves back and forth in an extension direction of the abutting portion 330.

[0034] In one embodiment, the tooth portion 326 of the crankshaft 322 is provided with an upper starting point and a lower starting point to thereby determine lift ranges of the lift seat 301 and the cleaning device 500. Preferably, the tooth portion 326 has a plurality of continuous teeth formed thereon, and two ends of the plurality of teeth form the upper starting point and the lower starting point, respectively. In one embodiment, by setting the number of teeth of the tooth portion 326, the two ends of the continuous teeth correspond to the upper starting point and the lower starting point, and the tooth portion 326 cannot further travel forward or backward once having rotated to the two ends, such that the crankshaft 322 stops rotating. In one embodiment, when the lift module 300 detects an increase in the output current of the motor 354, it is determined that the tooth portion 326 of the crankshaft 322 has reached the upper starting point or the lower starting point, and so a supply current is stopped or reduced to ensure normal operations of the lift module 300.

[0035] In one embodiment, the tooth portion 326 extends out from the crankshaft 322 toward a first direction, and the force arm 324 extends out from the crankshaft 322 toward a second direction, wherein the first direction is not parallel to the second direction. Preferably, the crankshaft 322 leans on the crankshaft support 310 and rotates. In one embodiment, the self-propelled cleaning machine 100 further includes a circuit board 190 provided with a controller thereon. When the self-propelled cleaning machine 100 moves on the surface, the controller is

configured to perform the steps of: vacuuming cleaning by the first suction portion 122, vacuum cleaning by the second suction portion 124, spraying water by the water spray module 160, and mopping with the cleaning cloth 520 by the cleaning device 500.

[0036] Referring to FIG. 3 to FIG. 5, in one embodiment, the at least one rocker of the lift module 300 includes a first rocker 361 and a second rocker 362. The first rocker 361 and the second rocker 362 are located on two opposite sides of an extension direction of the mopping crank arm 430 of the reciprocating device 400, respectively. In this embodiment, the first rocker 361 and the second rocker 362 are connected together by a connecting rod 369. Thus, forces respectively received by the first rocker 361 and the second rocker 362 can be transmitted therebetween to balance forces on left and right sides when the lift seat 301 is lifted. In one embodiment, the lift module 300 may further include a third rocker 363 and a fourth rocker 364. The third rocker 363 and the fourth rocker 364 are located on two opposite sides of the extension direction of the mopping crank arm 430 of the reciprocating device 400, respectively. In one embodiment, each of the rockers 361, 362, 363 and 364 is capable of swaying within a predetermined angle by regarding a first end or a second end thereof as an axis. Preferably, the rockers 361, 362, 363 and 364 form a four-bar linkage module, which can lift more horizontally the cleaning cloth holder 510 when the lift seat 301 lifts, such that the cleaning cloth holder 510 is less inclined so as to enable the lift seat 301 to move up and down in a more parallel or horizontal manner.

[0037] The second ends of the rocker 361, the rocker 362, the rocker 363 and the rocker 364 are respectively connected to an upper surface of the lift seat 301, and the lift motor (or the position at which the end of the force arm 324 applies a force on the abutting portion 330) is located within a range defined by the rocker 361, the rocker 362, the rocker 363 and the rocker 364. As shown in FIG. 4 and FIG. 5, the second ends of the rocker 361, the rocker 362, the rocker 363 and the rocker 364 form a quadrilateral region, and the lift motor is provided in the quadrilateral region. According to structure above, the center of gravity of the lift module 300 can be located within the range defined by the rocker 361, the rocker 362, the rocker 363 and the rocker 364, enabling the lift seat 301 to move up and down in a more parallel or horizontal manner.

[0038] In one embodiment, the self-propelled cleaning machine 100 further includes a first mounting piece 367 and a plurality of second mounting pieces 368. The first mounting piece 367 is fixed at the base 114, and is configured to mount the first ends of the rocker 361, the rocker 362, the rocker 363 and the rocker 364 at the base 114. The second mounting pieces 368 are fixed at the lift seat 301, and are configured to mount the second ends of the rocker 361, the rocker 362, the rocker 363 and the rocker 364 at the lift seat 301.

[0039] Referring to FIG. 4, in one embodiment, the mopping motor 410 is provided above the lift seat 301. Moreover, the mopping motor upper cover 340 covers the mopping motor 410 and is fixed at the lift seat 301. The mopping motor upper cover 340 and the lift seat 301 define an accommodating space between them which is used to to accommodate the mopping crankshaft 420 and the mopping motor 410. In one embodiment, the lift seat 301 is provided with sidewalls to form a motor mounting seat 341, and the mopping motor 410 is provided at the motor mounting seat 341. The lift seat 301 is provided with sidewalls to form a crankshaft mounting seat 342, and the mopping crankshaft 420 is provided at the crankshaft mounting seat 342. The lift seat 301 is defined with an opening 302. A first end of the mopping crank arm 430 is located on an upper side of the lift seat 301, a second end of the mopping crank arm 430 is located on a lower side of the lift seat 301, and the mopping crank arm 430 passes through the opening 302 from the upper side of the lift seat 301 and extends to the lower side of the lift seat 301. Moreover, the mopping motor 410, the mopping crankshaft 420 and the mopping crank arm 430 move up and down along with the up-and-down movements of the lift seat 301. In one embodiment, the cleaning cloth holder 510 is provided with sidewalls to form a crank arm mounting seat 513, and a second end of the mopping crank arm 430 is provided at the crank arm mounting seat 513, enabling the cleaning cloth holder 510 to perform a reciprocating motion via the mopping crank arm 430.

[0040] Referring to FIG. 4 and FIG. 6, in one embodiment, the base 114 is defined with an accommodating opening 115. The mopping motor 410, the mopping crankshaft 420 and the mopping crank arm 430 move up and down in the accommodating opening 115 along with the up-and-down movements of the lift seat 301.

[0041] In one embodiment, the cleaning device 500 includes a first guide structure, and the lift seat 301 includes a second guide structure. Preferably, the first guide structure coordinates with the second guide structure to guide the reciprocating motion of the cleaning device 500. More specifically, the cleaning device 500 is guided to perform the reciprocating motion within a range defined by the first guide structure and the second guide structure. In one embodiment, the first guide structure is a slide block and the second guide structure is a guide groove, or the first guide structure is a guide groove and the second guide structure is a slide block. As shown in FIG. 4, the first guide structure of the cleaning device 500 is a slide block 561, and the second guide structure of the lift seat 301 is a guide groove 562. The slide groove 561 is provided in the guide groove 562 and is capable of performing a reciprocating motion in the guide groove 562, thereby enabling the cleaning device 500 to perform the reciprocating motion relative to the lift seat 301.

[0042] In one embodiment, the cleaning device 500 further includes a roller 563. The roller 563 is located between the cleaning cloth holder 510 and the lift seat 301 and rolls on the cleaning cloth holder 510 or the lift

seat 301 to thereby reduce a frictional force between the cleaning cloth holder 510 and the lift seat 301. In one embodiment, an up-down direction of the roller 563 is located between the cleaning cloth holder 510 and the lift seat 301. The cleaning cloth holder 510 is provided with sidewalls to form a roller mounting seat 511, and the roller 563 leans on the roller mounting seat 511 and rotates. In one embodiment, the cleaning device 500 further includes a bearing 564. The cleaning cloth holder 510 is also provided with a mounting column 512 protruding from a top surface thereof, and the bearing 564 is rotatably provided on the mounting column 512. Preferably, the bearing 564 is located in the guide groove 562, and the bearing 564 rotates by regarding the mounting column 512 as an axis while performing the reciprocating motion in the guide groove 562. In one embodiment, the bearing 564 may be the slide block 561. In one embodiment, the slide block 561 is mounted on a top surface of the mounting column 512 and the bearing 564 is connected to the slide block 561.

[0043] In one embodiment, a left-right direction of another roller 563 may also be configured to be located between the cleaning cloth holder 510 and the lift seat 301. In one embodiment, the self-propelled cleaning machine 100 further includes at least one elastic component 370. The elastic component 370 is provided between the lift seat 301 and the base 114, and is configured to apply a force of action on the lift seat 301 in a direction away from the base 114.

[0044] In other embodiments, at least one guide column may also be provided on the lift seat 301. The at least one guide column passes through at least one guide opening of the base 114, so that the lift seat 301 moves in a long-axis direction of the at least one guide column. In one embodiment, the guide column forms a hollow polygonal column or a hollow semicircular column. According to the design scenario above, the lift seat 301 is also enabled to vertically move up and down. However, in this embodiment, when the reciprocating device causes the cleaning device to perform the reciprocating motion, the guide column also vibrates in the guide opening, resulting in large noises as well as affecting the up-and-down movements of the lift seat 301. Thus, preferably, a design of rockers is used to better guide the lift seat 301 to ascend and descend in a more parallel or horizontal manner. In one embodiment, the rocker 361, the rocker 362, the rocker 363 and the rocker 364 are provided with a slight elasticity, that is, a level that does not affect swaying thereof, so that the vibration generated by the reciprocating device can be absorbed by the rocker 361, the rocker 362, the rocker 363 and the rocker 364.

[0045] In conclusion, according to the embodiments of the present invention, the self-propelled cleaning machine includes the reciprocating device to enable the mopping cloth to mop the floor back and forth and further includes the lift module 300 to enable the mopping cloth to lift for adapting to changes of the floor. That is, in response to conditions of the floor, the self-propelled cleaning machine 100 selectively causes the cleaning device 500 to depart from the floor surface and moves, thereby reducing risks of unwanted contact of the cleaning device 500 with respect to the floor surface.

Claims

1. A self-propelled cleaning machine, comprising:

a base;
a walking module, neighboring on the base, configured to contact a floor when the self-propelled cleaning machine moves on the floor;
a lift module, comprising a lift seat, wherein the lift seat is provided below the base and is configured to move up and down relative to the base for the lift seat to approach or depart from the base;
a cleaning device, configured to contact the floor when the self-propelled cleaning machine is in a mopping mode for cleaning the floor; and
a reciprocating device, connected to the cleaning device;
wherein, at least a portion of the reciprocating device is configured to be connected to the lift seat of the lift module, so that the at least a portion of the reciprocating device moves up and down along with up-and-down movements of the lift seat, and the reciprocating device is configured to enable the cleaning device to perform a reciprocating motion relative to the lift seat in the mopping mode.

2. The self-propelled cleaning machine according to claim 1, wherein the lift module comprises at least one rocker, a first end of the at least one rocker is rotatably connected to the base, and a second end of the at least one rocker is rotatably connected to the lift seat and is capable of moving up and down along with the up-and-down movements of the lift seat.

3. The self-propelled cleaning machine according to claim 2, wherein the lift module further comprises:

a crank device;
an abutting portion, crossing a portion of the crank device and connected to the lift seat; and
a driving device, provided on the base, the driving device configured to drive the crank device to rotate;
wherein, the lift module is configured to cause the portion of the crank device to apply a force on the abutting portion via a rotation of the crank device to thereby lift the lift seat.

4. The self-propelled cleaning machine according to

claim 3, wherein the crank device comprises:

a crankshaft, provided at the base;
a force arm, connected to the crankshaft; and
a tooth portion, provided at the crankshaft and coupled to the driving device; and
wherein the crank device is configured to rotate the crankshaft when the driving device drives the tooth portion to rotate in a first rotation direction or a second rotation direction, and to cause an end of the force arm to approach or depart from the base via the rotation of the crankshaft.

5. The self-propelled cleaning machine according to claim 4, wherein the crankshaft leans against a protrusion on the base and hence rotates; the tooth portion has a plurality of continuous teeth, and two ends of the plurality of teeth form an upper starting point and a lower starting point, respectively; the driving device comprises:

a gear, engaged with the tooth portion of the crank device; and
a lift motor outputting a torque in the first rotation direction or the second rotation direction, and the lift motor driving the gear and the tooth portion to rotate in the first rotation direction or the second rotation direction.

6. The self-propelled cleaning machine according to claim 5, wherein the reciprocating device comprises:

a mopping motor;
a mopping crankshaft, configured to be driven and rotated by the mopping motor; and
a mopping crank arm, having a first end connected to the mopping crankshaft, and a second end configured to be connected to the cleaning device and to perform a reciprocating motion along with a rotation of the mopping crankshaft;
wherein, the mopping motor, the mopping crankshaft and the mopping crank arm of the reciprocating device move up and down along with the up-and-down movements of the lift seat.

7. The self-propelled cleaning machine according to claim 4, wherein the at least one rocker comprises:

a first rocker; and
a second rocker;
wherein, the first rocker and the second rocker are located on two opposite sides of an extension direction of the mopping crank arm, respectively.

8. The self-propelled cleaning machine according to claim 7, wherein

the first rocker and the second rocker are connected by a connecting rod, the at least one rocker further comprises a third rocker and a fourth rocker, and
the third rocker and the fourth rocker are located on the two opposite sides of the extension direction of the mopping crank arm, respectively.

9. The self-propelled cleaning machine according to claim 8, wherein

a second end of the first rocker, a second end of the second rocker, a second end of the third rocker and a second end of the fourth rocker are respectively connected to an upper surface of the lift seat, and
a position of the abutting portion at which a force is applied by the lift motor or the end of the force arm is located within a range defined by the first rocker, the second rocker, the third rocker and the fourth rocker.

10. The self-propelled cleaning machine according to claim 6, wherein

the mopping motor is provided above the lift seat,
the lift seat is defined with an opening,
the first end of the mopping crank arm is located on an upper side of the lift seat, the second end of the mopping crank arm is located on a lower side the lift seat, the mopping crank arm passes through the opening from the upper side of the lift seat and extends to the lower side of the lift seat, and
the mopping motor, the mopping crankshaft and the mopping crank arm move up and down along with the up-and-down movements of the lift seat.

11. The self-propelled cleaning machine according to claim 6 or 10, wherein the base is defined with an accommodating opening, and the mopping motor, the mopping crankshaft and the mopping crank arm are located in the accommodating opening and move up and down along with the up-and-down movements of the lift seat.

12. The self-propelled cleaning machine according to claim 1, wherein

the cleaning device comprises a first guide structure,
the lift seat comprises a second guide structure, and
the first guide structure coordinates with the second guide structure to guide the reciprocating motion of the cleaning device.

13. The self-propelled cleaning machine according to claim 12, wherein

one of the first guide structure and the second guide structure is a slide block,
the other one of the first guide structure and the second guide structure is a guide groove, and
the slide block is provided in the guide groove and is capable of performing a reciprocating motion in the guide groove, thereby enabling the cleaning device to perform the reciprocating motion relative to the lift seat.

14. The self-propelled cleaning machine according to claim 1, wherein the cleaning device comprises:

a cleaning cloth holder, disposed below the lift seat; and
a cleaning cloth, provided on a bottom surface of the cleaning cloth holder, and configured to contact the floor.

15. The self-propelled cleaning machine according to claim 14, wherein the cleaning device further comprises:
a roller, located between the cleaning cloth holder and the lift seat and rolling on the cleaning cloth holder or the lift seat to thereby reduce a frictional force between the cleaning cloth holder and the lift seat.

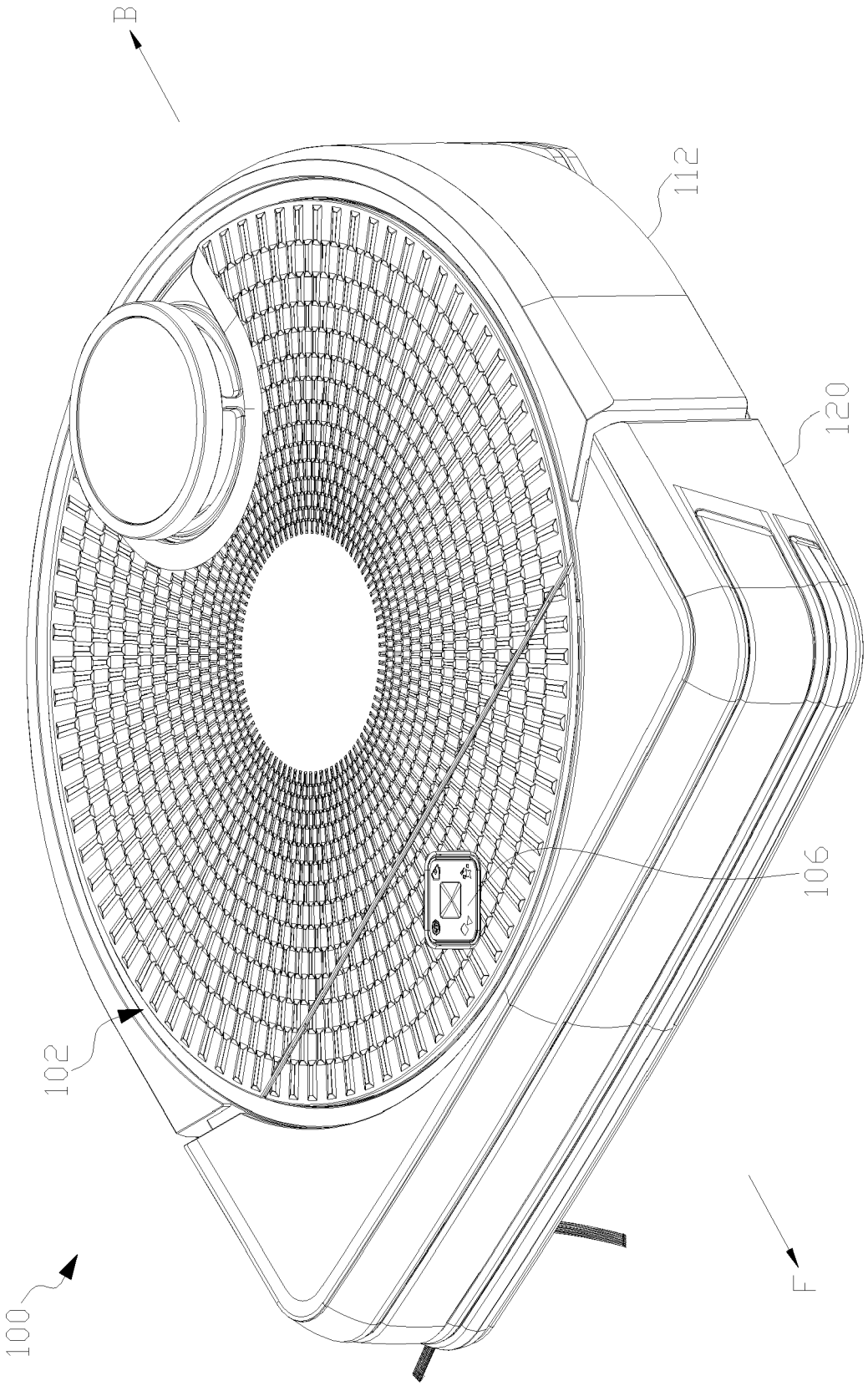

FIG.1

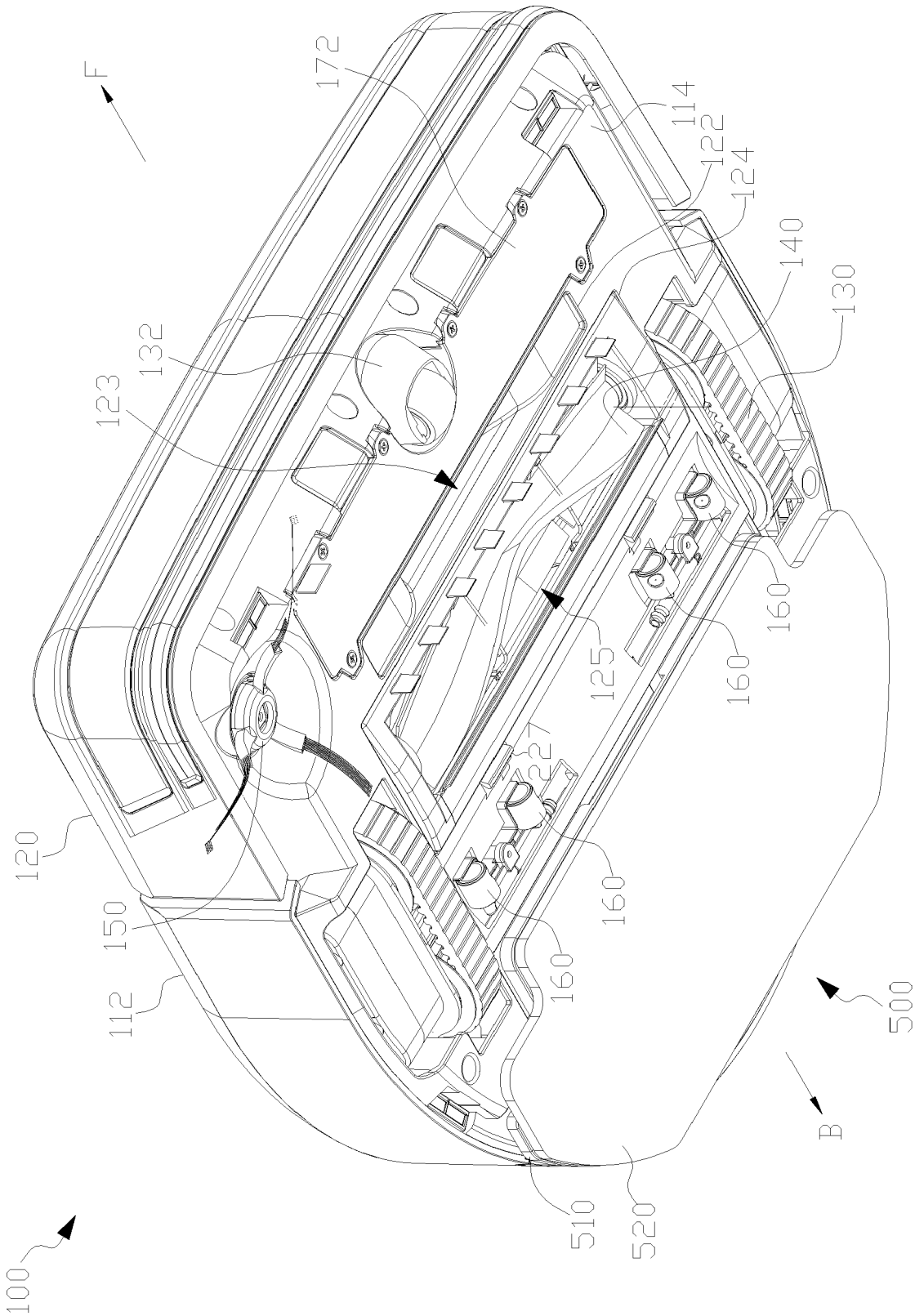
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FIG.2

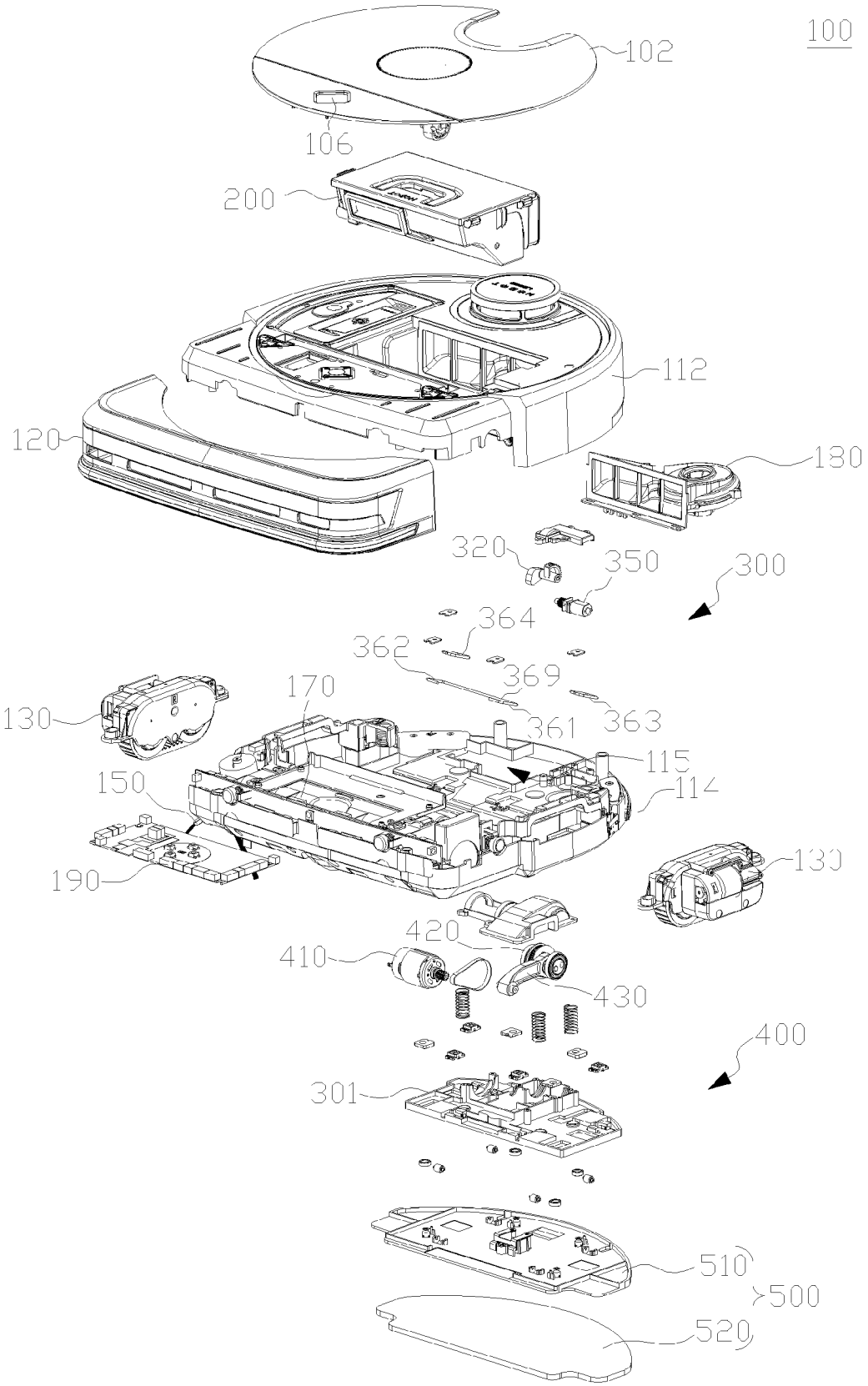
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FIG.3

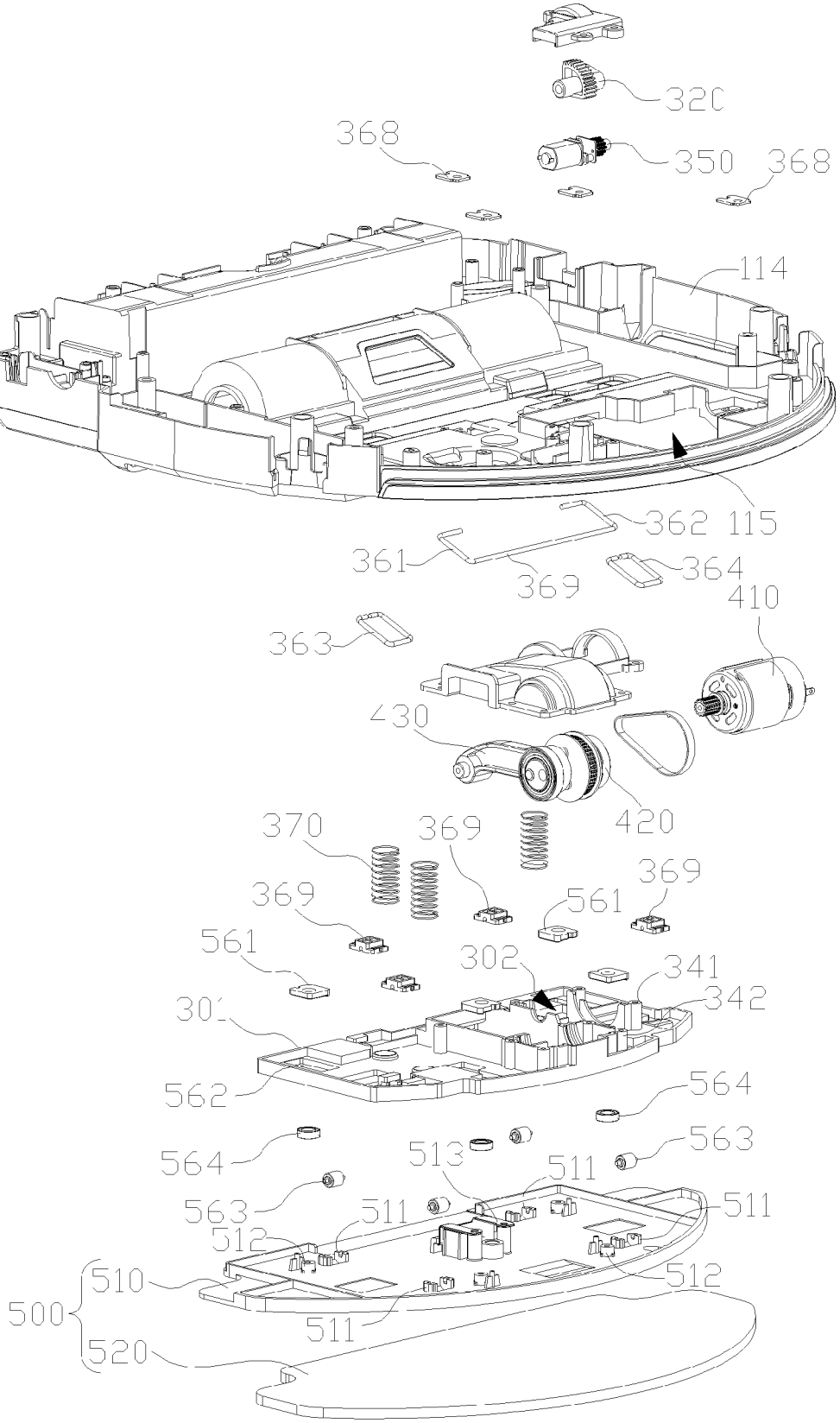
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FIG.4

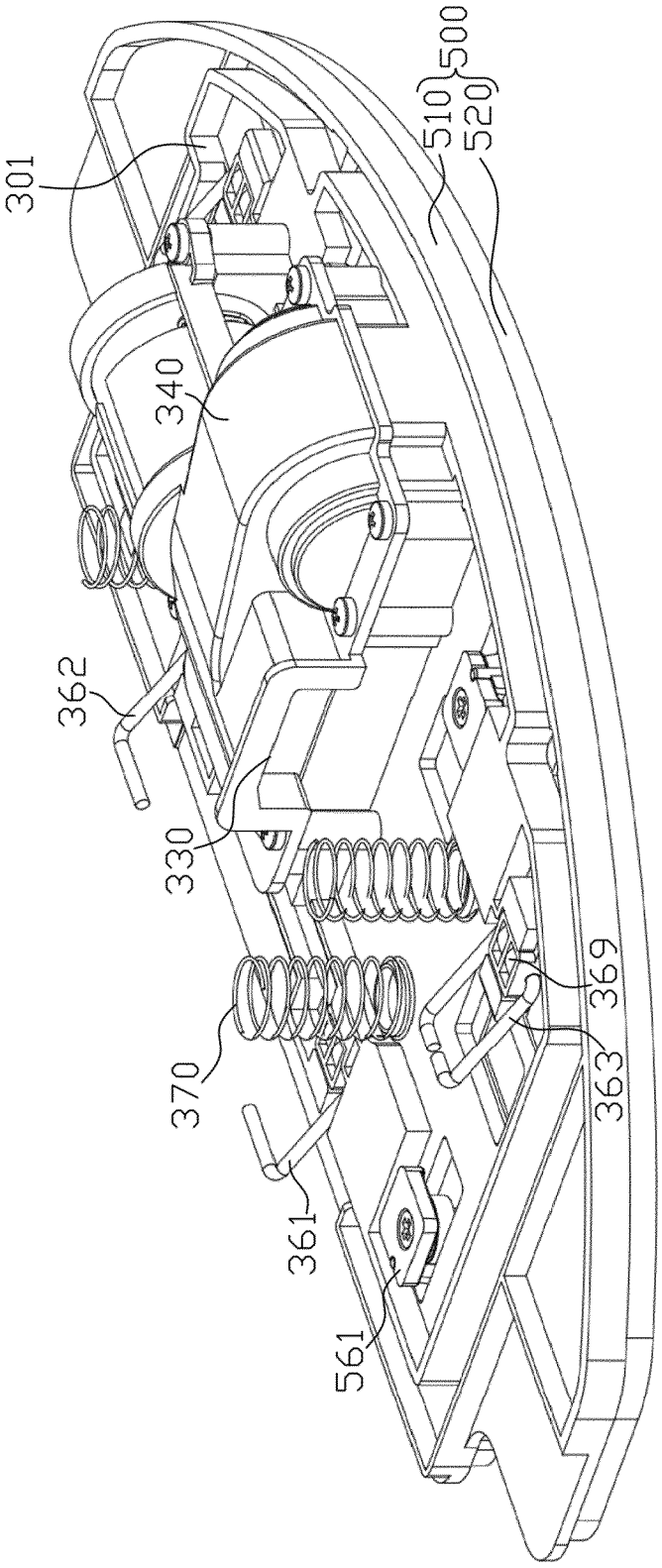

FIG.5

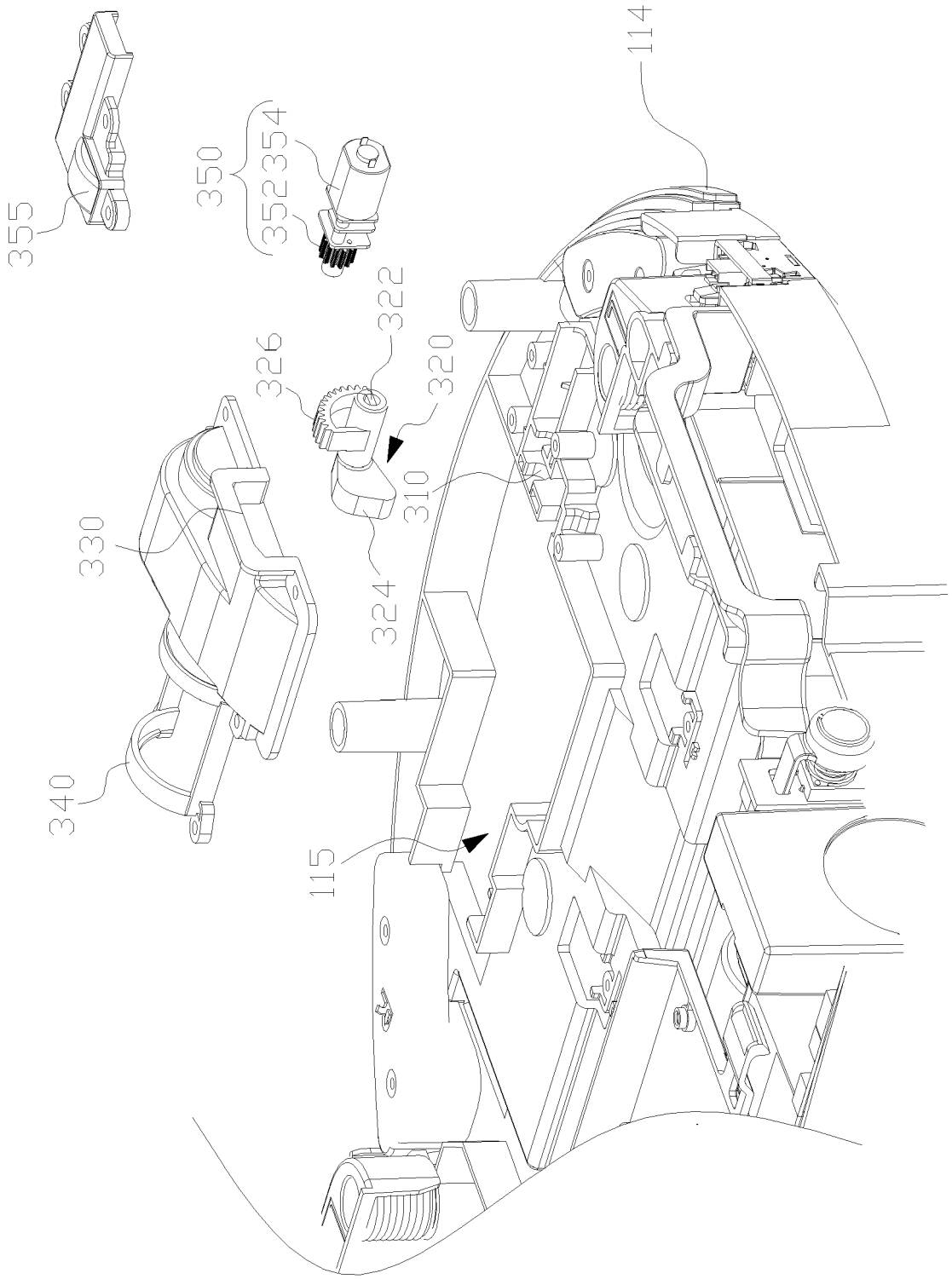

FIG.6

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EUROPEAN SEARCH REPORT

Application Number
EP 23 16 1188

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X A	CN 216 569 771 U (SHENZHEN TSUCHUAN ROBOT LTD COMPANY) 24 May 2022 (2022-05-24) * paragraphs [0055], [0082], [0098]; figures 1-21 *	1-4, 12-15 5	INV. A47L11/284 A47L11/28 A47L11/40 A47L25/00
X A	CN 113 693 497 A (BEIJING ROBOROCK TECH CO LTD) 26 November 2021 (2021-11-26) * paragraph [0106]; figures 1,2,9-23 *	1,2, 12-15 5	
X A	CN 114 795 009 A (WUXI ROIDMI INF TECH CO LTD) 29 July 2022 (2022-07-29) * paragraph [0047]; claims 1,6; figures 1-9 *	1,12-15 5	
X A	CN 216 364 940 U (SUZHOU LEYTT INTELLIGENT TECH CO LTD) 26 April 2022 (2022-04-26) * paragraph [0108]; figures 1,15-20 *	1,12-15 5	

TECHNICAL FIELDS SEARCHED (IPC)

A47L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	19 December 2023	Pössinger, Tobias

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19-12-2023

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
CN 216569771 U	24-05-2022	NONE	
CN 113693497 A	26-11-2021	CN 113693497 A	26-11-2021
		EP 4292493 A1	20-12-2023
		WO 2022170724 A1	18-08-2022
CN 114795009 A	29-07-2022	NONE	
CN 216364940 U	26-04-2022	NONE	

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- CN 202210945808 **[0001]**
- CN 112842174 A **[0003]**
- CN 107510417 B **[0004]**