



(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
28.02.2024 Bulletin 2024/09

(51) International Patent Classification (IPC):
A47L 11/40^(2006.01) A47L 11/24^(2006.01)

(21) Application number: **21937628.2**

(86) International application number:
PCT/CN2021/127143

(22) Date of filing: **28.10.2021**

(87) International publication number:
WO 2022/222406 (27.10.2022 Gazette 2022/43)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **19.04.2021 CN 202110417448**

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

(57) A self-propelled cleaning apparatus, comprising a main body (7), a cleaning device and a lifting device, wherein the cleaning device is connected to the main body (7) by means of the lifting device. The lifting device comprises a synchronous linkage assembly (1), a link rod mechanism (2) and a driving part (3), wherein the link rod mechanism (2) comprises a first link rod (201) and a second link rod (202), the first link rod (201) and the second link rod (202) are rotatably connected to the main body (7) around an axis in a horizontal direction, and the first link rod (201) is rotatably connected to the

second link rod (202) by means of the synchronous linkage assembly (1); and the driving part (3) is used for driving the first link rod (201) so that the cleaning device can ascend or descend relative to the main body (7). Thus, the driving part (3) drives the first link rod (201) to rotate so that the cleaning device can ascend or descend relative to the main body (7), and therefore the space occupied by the lifting device in a vertical direction can be reduced, thereby reducing the size of the self-propelled cleaning apparatus, and facilitating the miniaturization of the self-propelled cleaning apparatus.

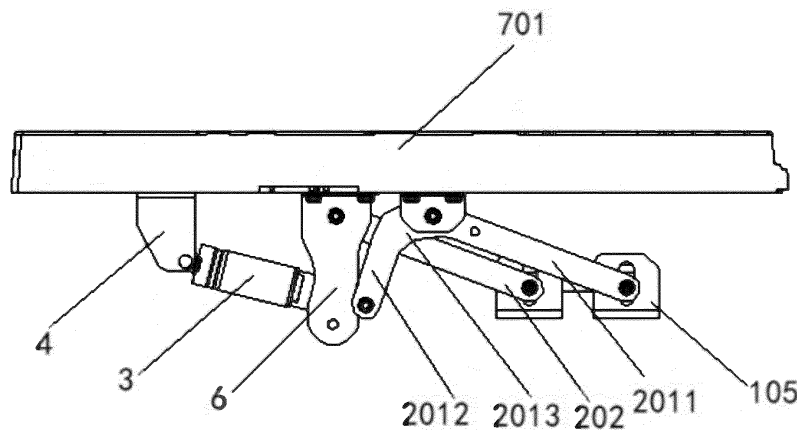


FIG. 4

Description

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority to Chinese Patent Application No. 202110417448.3, filed on April 19, 2021, which is incorporated herein by reference in its entirety as a part of the present application.

TECHNICAL FIELD

[0002] The present disclosure relates to the field of cleaning devices, and in particular to a self-moving cleaning device.

BACKGROUND ART

[0003] With the development of social productivity, mechanization and automation have gradually replaced the heavy manual labor of human beings. Since traditional scrubbing and mopping of floors usually with mops and other tools is low in work efficiency and causes the floors not to be dry easily, a self-moving cleaning device is provided accordingly in order to solve the above problem.

[0004] When the self-moving cleaning device performs cleaning, a lifting and lowering apparatus lowers a cleaning apparatus, so that the cleaning apparatus is in contact with a floor to clean a surface to be cleaned. Upon completion of the cleaning, the lifting and lowering apparatus lifts the cleaning apparatus, thus reducing wear of the surface to be cleaned to the cleaning apparatus.

SUMMARY OF THE INVENTION

[0005] A series of concepts in simplified forms are introduced in SUMMARY OF THE INVENTION, which will be described in further detail in DETAILED DESCRIPTION. SUMMARY OF THE INVENTION does not mean trying to define key features and necessary technical features of the recited technical solutions, let alone trying to determine the scope of protection of the recited technical solution.

[0006] In a first aspect of the present disclosure, a self-moving cleaning device is provided, including a main body, a sweeping apparatus and a lifting and lowering apparatus, wherein the sweeping apparatus is connected to the main body by means of the lifting and lowering apparatus; and

the lifting and lowering apparatus includes a synchronous linkage assembly, a connecting rod mechanism and a driving portion, the connecting rod mechanism including a first connecting rod and a second connecting rod, the first connecting rod and the second connecting rod being rotationally connected to the main body around an axis in a horizontal direction, and the first connecting rod being rotationally connected to the second connecting rod by means of the synchronous linkage assembly; and the

driving portion is configured to drive the first connecting rod to enable the sweeping apparatus to be lifted and lowered relative to the main body.

[0007] In some embodiments, a rotational connection between the first connecting rod and the main body and a rotational connection between the second connecting rod and the main body are located on the same horizontal plane.

[0008] In some embodiments, the first connecting rod includes a first swing arm, a bent portion and a second swing arm, the bent portion being connected to one end of the first swing arm and one end of the second swing arm, the bent portion being rotationally connected to the main body, the other end of the first swing arm being rotationally connected to the second connecting rod by means of the synchronous linkage assembly, and the other end of the second swing arm being rotationally connected to the driving portion.

[0009] In some embodiments, the first connecting rod is located on a first vertical plane, the second connecting rod is located on a second vertical plane, and the first vertical plane and the second vertical plane are different vertical planes parallel to each other.

[0010] In some embodiments, the first connecting rod is at least partially arranged horizontally parallel to the second connecting rod.

[0011] In some embodiments, the number of the connecting rod mechanisms is two, and the two sets of connecting rod mechanisms are symmetrically arranged on two sides of the synchronous linkage assembly, respectively.

[0012] In some embodiments, the synchronous linkage assembly includes a first synchronizing shaft, a second synchronizing shaft, a third synchronizing shaft and a connector, wherein the connector is rotationally connected to the first synchronizing shaft and the second synchronizing shaft; and

one ends of the first connecting rods of the two sets of connecting rod mechanisms are rotationally connected by means of the first synchronizing shaft, and the other ends of first connecting rods of the two sets of connecting rod mechanisms are rotationally connected by means of the second synchronizing shaft; the second connecting rods of the two sets of connecting rod mechanisms are rotationally connected by means of the third synchronizing shaft; and the driving portion is rotationally connected to the first synchronizing shaft.

[0013] In some embodiments, the connecting rod mechanism further includes a position-limiting portion mounted on the main body, the position-limiting portion being configured to prevent the first connecting rod and the second connecting rod from rotating so as to limit a lowering height of the sweeping apparatus.

[0014] In some embodiments, the second connecting rod is rotationally connected to a lower portion of the position-limiting portion.

[0015] In some embodiments, the synchronous linkage assembly further includes mounting bases arranged

at two ends of the second synchronizing shaft and the third synchronizing shaft, the mounting bases being connected to the sweeping apparatus.

[0016] In a second aspect of the present disclosure, a lifting method for the self-moving cleaning device according to the first aspect of the present disclosure is provided. The lifting method includes: controlling a driving portion to drive a first connecting rod and a second connecting rod to rotate in a first direction, so as to lift a sweeping apparatus.

[0017] In a third aspect of the present disclosure, a lowering method for the self-moving cleaning device according to the first aspect of the present disclosure is provided. The lowering method includes: controlling a driving portion to drive a first connecting rod and a second connecting rod to rotate in a second direction that is opposite to the first direction, so as to lower a sweeping apparatus.

[0018] According to the self-moving cleaning device provided by the embodiments of the present invention, the first connecting rod is driven to rotate by the driving portion, so that the sweeping apparatus can be lifted and lowered relative to the main body. In this way, the space occupied by the lifting and lowering apparatus in a vertical direction can be reduced, such that the size of the self-moving cleaning device is reduced, and miniaturization of the self-moving cleaning device is facilitated.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] The following accompanying drawings of the present invention are used herein for understanding the present invention as part of the embodiments of the present invention. The accompanying drawings show the embodiments of the present invention and descriptions thereof, which are used to explain the principles of the present invention.

[0020] In the drawings:

FIG. 1 is an exploded diagram of a lifting and lowering apparatus according to some embodiments of the present invention;

FIG. 2 is a diagram of the lifting and lowering apparatus in a lifting status according to some embodiments of the present invention;

FIG. 3 is a perspective diagram of FIG. 2;

FIG. 4 is a diagram of the lifting and lowering apparatus in a lowering status according to some embodiments of the present invention;

FIG. 5 is a perspective diagram of FIG. 4;

FIG. 6 is a structural diagram of the lifting and lowering apparatus and a sweeping apparatus connected as a whole;

FIG. 7 is an exploded diagram of FIG. 6;

FIG. 8 is an exploded diagram of the sweeping apparatus according to some embodiments of the present invention;

FIG. 9 is a top view of FIG. 8;

FIG. 10 is a cross-sectional diagram taken along line A-A of FIG. 9;

FIG. 11 is a schematic diagram of a process of disengagement between a brush disc and a transmission mechanism;

FIG. 12 is a schematic diagram of a process of engagement between the brush disc and the transmission mechanism;

FIG. 13 is a structural diagram of a main body of a self-moving cleaning device according to some embodiments of the present invention;

FIG. 14 is a schematic diagram of a process of hook-fit between a curved portion and a position-limiting portion; and

FIG. 15 is a schematic diagram of a process of unhooking between the curved portion and the position-limiting portion.

List of Reference Numerals:

[0021] 1, synchronous linkage assembly; 101, first synchronizing shaft; 102, second synchronizing shaft; 103, third synchronizing shaft; 104, connector; 105, mounting base; 2, connecting rod mechanism; 201, first connecting rod; 2011, first swing arm; 2012, second swing arm; 2013, bent portion; 202, second connecting rod; 3, driving portion; 4, first bracket; 5, second bracket; 6, position, limiting portion; 7, main body; 701, chassis; 702, fluid storage apparatus; 8, brush disc; 801, brush disc body; 802, bristle; 803, orientating portion; 9, engagement mechanism; 901, engagement portion; 9011, engagement body; 9012, clamping groove; 9013, first clamping groove; 9014, second clamping groove; 902, position-limiting portion; 9021, position-limiting pin; 9022, fastener; 10, transmission portion; 1001, connecting shaft; 1002, connecting disc; 1003, guiding portion; 11, stop portion; 12, locking portion; 1201, elastic arm; 1202, curved portion; 13, bolt; 14, rotating motor; and 15, packaging housing.

DETAILED DESCRIPTION

[0022] In the following description, a large number of specific details are provided for more thorough understanding of the present invention. However, it is apparent to those skilled in the art that the present invention may be implemented without one or more of these details. In other examples, some of the technical features well known in the art are not described in order to avoid confusion with the present invention.

[0023] It should be noted that the terms used herein are only intended to describe specific embodiments rather than to limit exemplary embodiments of the present invention. As used herein, the singular forms may also be intended to encompass plural forms, unless otherwise stated. In addition, it should be further understood that the terms "include" and/or "comprise" used in the Description indicate the presence of the discussed features,

integers, steps, operations, elements and/or components, but do not exclude the presence or addition of one or more other features, integers, steps, operations, elements, components and/or combinations thereof.

[0024] The exemplary embodiments according to the present invention will now be described in more detail with reference to the accompanying drawings. However, these exemplary embodiments may be implemented in a variety of different forms and should not be construed as being limited to the embodiments set forth herein. It should be understood that these embodiments are provided to make the disclosure of the present invention thorough and complete and to fully convey the concepts of these exemplary embodiments to those of ordinary skill in the art.

[0025] As shown in FIGs. 1, 3 and 11, a self-moving cleaning device is provided according to an embodiment of the present invention. FIG. 1 is an exploded diagram of a lifting and lowering apparatus according to some embodiments of the present invention. FIG. 2 is a diagram of the lifting and lowering apparatus in a lifting status according to some embodiments of the present invention. FIG. 3 is a perspective diagram of FIG. 2. FIG. 11 is a schematic diagram of a process of disengagement between a brush disc and a transmission mechanism. The self-moving cleaning device includes a main body 7, a sweeping apparatus and a lifting and lowering apparatus. The sweeping apparatus is connected to the main body 7 by means of the lifting and lowering apparatus. The lifting and lowering apparatus includes a synchronous linkage assembly 1, a connecting rod mechanism 2 and a driving portion 3. The connecting rod mechanism 2 includes a first connecting rod 201 and a second connecting rod 202, the first connecting rod 201 and the second connecting rod is rotationally connected to the main body 7 around an axis in a horizontal direction, and the first connecting rod 201 is rotationally connected to the second connecting rod 202 by means of the synchronous linkage assembly 1. The driving portion 3 is configured to drive the first connecting rod 201 to enable the sweeping apparatus to be lifted and lowered relative to the main body 7.

[0026] According to the embodiment, the self-moving cleaning device is a device capable of automatically travelling in an area to be cleaned and capable of performing cleaning automatically. The self-moving cleaning device may include, but is not limited to, an automatic scrubber, an automatic sweeper, an automatic mopping and sweeping all-in-one machine, etc.

[0027] FIG. 13 is a structural diagram of a main body of a self-moving cleaning device according to some embodiments of the present invention. As shown in FIG. 13, a fluid storage apparatus 702 may be integrally molded from a material such as plastic, and may serve as a housing of the main body 7, so as to improve the resilience, toughness, corrosion resistance and impact resistance of the main body 7 and reduce the weight of the main body 7. A plurality of grooves, recesses, detents or the

like for mounting sprinklers, sewage recovery apparatuses and travelling apparatuses may be pre-formed in the peripheral wall of the fluid storage apparatus 702. In addition, in the case where a floor scrubber is used for cleaning a large venue, the volume of the main body 7 may be increased to increase the volume of the fluid storage apparatus 702, so that the fluid storage apparatus has sufficient cleaning liquid to meet a washing demand.

[0028] The travelling apparatus includes a plurality of sets of wheels arranged at the lower portion of the main body 7, the two wheels of each group are respectively located on two opposite sides of the main body 7, and the main body 7 is driven to travel by the wheels for cleaning.

[0029] The sprinkler includes a liquid outlet in fluid communication with the fluid storage apparatus 702 for discharging a cleaning liquid. In some embodiments, the fluid storage apparatus 702 is communicated with the liquid outlet by means of a cleaning liquid output pipeline, and the cleaning liquid output pipeline is further provided with necessary components such as a pump, such that the cleaning liquid can be delivered to the liquid outlet in time and in sufficient quantity. In some embodiments, the liquid outlet may also be arranged in front of a suction port. In this way, a surface to be cleaned in front of the suction port can be directly wetted by the liquid outlet, and the wetted surface is scrubbed by the sweeping apparatus, so that a scrubbing effect on the surface to be cleaned is also achieved. In some embodiments, the fluid storage apparatus 8 may be divided into a plurality of compartments, for example, divided into two compartments, one for storing the cleaning liquid and the other for storing recycled sewage. Further, in the case where clean water and a detergent are mixed, the compartment for storing the cleaning liquid may also be divided into two sub-compartments, with the volume of one sub-compartment much larger than that of the other, so that clean water is stored in the larger sub-compartment and the detergent is stored in the smaller sub-compartment.

[0030] The sewage recovery apparatus includes a fan assembly and a sewage recovery pipeline connected between the sewage recovery apparatus and the suction port. Under the action of a suction force provided by the fan assembly, the sewage recovery pipeline sucks impurities and sewage on the surface to be cleaned into a fluid storage apparatus 702 by means of the sewage recovery pipeline.

[0031] FIG. 8 is an exploded diagram of a sweeping apparatus according to some embodiments of the present invention. As shown in FIG. 8, the sweeping apparatus includes a brush disc 8, an engagement mechanism 9 and a transmission portion 10 connected to a rotating motor 14. The rotating motor 14 drives the transmission portion 10 to rotate relative to the brush disc 8 in a first direction, so that the brush disc 8 is engaged with the transmission portion 10 by means of an engagement mechanism 9. The rotating motor 14 drives the transmission portion 10 to rotate in a second direction

that is opposite to the first direction, so that the engagement mechanism 9 disengages from the transmission portion 10. The first direction is a direction of rotation of the transmission portion 10 under a normal working status.

[0032] FIG. 9 is a top view of FIG. 8. FIG. 10 is a cross-sectional diagram taken along line A-A in FIG. 9. As shown in FIGs. 8 and 10, the transmission portion 10 includes a connecting disc 1002 and a connecting shaft 1001 located in the middle of the connecting disc 1002. The brush disc 8 includes a brush disc body 801 and bristles 802 arranged at the lower portion of the brush disc body 801. After the brush disc body 801 is connected to the connecting disc 1002 of the transmission portion 10, the rotating motor 14 rotates to drive the connecting shaft 1001 of the transmission portion 10 to rotate, so that the bristles 802 of the brush disc 8 are driven to rotate to clean a floor to be cleaned, and dirty water and dirt are thrown out by a centrifugal force generated by the rotation and recovered by the sewage recovery apparatus. The bristles 802 may be made of nylon, which can greatly enhance the corrosion resistance and the aging resistance of the bristles 802, reduce the degree of wear of the bristles 802, and prolong the service life of the bristles 802. The bristles 802 may also be formed by injection molding using ABS, and thus have excellent corrosion resistance and impact resistance and high stability. Further, the bristles 802 may also be arranged in a wave shape in their own length directions, and may be only arranged at the outer edge of the brush disc 8, and every two adjacent bristles 802 are staggered with each other, so that the density of the bristles 802 is increased, which can play an excellent water-retaining role, and at the same time can reduce the usage amount of the bristles 802. Besides, since only a single layer of bristles 802 can play an excellent water-retaining role, the production cost of the brush disc 8 is reduced.

[0033] The first direction is the direction of rotation of the transmission portion 10 under a normal working status, i.e., when the transmission portion 10 rotates clockwise in normal operation, the first direction is clockwise and the second direction is counterclockwise; and when the transmission portion 10 rotates counterclockwise in normal operation, the first direction is counterclockwise and the second direction is clockwise.

[0034] When the brush disc 8 needs to be dismounted, an external force is applied to the brush disc 8, and then the driving portion 10 is driven by the rotating motor 14 to rotate relative to the brush disc 8 in the second direction, so that the brush disc 8 is disengaged from the driving portion 10 by means of the engagement mechanism 9, and is separated from the driving portion 10 to complete the dismounting. When the brush disc 8 needs to be mounted, an external force is applied to the brush disc 8, and then the driving portion 10 is driven by the rotating motor 14 to rotate relative to the brush disc 8 in the first direction, so that the brush disc 8 is engaged with the driving portion 10 by means of the engagement mechanism

9, thereby connecting the brush disc 8 to the driving portion 10 to complete the mounting. In this way, the automatic mounting and dismounting of the brush disc 8 can be achieved; and thus, the workload of an operator is reduced, the operation is convenient, and moreover, the mounting and dismounting efficiency is improved.

[0035] FIG. 6 is a structural diagram of the lifting and lowering apparatus and a sweeping apparatus connected as a whole. FIG. 7 is an exploded diagram of FIG. 6. As shown in FIGs. 6 and 7, the lifting and lowering apparatus is configured to drive the transmission portion 10 to be lifted or lowered; and the lifting and lowering apparatus and the rotating motor 14 cooperate to realize engagement or disengagement between the engagement mechanism 9 and the transmission portion 10. The transmission portion 10 is driven to be lifted, be lowered and rotate by the lifting and lowering apparatus and the rotating motor 14, so that the brush disc 8 can be mounted and dismounted automatically. Thus, the workload of the operator is reduced, the operation is convenient to operate, and moreover, the mounting and dismounting efficiency is improved. The rotating motor 14 may be connected to the lifting and lowering apparatus by means of a packaging housing 15.

[0036] In some embodiments, the lifting and lowering apparatus and the rotating motor 14 may cooperate in the following two ways to realize engagement or disengagement between the brush disc 8 and the transmission portion 10.

[0037] The first mode of cooperation is as follows: in the process of driving the transmission portion 10 to be lowered by the lifting and lowering apparatus, the rotating motor 14 drives the transmission portion 10 to rotate in the first direction, and after the lifting and lowering apparatus drives the transmission portion 10 to be lowered in place, the rotating motor 14 drives, at a first maximum stroke, the transmission portion 10 to rotate relative to the brush disc 8 in the first direction, so that the engagement mechanism 9 engages with the transmission portion 10.

[0038] The first maximum stroke is a rotation stroke in which the rotating motor 14 rotates in the first direction so that the engagement mechanism 9 engages with the transmission portion 10, i.e., in case of a stroke less than the first maximum stroke, the transmission portion 10 cannot be engaged with the engagement mechanism 9. Lowering in place means that the lifting and lowering apparatus lowers the transmission portion 10 to a position where the bristles 802 of the brush disc 8 are be in contact with the floor and a pressure is applied to the brush disc 8.

[0039] FIG. 12 is a schematic diagram of a process of engagement between the brush disc and the transmission mechanism. As shown in FIG. 12, when the brush disc 8 needs to be mounted, the brush disc 8 is placed on the floor, then the transmission portion 10 is lowered by means of the lifting and lowering apparatus; and in the process of lowering, the rotating motor 14 drives the transmission portion 10 to rotate in the first direction. After

the lifting and lowering apparatus drives the transmission portion 10 to be lowered in place, the transmission portion 10 is engaged with the brush disc 8 and a pressure is applied to the brush disc 8. Similarly, the bristles 802 are also subject to a larger downward pressure exerted by the lifting and lowering apparatus, such that a larger frictional force is generated between the bristles 802 and the floor. In this way, when the rotating motor 14 drives the transmission portion 10 to rotate in the first direction, the brush disc 8 may not rotate therewith, so that the transmission portion 10 may rotate relative to the brush disc 8. In addition, the rotating motor 14 drives the transmission portion 10 to rotate at the first maximum stroke, so that the engagement mechanism 9 engages with the transmission portion 10, thus completing the mounting of the brush disc 8.

[0040] In the process of driving the transmission portion 10 to be lowered by the lifting and lowering apparatus, the rotating motor 14 drives the transmission portion 10 to rotate in a second direction, and after the lifting and lowering apparatus drives the transmission portion 10 to be lowered in place, the rotating motor 14 drives, at a second maximum stroke, the transmission portion 10 to rotate relative to the brush disc 8 in the second direction, so that the engagement mechanism 9 disengages from the transmission portion 10.

[0041] The second maximum stroke is a rotation stroke in which the rotating motor 14 rotates in the second direction so that the engagement mechanism 9 disengages from the transmission portion 10, i.e., in case of a stroke less than the second maximum stroke, the transmission portion 10 cannot be disengaged from the engagement mechanism 9.

[0042] FIG. 11 is a schematic diagram of a process of disengagement between the brush disc and the transmission mechanism. As shown in FIG. 11, when the brush disc 8 needs to be dismounted, the transmission portion 10 is lowered by the lifting and lowering apparatus; and in the process of lowering, the rotating motor 14 drives the transmission portion 10 to rotate in the second direction. After the lifting and lowering apparatus drives the transmission portion 10 to be lowered in place, the transmission portion 10 is engaged with the brush disc 8, and a pressure is applied to the brush disc 8. Similarly, the bristles 802 are also subject to a larger downward pressure exerted by the lifting and lowering apparatus, such that a larger frictional force is generated between the bristles 802 and the floor. In this way, when the rotating motor 14 drives the transmission portion 10 to rotate in the second direction, the brush disc 8 may not rotate therewith, so that the transmission portion 10 may rotate relative to the brush disc 8. In addition, the rotating motor 14 drives the transmission portion 10 to rotate at the second maximum stroke, so that the engagement mechanism 9 disengages from the transmission portion 10, thus completing the dismounting of the brush disc 8.

[0043] The second mode of cooperation is as follows: after the lifting and lowering apparatus drives the trans-

mission portion 10 to be lowered in place, the rotating motor 14 drives, at the first maximum stroke, the transmission portion 10 to rotate relative to the brush disc 8 in the first direction, so that the engagement mechanism 9 engages with the transmission portion 10.

[0044] FIG. 12 is a schematic diagram of a process of engagement between the brush disc and the transmission mechanism. As shown in FIG. 12, when the brush disc 8 needs to be mounted, the brush disc 8 is placed on the floor. After the lifting and lowering apparatus drives the transmission portion 10 to be lowered in place, the transmission portion 10 is engaged with the brush disc 8, and a pressure is applied to the brush disc 8. Similarly, the bristles 802 are also subject to a larger downward pressure exerted by the lifting and lowering apparatus, such that a larger frictional force is generated between the bristles 802 and the floor. In this way, when the rotating motor 14 drives the transmission portion 10 to rotate in the first direction, the brush disc 8 may not rotate therewith, so that the transmission portion 10 can rotate relative to the brush disc 8. In addition, the rotating motor 14 drives the transmission portion 10 to rotate at the first maximum stroke, so that the engagement mechanism 9 engages with the transmission portion 10, thus completing the mounting of the brush disc 8.

[0045] After the lifting and lowering apparatus drives the transmission portion 10 to be lowered in place, the rotating motor 14 drives, at a second maximum stroke, the transmission portion 10 to rotate relative to the brush disc 8 in the second direction, so that the engagement mechanism 9 disengages from the transmission portion 10.

[0046] FIG. 11 is a schematic diagram of a process of disengagement between the brush disc and the transmission mechanism. As shown in FIG. 11, when the brush disc 8 needs to be dismounted, after the lifting and lowering apparatus drives the transmission portion 10 to be lowered in place, the transmission portion 10 is engaged with the brush disc 8, and a pressure is applied to the brush disc 8. Similarly, the bristles 802 are also subject to a larger downward pressure exerted by the lifting and lowering apparatus, such that a larger frictional force is generated between the bristles 802 and the floor. In this way, when the rotating motor 14 drives the transmission portion 10 to rotate in the second direction, the brush disc 8 may not rotate therewith, so that the transmission portion 10 can rotate relative to the brush disc 8. In addition, the rotating motor 14 drives the transmission portion 10 to rotate at the second maximum stroke, so that the engagement mechanism 9 disengages from the transmission portion 10, thus completing the mounting of the brush disc 8. Compared with the first mode of cooperation, this mode can reduce the power consumption of the rotating motor 14 and save energy since the rotating motor 14 works after lowering in place is realized.

[0047] In the foregoing embodiment, as shown in FIGs. 8 and 9, the engagement mechanism 9 includes at least two engagement portions 901 arranged on the transmis-

sion portion 10, and a position-limiting portion 902 arranged on the brush disc 8 and corresponding to each engagement portion 901; after the brush disc 8 is engaged with the transmission portion 10, each engagement portion 901 engages with the corresponding position-limiting portion 902 when the transmission portion 10 drives the engagement portion 901 to rotate to an engagement position; and each engagement portion 901 disengages from the corresponding position-limiting portion 902 when the transmission portion 10 drives the engagement portions 901 to rotate to a disengagement position.

[0048] The number of the engagement portions 901 may be set by the staff according to actual needs, which is not strictly limited in the embodiments. In some possible implementations, there are three engagement portions 901, which can ensure that the number of the engagement portions 901 is smaller, reduce the complexity of the overall structure, and ensure the stability of the engagement. Since the position-limiting portions 902 and the engagement portions 901 are in one-to-one correspondence, the number of the position-limiting portions 902 is the same as that of the engagement portions 901.

[0049] It should be noted that the engagement portion 901 has the ability to engage with the position-limiting portion 902, but whether the engagement portion 901 may engage with the position-limiting portion 902 depends on whether the engagement portion 901 reaches the engagement position.

[0050] The disengagement position is specifically any position on the spacing between every two adjacent position-limiting portions 902. When the transmission portion 10 drives the engagement portion 901 to rotate to any position on the spacing between every two adjacent position-limiting portions 902, the engagement portion 901 is separated from (i.e., disengages from) the position-limiting portion 902.

[0051] In specific use, as shown in FIGs. 8 and 9, at least two engagement portions 901 are connected to the outer edge of the connecting disc 1002 of the transmission portion 10, and at least two engagement portions 901 are evenly distributed on the same circumference. At least two position-limiting portions 902 are arranged on the upper surface of the brush disc 8 and evenly distributed on the same circumference, ensuring that the brush disc 8 is subject to a uniform connecting force after the engagement portions 901 and the position-limiting portions 902 are engaged with each other, and preventing the brush disc 8 from tilting which affects the cleaning effect.

[0052] Further, the first direction is the same as the direction of rotation of the transmission portion 10 under a normal working status.

[0053] During a cleaning operation by a floor scrubber, the lifting and lowering apparatus drives the brush disc 8 to be lowered by the transmission portion 10, so as to enable the brush disc 8 to be in contact with the surface to be cleaned. After that, the cleaning liquid is delivered

to the liquid outlet and then is provided to the brush disc 8. At the same time, the rotating motor 14 drives the brush disc 8 to rotate by the transmission portion 10, thus achieving the cleaning operation. Upon completion of the cleaning operation, the lifting and lowering apparatus is driven to be lifted by the transmission portion 10, so that a distance is formed between the sweeping apparatus and the surface to be cleaned, which reduces wear of the floor to the sweeping apparatus and prolongs the service life of the sweeping apparatus.

[0054] In specific use, as shown in FIGs. 6 and 7, there are two sweeping apparatuses, the transmission portions of the two sweeping apparatuses rotate in opposite directions under normal working status.

[0055] When the two sweeping apparatuses are working, the transmission portions 10 of the two sweeping apparatuses rotate in opposite directions under normal working status, i.e., the first direction and the second direction of the two sweeping apparatuses are opposite to each other, so that dust and other impurities may be swept to a suction port in the middle of the self-moving cleaning device for absorption. Exemplarily, if the transmission portion 10 of one sweeping apparatus rotates clockwise under the normal working status, i.e., the first direction is clockwise and the second direction is counterclockwise, the transmission portion 10 of the other sweeping apparatus rotates counterclockwise under the normal working status, i.e., the first direction is counterclockwise and the second direction is clockwise. In this embodiment, after the brush disc 8 is engaged with the transmission portion 10, all the engagement portions 901 and all the position-limiting portions 902 are located on the same circumference, which ensures that other engagement portions 901 also engage with the corresponding position-limiting portions 902 when one engagement portion 901 engages with the corresponding position-limiting portion 902, thereby improving the accuracy of the engagement.

[0056] In the foregoing embodiment, as shown in FIGs. 9 to 12, each engagement portion 901 includes an engagement body 9011, and the engagement body 9011 is connected to the outer edge of the transmission portion 10 and extends away from the transmission portion 10. A clamping groove 9012 is formed at least in the side of the engagement body 9011 opposite to the corresponding position-limiting portion 902, and each position-limiting portion 902 includes a position-limiting pin 9021 connected to the brush disc 8. The clamping groove 9012 of each engagement body 9011 is engaged with the corresponding position-limiting pin 9021 when the transmission portion 10 drives the engagement body 9011 to rotate to the engagement position. The clamping groove 9012 of each engagement body 9011 is disengaged from the corresponding position-limiting pin 9021 when the transmission portion 10 drives the engagement body 9011 to rotate to the disengagement position.

[0057] In some embodiments, the position-limiting pin 9021 includes a post and a position-limiting bump ar-

ranged above the post. When the engagement body 9011 rotates to the engagement position, the post is at least partially located in the clamping groove 9012, and the position-limiting bump plays the role of axially limiting the position of the edge of the clamping groove 9012 to prevent the engagement body 9011 from falling off due to gravity in the axial direction, thereby realizing engagement between the clamping groove 9012 and the position-limiting pin 9021. When the engagement body 9011 rotates to the disengagement position, the post is separated from the clamping groove 9012, and the position-limiting bump may not play the role of axial position limiting, so that the engagement portion 901 may be separated from the position-limiting portion 902. Engagement and disengagement are realized by cooperation between the clamping groove 9012 and the position-limiting pin 9021, which achieves a simple structure and convenient operation.

[0058] Further, as shown in FIG. 8, the position-limiting pin 9021 and the brush disc body 801 are in detachable connection, and a passage for fasteners 9022, for example, bolts 13, is formed in the main body. The fasteners 9022, for example, the bolts 13, pass through the passage to be in threaded connection with the brush disc, thereby realizing the detachable connection between the position-limiting pin 9021 and the brush disc 8. In case of serious wear of the position-limiting pin 9021, the only requirement is to replace the position-limiting pin 9021 but not to scrap the whole brush disc 8, which prolongs the service life of the brush disc 8 and reduces the cost.

[0059] The groove may be formed in the engagement body 9011 by different ways, and the different groove forming ways will be described in detail below.

[0060] In a first implementation, the clamping groove 9012 is only formed in the side of the engagement body 9011 opposite to the corresponding position-limiting portion 902.

[0061] In this implementation, the clamping groove 9012 is only formed in the side opposite to the corresponding position-limiting portion 902, which can simplify the manufacturing process and flow of the engagement portion 901 and improve the production efficiency. In order to improve the stability of the engagement, the direction in which the clamping groove 9012 of the engagement body 9011 rotates towards the corresponding position-limiting pin 9021 should be the same as the direction of rotation of the transmission portion 10 under the normal working status.

[0062] As shown in FIGs. 8 and 9, in a second implementation, each engagement body 9011 is provided with a first clamping groove 9013 on a first side, and provided with a second clamping groove 9014 on a second side, and the second side is the side of the engagement body 9011 opposite to the first side. The engagement position includes a first engagement position and a second engagement position. When the transmission portion 10 drives the engagement body 9011 to rotate to the first engagement position, the first clamping groove 9013 of

each engagement body 9011 is engaged with the adjacent position-limiting pin 9021. When the transmission portion 10 drives the engagement body 9011 to rotate to the second engagement position, the second clamping groove 9014 of each engagement body 9011 is engaged with the corresponding position-limiting pin 9021. When the transmission portion 10 drives the engagement body 9011 to rotate to the disengagement position, the first clamping groove 9013 of each engagement body 9011 is disengaged from the adjacent position-limiting pin 9021, and the second clamping groove 9014 of each engagement body 9011 is disengaged from the adjacent position-limiting pin 9021.

[0063] In this implementation, the first clamping groove 9013 and the second clamping groove 9014 are arranged on the two opposite sides of the engagement body 9011, respectively, so that the engagement body 9011 can engage with both two adjacent position-limiting pins 9021, i.e., the engagement body 9011 can rotate clockwise or counterclockwise for engagement. That is, according to the direction of rotation of the transmission portion 10 under the normal working status, one of the two position-limiting pins 9021 adjacent to the engagement body 9011 is selected as the position-limiting portion 902 corresponding to the engagement portion 901. If the transmission portion 10 rotates clockwise under the normal working status, and the direction in which the engagement body 9011 rotates to the first disengagement position is clockwise, the position-limiting pin 9021 adjacent to the first clamping groove 9013 is determined as the position-limiting portion 902 corresponding to the engagement portion 901. Similarly, if the transmission portion 10 rotates anticlockwise under the normal working status, and the direction in which the engagement body 9011 rotates to the second disengagement position is counterclockwise, the position-limiting pin adjacent to the second clamping groove 9014 is determined as the position-limiting portion 902 corresponding to the engagement portion 901, such that the engagement portion 901 can engage with the corresponding position-limiting portion 902 regardless of whether the transmission portion 10 rotates clockwise or anticlockwise under the normal working status, which improves the applicability and the flexibility in use. Moreover, the disengagement position is still any position on the spacing between every two adjacent position-limiting portions 902, so that when the engagement body 9011 rotates to the disengagement position, both of the first clamping groove 9013 and the second clamping groove 9014 are disengaged from the adjacent position-limiting pins, thereby facilitating disengagement.

[0064] Further, for the second implementation, as shown in FIGs. 8 and 9, at least one engagement portion 901 is equipped with a corresponding stop portion 11, and the stop portion 11 is configured to prevent the first clamping groove 9013 or the second clamping groove 9014 from being engaged with the adjacent position-limiting portion 902.

[0065] When the engagement portion 901 rotates to-

wards the disengagement position at an excessively large angle, the stop portion 11 may avoid the case that the first clamping groove 9013 or the second clamping groove 9014 on the other side is engaged with the adjacent position-limiting portion 902, so that the brush disc 8 cannot be separated from the transmission portion 10. In some embodiments, in the case where the direction in which the first clamping groove 9013 rotates towards the adjacent position-limiting portion 902 is the same as the direction of rotation of the transmission portion 10 under the normal working status, at least one second clamping groove 9014 is provided with the stop portion 11, so as to prevent the second clamping groove 9014 from being engaged with the adjacent position-limiting portion 902 during disengagement. Similarly, in the case where the direction in which the second clamping groove 9014 rotates towards the adjacent position-limiting portion 902 is the same as the direction of rotation of the transmission portion 10 under the normal working status, at least one first clamping groove 9013 is provided with the stop portion 11, so that the first clamping groove 9013 is prevented from being engaged with the adjacent position-limiting portion 902 during disengagement.

[0066] In the process of specific use, all the engagement portions 901 and all the position-limiting portions 902 are engaged and disengaged at the same time, so that all the first clamping grooves 9013 or all the second clamping grooves 9014 can be stopped by providing one or several engagement portions 901 with the corresponding stop portions 11, thereby simplifying the structure and facilitating the assembly and manufacture. Of course, each engagement portion 901 may also be provided with the stop portion 11, so that the resistance of the stop portion 11 can be improved, thereby improving the stopping effect.

[0067] Further, the stop portion 11 is mounted on the edge of the transmission portion 10 and located in the position corresponding to the first clamping groove 9013 or the second clamping groove 9014, and the first clamping groove 2013 or the second clamping groove 2014 is at least partially covered by the stop portion 11.

[0068] The stop portion 11 covers the first clamping groove 2013 or the second clamping groove 2014, which can reduce the space occupied by the stop portion 11, thereby enabling the structure to be more compact.

[0069] In some embodiments, the stop portion 11 is detachably connected to the edge of the transmission portion 10.

[0070] The stop portion 11 and the transmission portion 10 are detachably connected, and the specific detachable connection may be realized by using the bolts 13 and other conventional connecting modes, which is not strictly limited in the embodiments. The detachable connection may facilitate the mounting and dismounting of the stop portion 11 so as to facilitate adjustment of the position of the stop portion 11. For example, in the case where a first stop portion 11 is provided at the first clamping groove 9013, and the direction in which the first

clamping groove 9013 rotates towards the adjacent position-limiting portion 902 is opposite to the direction of rotation of the transmission portion 10 under the normal working status, the only requirement is to detach the first stop portion 11 and install it at the second clamping groove 9014, which is convenient for a user to operate.

[0071] In the foregoing embodiment, at least one engagement portion 901 is provided with a corresponding locking portion 12, and the locking portion 12 is configured to lock with the corresponding position-limiting portion 902 when each engagement part 901 engages with the corresponding position-limiting portion 902, so as to prevent the engagement portion 901 from rotating towards the disengagement position.

[0072] Owing to locking by the locking portion 12, the engagement portion may be prevented from rotating towards the disengagement position due to shaking of the cleaning device in the process of traveling, which makes the engagement loose or even causes disengagement. Therefore, the stability and reliability of the engagement are further improved.

[0073] In the process of specific use, all the engagement portions 901 and all the position-limiting portions 902 are engaged and disengaged at the same time, so that all engagement can be locked by providing one or several engagement portions 901 with the corresponding locking portions 12, thereby simplifying the structure and facilitating the assembly and manufacture. Of course, each engagement portion 901 may also be provided with the locking portion 12, so that the locking force can be increased, and the locking effect can be improved.

[0074] In some embodiments, as shown in FIGs. 8 and 9, the locking portion 12 is mounted on the edge of the transmission portion 10 and located in the position corresponding to the engagement portion 901. The locking portion 12 includes an elastic arm 1201, and the end of the elastic arm 1201 near the corresponding position-limiting portion 902 is provided with a curved portion 1202. When each engagement portion 901 engages with the corresponding position-limiting portion 902, the position-limiting portion 902 is at least partially located in the curved portion 1202, so as to prevent the engagement portion 901 from rotating towards the disengagement position.

[0075] In the process of mounting and dismounting the brush disc 8, the lifting and lowering apparatus exerts a larger downward pressure, so that a larger frictional force is generated between the bristles 802 and the floor. The frictional force is greater than a force of interaction between the curved portion 1202 and the position-limiting portion 902. When the transmission portion 10 rotates relative to the brush disc 8 in the first direction, the end of the elastic arm 1201 with the curved portion 1202 gradually approaches the corresponding position-limiting portion 902. After the curved portion 1202 abuts against the position-limiting portion 902, after being forced, the curved portion 1202 makes the elastic arm 1201 move towards the transmission portion 10, so that the curved

portion 1202 avoids the transmission portion 10, and the transmission portion 10 continues to rotate. Afterwards, a resilience force generated by deformation of the elastic arm 1201 is used to make the curved portion 1202 move away from the transmission portion 10, so that the position-limiting portion 902 is at least partially located in the curved portion 1202, which further realizes automatic hoot-fit between the curved portion 1202 and the position-limiting portion 902.

[0076] In specific use, in the case where the engagement body 9011 is only provided with the clamping groove 9012 on the side opposite to the corresponding position-limiting portion 902, the curved portion 1202 is at least partially located above the clamping groove 9012, and the other end of an elastic clamping portion may be fixed to a connecting portion of the transmission portion 10. As shown in FIG. 14, during the rotation of the transmission portion 10 relative to the brush disc 1 in the first direction, the end of the elastic arm 1201 with the curved portion 902 gradually approaches the corresponding position-limiting portion 902. After the curved portion 1202 abuts against the position-limiting portion 902, after being forced, the curved portion 1202 enables the elastic arm 1201 to move towards the transmission portion 10, so that the curved portion 1202 avoids the transmission portion 10, and the transmission part 10 continues to rotate. Afterwards, a resilience force generated by deformation of the elastic arm 1201 is used to enable the curved portion 1202 to move away from the transmission portion 10, so that the position-limiting portion 902 is at least partially located in the curved portion 1202, which further realizes automatic hoot-fit between the curved portion 1202 and the position-limiting portion 902. Similarly, as shown in FIG. 15, during the rotation of the transmission portion 10 relative to the brush disc 8 in the first direction, after the curved portion 1202 abuts against the position-limiting portion 902, after being forced, the curved portion 1202 enables the elastic arm 1201 to move towards the transmission portion 10, so that the curved portion 1202 avoids the position-limiting portion 902, and the position-limiting portion 902 is disengaged from the curved portion 1202. Afterwards, along with the rotation of the transmission portion 10 relative to the brush disc 8 in the second direction, a resilience force generated by deformation of the elastic arm 1201 is used to enable the curved portion 1202 to move away from the transmission portion, completing separation of the position-limiting portion 902 from the curved portion 1202, so that the curved portion 1202 and the position-limiting portion 902 are unhooked.

[0077] As shown in FIGs. 8 and 9, in the case where each engagement body 9011 is provided with the first clamping groove 9013 on the first side and the second clamping groove 9014 on the second side, if it is necessary to rotate the first clamping groove 9013 to be engaged with the adjacent position-limiting pin, the curved portion 1202 is at least partially located above the first clamping groove 9013. If it is necessary to rotate the second clamping groove 9014 to be engaged with the adja-

cent position-limiting pin, the curved portion 1202 is at least partially located above the second clamping groove 9014. A reference may be made to the above descriptions for other hooking and unhooking principles, which will not be repeated herein.

[0078] In some implementations, as shown in FIGs. 8 and 10, the lower portion of the transmission portion 10 is provided with a guiding portion 1003, the brush disc 8 is further provided with an orientating portion 803 that matches the guiding portion 1003, and the transmission portion 10 is engaged with the brush disc 8 via the cooperation between the guiding portion 1003 and the orientating portion 803.

[0079] Through the cooperation between the orientating portion and the guiding portion 1003, engagement between the brush disc 8 and the transmission portion 10 can be realized quickly and accurately to avoid adjusting the relative position of the orientating portion to the brush disc 8, thereby improving the mounting and dismounting efficiency.

[0080] In some embodiments, as shown in FIGs. 6 and 8, the guiding portion 1003 is a protrusion of the transmission portion 10 extending downwards, and the orientating portion 803 is a recess for accommodating the protrusion.

[0081] The engagement between the brush disc 8 and the transmission portion 10 can be realized only by extending the protrusion into the recess, and the separation of the brush disc 8 from the transmission portion 10 can be realized by only taking the protrusion out of the recess, which is not only convenient for engagement, but also simple in structure and convenient to manufacture.

[0082] In the lifting and lowering apparatus according to this embodiment, the driving portion 3 may be specifically connected in different ways, one is that a driving end of the driving portion 3 is rotationally connected to the first connecting rod 201, another is that the driving end of the driving portion 3 is rotationally connected to the second connecting rod 202, and yet another is that the driving end of the driving portion 3 is rotationally connected to the synchronous linkage assembly 1. Either way, the driving end of the driving portion 3 may drive the first connecting rod 201 and the second connecting rod 202 to rotate simultaneously. Further, the bottom of the driving portion 3 is rotationally connected to the main body 7. In some embodiments, the main body 7 is provided with a first bracket 4, and the bottom of the driving portion 3 is rotationally connected to the first bracket 4. In this way, the complexity in manufacturing the main body 7 can be reduced, and the production of the main body 7 is facilitated.

[0083] When the sweeping apparatus needs to be lifted and lowered, the driving end of the driving portion 3 drives the first connecting rod 201 and the second connecting rod 202 to rotate simultaneously, so that the first connecting rod 201 and the second connecting rod 202 are displaced in the horizontal direction and the vertical direction, and the sweeping apparatus is driven to be lifted

and be lowered by the displacement generated in the vertical direction. The horizontal direction is parallel to a chassis 701 of the main body 7, and the vertical direction is perpendicular to the chassis 701 of the main body 7. The driving portion 3 may be a linear motor, or an electric push rod, or the like, which is not strictly limited in the embodiments. In the embodiments, the driving portion 3 drives the first connecting rod 201 to rotate, so that the sweeping apparatus can be lifted and lowered relative to the main body 7. In this way, the space occupied by the lifting and lowering apparatus in the vertical direction can be reduced, such that the size of the self-moving cleaning device is reduced, and miniaturization of the self-moving cleaning device is facilitated.

[0084] As shown in FIGs. 2 to 5, a rotational connection between the first connecting rod 201 and the main body 7 and a rotational connection between the second connecting rod 202 and the main body 7 are located on the same horizontal plane, such that the space occupied by the first connecting rod 201 and the second connecting rod 202 in the vertical direction is reduced, which reduces the space occupied by the lifting and lowering apparatus in the vertical direction.

[0085] Further, the horizontal plane refers to a surface parallel to the chassis 701 of the main body 7. During the rotation of the first connecting rod 201 and the second connecting rod 202, the ends of the first connecting rod 201 and the second connecting rod 202 connected by means of the synchronous linkage assembly 1 are always located on the same horizontal plane, which can prevent the sweeping apparatus from flipping over after cleaning during lifting and lowering; and this over flip will result in only partial contact of the sweeping apparatus with the surface to be cleaned, which reduces the cleaning effect or causes failure of the cleaning operation.

[0086] In some embodiments, as shown in FIGs. 2 to 4, the first connecting rod 201 includes a first swing arm 2011, a bent portion 2013 and a second swing arm 2012. The bent portion 2013 is connected to one end of the first swing arm 2011 and one end of the second swing arm 2012, the bent portion 2013 is rotationally connected to the main body 7, the other end of the first swing arm 2011 is rotationally connected to the second connecting rod 202 by means of the synchronous linkage assembly 1, and the other end of the second swing arm 2012 is rotationally connected to the driving portion 3.

[0087] The main body 7 may also be provided with a second bracket 5, and the bent portion 2013 is rotationally connected to the second bracket 5, so that the complexity in manufacturing the main body 7 can be reduced, and the production of the main body 7 is facilitated.

[0088] When the sweeping apparatus needs to be lifted and lowered, the driving end of the driving portion 3 drives the second swing arm 2012 to rotate, and the second swing arm 2012 drives the first swing arm 2011 to rotate by means of the bent portion 2013. Afterwards, the second connecting rod 202 is driven to rotate by means of the synchronous linkage assembly 1, such that the

sweeping apparatus is driven to be lifted and be lowered via the displacement generated by the first swing arm 2011 and the second connecting rod 202 in the vertical direction.

[0089] The first swing arm 2011 and the second swing arm 2012 form an included angle. In this way, the second swing arm 2012 may rotate at a smaller angle to drive the first swing arm 2011 to rotate, thereby reducing the driving stroke of the driving portion 3. Moreover, the length of the first swing arm 2011 is greater than that of the second swing arm 2012, which can increase the movement height of the first swing arm 2011 in the vertical direction, so that the cleaning apparatus may have a larger lifting and lowering height to meet the requirements for different lifting and lowering heights.

[0090] Further, as shown in FIGs. 3 to 5, the first connecting rod 201 is at least partially arranged horizontally parallel to the second connecting rod 202. By taking the first connecting rod 201 in the foregoing embodiment as an example, the second connecting rod 202 is arranged horizontally parallel to the first swing arm 2011. Here, horizontally parallel means that the two links are rotationally connected to the main body 7 at the same level, and it is ensured that the first connecting rod 201 is at least partially arranged parallel to the second connecting rod 202.

[0091] The first connecting rod 201 is at least partially arranged horizontally parallel to the second connecting rod 202. Therefore, the space occupied by the lifting and lowering apparatus in the vertical direction is reduced, and thus, the size of the self-moving cleaning device is reduced, which facilitates miniaturization of the self-moving cleaning device, ensures smooth linkage of the connecting rod mechanism and prevents the first connecting rod 201 and the second connecting rod 202 from mutual interference.

[0092] Further, as shown in FIGs. 2 to 4, the first connecting rod 201 is located on a first vertical plane, the second connecting rod 202 is located on a second vertical plane, and the first vertical plane and the second vertical plane are different vertical planes parallel to each other.

[0093] The first vertical plane and the second vertical plane are surfaces perpendicular to the horizontal plane. The first connecting rod 201 and the second connecting rod 202 are located on the different vertical planes parallel to each other, which prevents the first connecting rod 201 and the second connecting rod 202 from mutual interference during rotation, and ensures smooth rotation of the first connecting rod 201 and the second connecting rod 202. Moreover, the projection of the second connecting rod 202 onto the first vertical plane is at least partially located in the area between the first swing arm 2011 and the second swing arm 2012. In this way, the space occupied by the first connecting rod 201 and the second connecting rod 202 coincides with other, so that the space occupied by the first connecting rod 201 and the second connecting rod 202 in the horizontal direction is reduced. Meanwhile, the total displacement of the first

connecting rod 201 and the second connecting rod 202 in the horizontal direction can also be reduced, such that the space occupied by the lifting and lowering apparatus in the horizontal direction is further reduced.

[0094] Further, the included angle is 90° . Setting the included angle between the first swing arm 2011 and the second swing arm 2012 to 90° can facilitate the manufacture of the first connecting rod 201.

[0095] In the foregoing embodiments, as shown in FIGs. 1, 3 and 5, there are two sets of connecting rod mechanisms 2, and the two sets of connecting rod mechanisms 2 are symmetrically arranged on two sides of the synchronous linkage assembly 1 respectively.

[0096] The connecting rod mechanisms 2 are symmetrically arranged in two sets, which avoids the problem of unbalanced force exertion caused by the fact that the first connecting rod 201 and the second connecting rod 202 are not coplanar, and meanwhile improves the overall strength of the lifting and lowering apparatus.

[0097] Specifically, as shown in FIGs. 1, 3 and 5, the synchronous linkage assembly 1 includes a first synchronizing shaft 101, a second synchronizing shaft 102, a third synchronizing shaft 103 and a connector 104, and the connector 104 is rotationally connected to the first synchronizing shaft 101 and the second synchronizing shaft 102. One ends of the first connecting rods 201 of the two sets of connecting rod mechanisms 2 are rotationally connected by means of the first synchronizing shaft 101, and the other ends thereof are rotationally connected by means of the second synchronizing shaft 102; and the second connecting rods 202 of the two sets of connecting rod mechanisms 2 are rotationally connected by means of the third synchronizing shaft 103. The driving portion 3 is rotationally connected to the first synchronizing shaft 101.

[0098] The connector 104 is a connecting plate with a first thickness, and the middle of the connecting plate may be set to a hollow structure, such that the weight of the connector 104 is reduced. The two opposite sides of the connecting plate may be respectively provided with a first through hole for the first synchronizing shaft 101 to pass through and a second through hole for the second synchronizing shaft 102 to pass through. In this way, the connection between the first synchronizing shaft 101 and the second synchronizing shaft 102 can be completed by enabling the first synchronizing shaft 101 to pass through the first through hole and the second synchronizing shaft 102 to pass through the second through hole, which is not only stable in connection, but also convenient in mounting.

[0099] The driving end of the driving portion 3 is rotationally connected to the middle of the first synchronizing shaft 101, so that the two sets of connecting rod mechanisms 2 are subject to the same driving force, which ensures the synchronization of rotation and enables the lifting and lowering apparatus to work more smoothly.

[0100] In this embodiment, as shown in FIGs. 2 and 3, extended movement is conducted by the driving end of

the driving portion 3, then the first connecting rod 201 is driven to rotate counterclockwise by the first synchronizing shaft 101, and at the same time, the first connecting rod 201 drives the second connecting rod 202 to rotate counterclockwise by linkage of the second synchronizing shaft 102, the third synchronizing shaft 103 and the connector 104, such that the sweeping apparatus is driven to be lifted. Similarly, as shown in FIGs. 4 and 5, shortened movement is conducted by the driving end of the driving portion 3, then the first connecting rod 201 is driven to rotate clockwise by the first synchronizing shaft 101, and at the same time, the first connecting rod 201 drives the second connecting rod 202 to rotate clockwise by linkage of the second synchronizing shaft 102, the third synchronizing shaft 103 and the connector 104, such that the sweeping apparatus is driven to be lowered.

[0101] In order to ensure that the lowering height of the sweeping apparatus adapts to actual needs, in some implementations, as shown in FIGs. 2 to 5, the connecting rod mechanism 2 further includes a position-limiting portion 6 mounted on the main body 7, and the position-limiting portion is configured to prevent the first connecting rod 201 and the second connecting rod 202 from rotating so as to limit the lowering height of the sweeping apparatus.

[0102] The position-limiting portion 6 is located on the side of the first synchronizing shaft 101 close to the driving portion 3, and the position-limiting portion 6 may be a baffle with a certain height so as to play a role of limiting the first synchronizing shaft 101. In order to avoid interference with driving motion of the driving portion, the position-limiting portion 6 may be arranged near the end portion of the first synchronizing shaft 101.

[0103] As shown in FIGs. 4 and 5, the first synchronizing shaft 101 is prevented from rotating by providing the position-limiting portion 6, so that the rotation of the first connecting rod 201 and the second connecting rod 202 is limited. In this way, the sweeping apparatus cannot continue to be lowered after being lowered to a preset position, which achieves precise control of the lowering height of the sweeping apparatus. By adjusting the distance between the position-limiting portion 6 and the first synchronizing shaft 101, the lowering height of the sweeping apparatus may be adjusted, i.e., the closer the position-limiting portion 6 is to the first synchronizing shaft 101, the smaller the angle of rotation of the first connecting rod 201 and the second connecting rod 202 is, the smaller the lowering height of the sweeping apparatus is; and the farther the position-limiting portion 6 is from the first synchronizing shaft 101, the greater the angle of rotation of the first connecting rod 201 and the second connecting rod 202 is, the greater the lowering height of the sweeping apparatus is. The staff can determine the distance between the position-limiting portion 6 and the first synchronizing shaft according to actual needs.

[0104] Further, as shown in FIGs. 2 to 5, the second connecting rod 202 is rotationally connected to the lower

portion of the stop portion, so that it is unnecessary to separately equip the second connecting rod 202 with a hinge bracket, which simplifies the structure and enables the structure to be more compact.

[0105] In the foregoing embodiment, as shown in FIGs. 1 to 5, the synchronous linkage assembly 1 further includes mounting bases 105 arranged at two ends of the second synchronizing shaft 102 and the third synchronizing shaft 103, and the mounting bases 105 are connected to the sweeping apparatus.

[0106] The mounting bases 105 are arranged at the two ends of the second synchronizing shaft 102 and the third synchronizing shaft 103, which can not only ensure the stability of connection between the lifting and lowering apparatus and the sweeping apparatus, but also enable the sweeping apparatus to be forced uniformly. Thus, the sweeping apparatus is prevented from tilting in the process of lifting and lowering.

[0107] Regarding the self-moving cleaning device in the foregoing embodiments, a lifting method for a self-moving cleaning device is provided according to an embodiment of the present invention, and includes:

[0108] S101: controlling a driving portion to drive a first connecting rod and a second connecting rod to rotate in a first direction, so as to lift a sweeping apparatus.

[0109] In some embodiments, S101 includes: S1011: controlling the driving portion 3 to drive the first connecting rod 201 to rotate around a first rotational connection point in the first direction, and driving, by means of a synchronous linkage assembly 1, the second connecting rod 202 to rotate around a second rotational connection point in the first direction, so as to lift the sweeping apparatus.

[0110] In some embodiments, S1011 specifically includes:

S10111: controlling the driving portion 3 to drive a second swing arm 2012 of the first connecting rod 201 to rotate around the first rotational connection point in the first direction, driving, by means of the second swing arm 2012, a first swing arm 2011 of the first connecting rod 201 to rotate around the first rotational connection point in the first direction, and driving, by means of the synchronous linkage assembly 1, the second connecting rod 202 to rotate around the second rotational connection point in the first direction to lift the sweeping apparatus.

[0111] Regarding the self-moving cleaning device in the foregoing embodiments, a lowering method for a self-moving cleaning device is provided according to an embodiment of the present invention, and includes:

S201: controlling a driving portion to drive a first connecting rod and a second connecting rod to rotate in a second direction that is opposite to the first direction, so as to drive a sweeping apparatus to be lowered.

[0112] In some embodiments, S101 includes:

S2011: controlling a driving portion 3 to drive a first connecting rod 201 to rotate around a first rotational connection point in a second direction that is opposite to a first direction, and driving, by means of a synchronous linkage

assembly 1, a second connecting rod 202 to rotate around a second rotational connection point in the second direction that is opposite to the first direction, so as to lower the sweeping apparatus.

[0113] In some embodiments, S1011 specifically includes:

S20111: controlling a driving portion 3 to drive a second swing arm 2012 of the first connecting rod 201 to rotate around the first rotational connection point in the second direction that is opposite to the first direction, driving, by means of the second swing arm 2012, a first swing arm 2011 of the first connecting rod 201 to rotate around the first rotational connection point in the second direction that is opposite to the first direction, and driving, by means of the synchronous linkage assembly 1, the second connecting rod 202 to rotate around a second rotational connection point in the second direction that is opposite to the first direction, so as to lower the sweeping apparatus.

[0114] All the embodiments of the present disclosure can be executed alone or in combination with other embodiments, which are regarded as the scope of protection of the present disclosure.

[0115] The present invention has been described through the above embodiments, but it should be understood that the above embodiments are only for the purpose of illustration and description, and are not intended to limit the present invention to the scope of the described embodiments. In addition, it may be understood by those skilled in the art that the present invention is not limited to the above embodiments, a variety of variations and modifications may be made according to the teaching of the present invention, and these variations and modifications all fall within the scope of protection of the present invention. The scope of protection of the present invention is defined by the appended claims and its equivalent scope.

Claims

1. A self-moving cleaning device, comprising a main body, a sweeping apparatus and a lifting and lowering apparatus, wherein the sweeping apparatus is connected to the main body by means of the lifting and lowering apparatus; the lifting and lowering apparatus comprises a synchronous linkage assembly, a connecting rod mechanism and a driving portion, the connecting rod mechanism comprises a first connecting rod and a second connecting rod, the first connecting rod and the second connecting rod are rotationally connected to the main body around an axis in a horizontal direction, the first connecting rod is rotationally connected to the second connecting rod by means of the synchronous linkage assembly; and the driving portion is configured to drive the first connecting rod to enable the sweeping apparatus to be lifted and lowered relative to the main body.

2. The self-moving cleaning device according to claim 1, wherein a location where the first connecting rod and the main body are rotationally connected and a location where the second connecting rod and the main body are rotationally connected are located on the same horizontal plane. 5
3. The self-moving cleaning device according to claim 2, wherein the first connecting rod comprises a first swing arm, a bent portion and a second swing arm, the bent portion is respectively connected to one end of the first swing arm and one end of the second swing arm, the bent portion is rotationally connected to the main body, the other end of the first swing arm is rotationally connected to the second connecting rod by means of the synchronous linkage assembly, and the other end of the second swing arm is rotationally connected to the driving portion. 10
4. The self-moving cleaning device according to claim 3, wherein the first connecting rod is located on a first vertical plane, the second connecting rod is located on a second vertical plane, and the first vertical plane and the second vertical plane are different vertical planes parallel to each other. 15
5. The self-moving cleaning device according to claim 3, wherein the first connecting rod is at least partially arranged horizontally parallel to the second connecting rod. 20
6. The self-moving cleaning device according to claim 2, wherein a number of the connecting rod mechanisms is two sets, and the two sets of connecting rod mechanisms are symmetrically arranged on two sides of the synchronous linkage assembly, respectively. 25
7. The self-moving cleaning device according to claim 6, wherein the synchronous linkage assembly comprises a first synchronizing shaft, a second synchronizing shaft, a third synchronizing shaft and a connector, wherein the connector is rotationally connected to the first synchronizing shaft and the second synchronizing shaft; one ends of the first connecting rods of the two sets of connecting rod mechanisms are rotationally connected by means of the first synchronizing shaft, and the other ends of first connecting rods of the two sets of connecting rod mechanisms are rotationally connected by means of the second synchronizing shaft; the second connecting rods of the two sets of connecting rod mechanisms are rotationally connected by means of the third synchronizing shaft; and the driving portion is rotationally connected to the first synchronizing shaft. 30
8. The self-moving cleaning device according to claim 7, wherein the connecting rod mechanism further comprises a position-limiting portion mounted on the main body, the position-limiting portion is configured to prevent the first connecting rod and the second connecting rod from rotating so as to limit a lowering height of the sweeping apparatus. 35
9. The self-moving cleaning device according to claim 8, wherein the second connecting rod is rotationally connected to a lower portion of the position-limiting portion. 40
10. The self-moving cleaning device according to claim 7, wherein the synchronous linkage assembly further comprises mounting bases arranged at two ends of the second synchronizing shaft and the third synchronizing shaft, the mounting bases are connected to the sweeping apparatus. 45
11. A lifting method for a self-moving cleaning device, comprising: 50

controlling a driving portion to drive a first connecting rod and a second connecting rod to rotate in a first direction, so as to lift a sweeping apparatus,

wherein the self-moving cleaning device comprises a main body, the sweeping apparatus and a lifting and lowering apparatus; the sweeping apparatus is connected to the main body by means of the lifting and lowering apparatus; and the lifting and lowering apparatus comprises a synchronous linkage assembly, a connecting rod mechanism and the driving portion, the connecting rod mechanism comprises the first connecting rod and the second connecting rod, the first connecting rod and the second connecting rod are rotationally connected to the main body around an axis in a horizontal direction, and the first connecting rod is rotationally connected to the second connecting rod by means of the synchronous linkage assembly. 55
12. The lifting method according to claim 11, wherein controlling the driving portion to drive the first connecting rod and the second connecting rod to rotate in the first direction, so as to lift the sweeping apparatus comprises:

controlling the driving portion to drive the first connecting rod to rotate around a first rotational connection point in the first direction, and driving, by means of the synchronous linkage assembly, the second connecting rod to rotate around a second rotational connection point in the first direction, so as to lift the sweeping apparatus. 60
13. The lifting method according to claim 11, wherein controlling the driving portion to drive the first con- 65

necting rod and the second connecting rod to rotate in the first direction, so as to lift the sweeping apparatus comprises:

controlling the driving portion to drive a second swing arm of the first connecting rod to rotate around a first rotational connection point in the first direction; driving, by means of the second swing arm, a first swing arm of the first connecting rod to rotate around the first rotational connection point in the first direction; and driving, by means of the synchronous linkage assembly, the second connecting rod to rotate around a second rotational connection point in the first direction, so as to lift the sweeping apparatus.

14. A lowering method for a self-moving cleaning device, comprising:

controlling a driving portion to drive a first connecting rod and a second connecting rod to rotate in a second direction opposite to a first direction, so as to lower a sweeping apparatus, wherein the self-moving cleaning device comprises a main body, the sweeping apparatus and a lifting and lowering apparatus; the sweeping apparatus is connected to the main body by means of the lifting and lowering apparatus; and the lifting and lowering apparatus comprises a synchronous linkage assembly, a connecting rod mechanism and the driving portion, the connecting rod mechanism comprises the first connecting rod and the second connecting rod, the first connecting rod and the second connecting rod are rotationally connected to the main body around an axis in a horizontal direction, and the first connecting rod is rotationally connected to the second connecting rod by means of the synchronous linkage assembly.

15. The lowering method according to claim 14, wherein controlling the driving portion to drive the first connecting rod and the second connecting rod to rotate in the second direction opposite to the first direction, so as to lower the sweeping apparatus comprises: controlling the driving portion to drive the first connecting rod to rotate around a first rotational connection point in the second direction opposite to the first direction, and driving, by means of the synchronous linkage assembly, the second connecting rod to rotate around a second rotational connection point in the second direction opposite to the first direction, so as to lower the sweeping apparatus.

16. The lowering method according to claim 14, wherein controlling the driving portion to drive the first connecting rod and the second connecting rod to rotate in the second direction opposite to the first direction, so as to lower the sweeping apparatus comprises: controlling the driving portion to drive a second swing

arm of the first connecting rod to rotate around a first rotational connection point in the second direction opposite to the first direction, driving, by means of the second swing arm, a first swing arm of the first connecting rod to rotate around the first rotational connection point in the second direction opposite to the first direction, and driving, by means of the synchronous linkage assembly, the second connecting rod to rotate around a second rotational connection point in the second direction opposite to the first direction, so as to lower the sweeping apparatus.

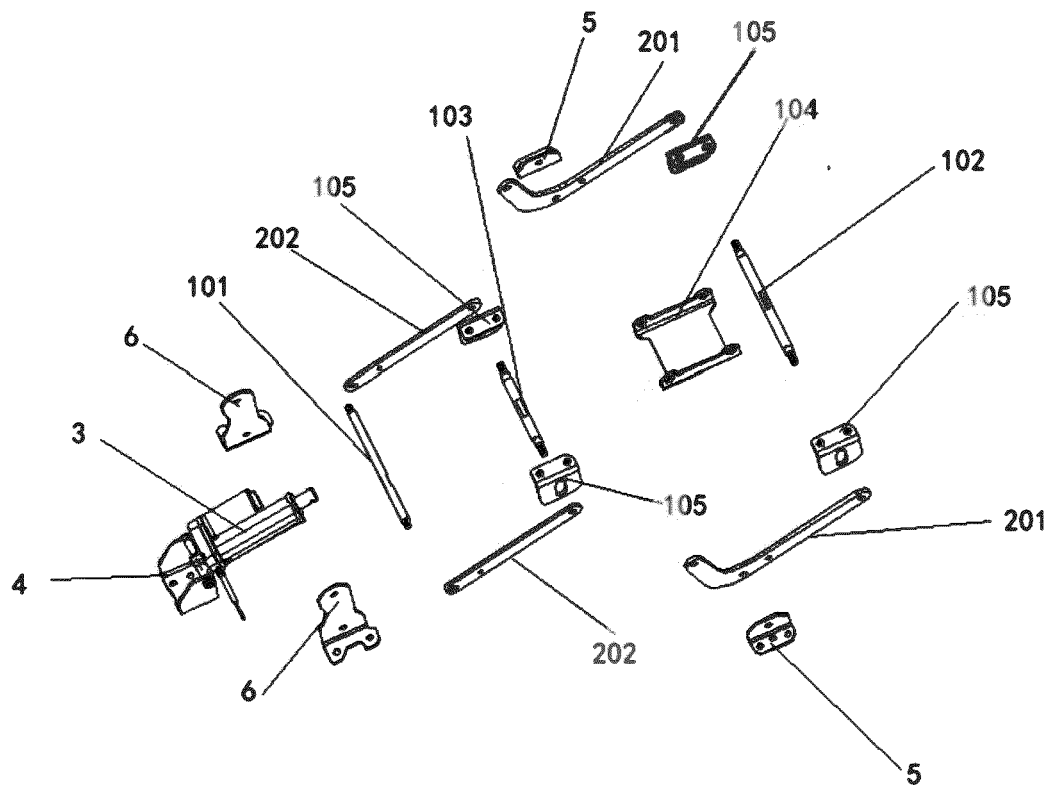


FIG. 1

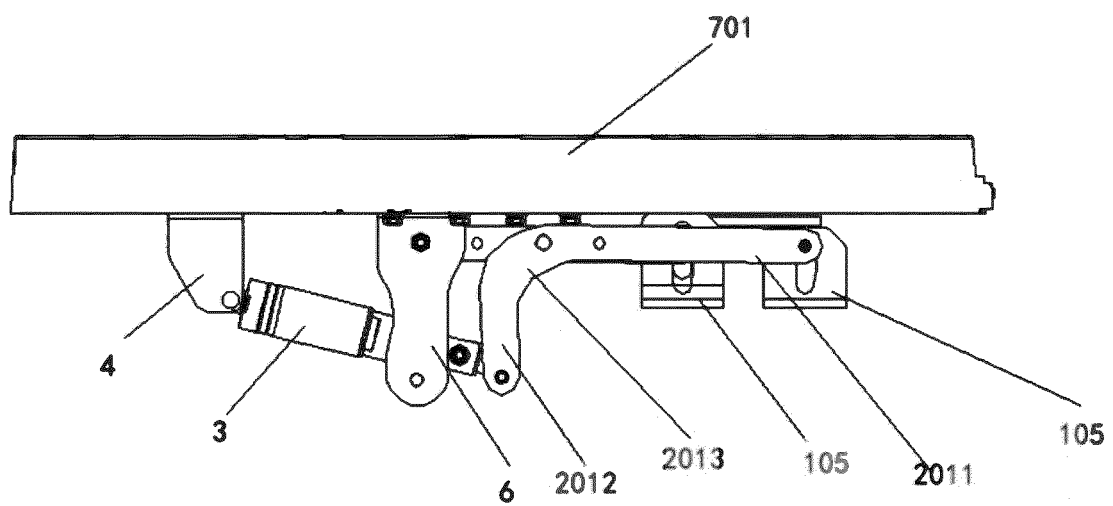


FIG. 2

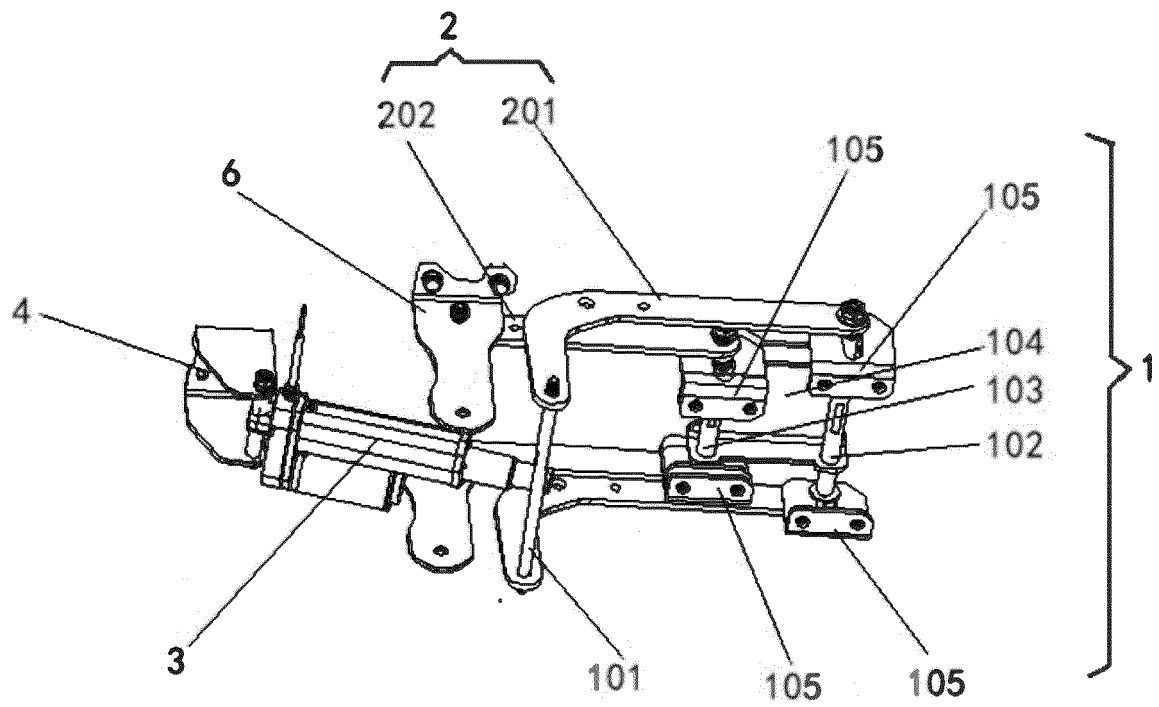


FIG. 3

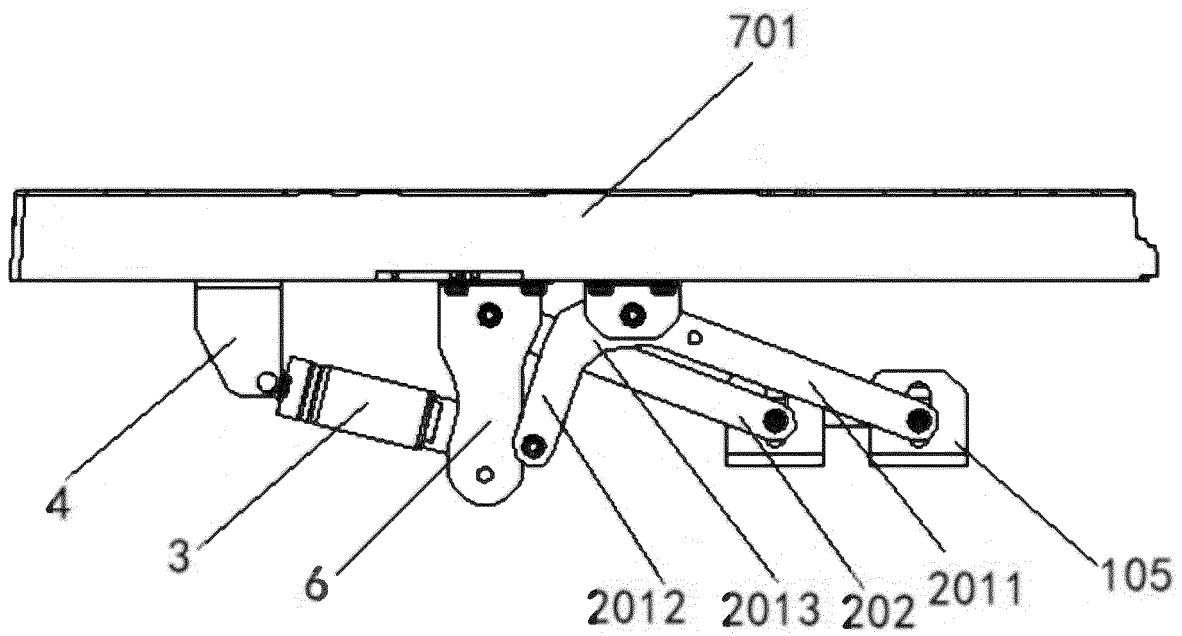


FIG. 4

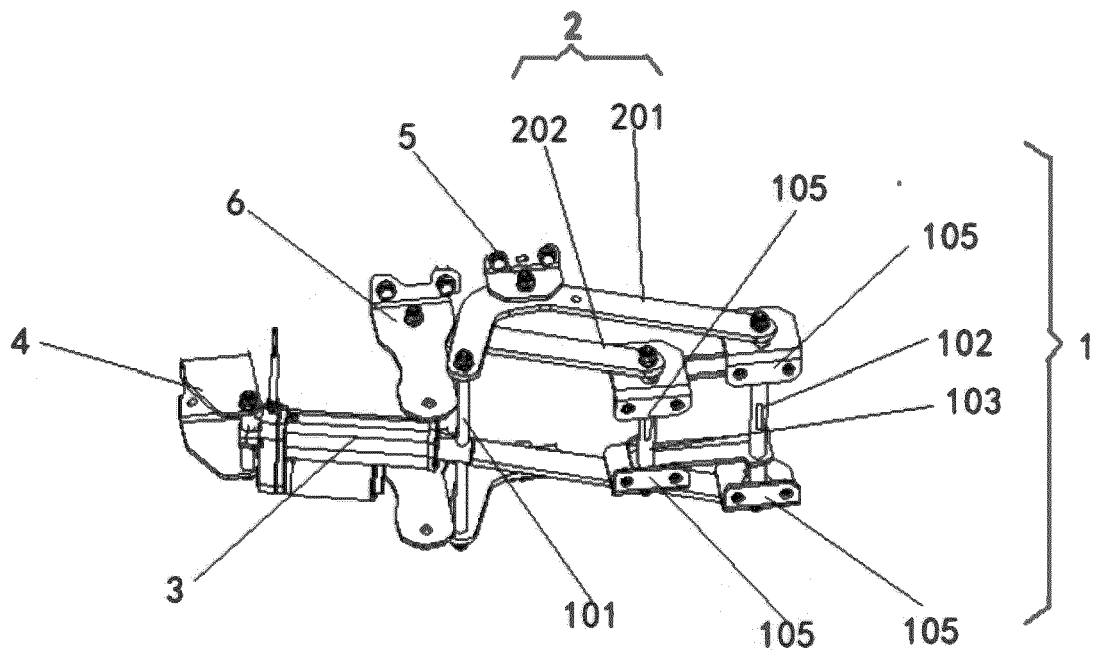


FIG. 5

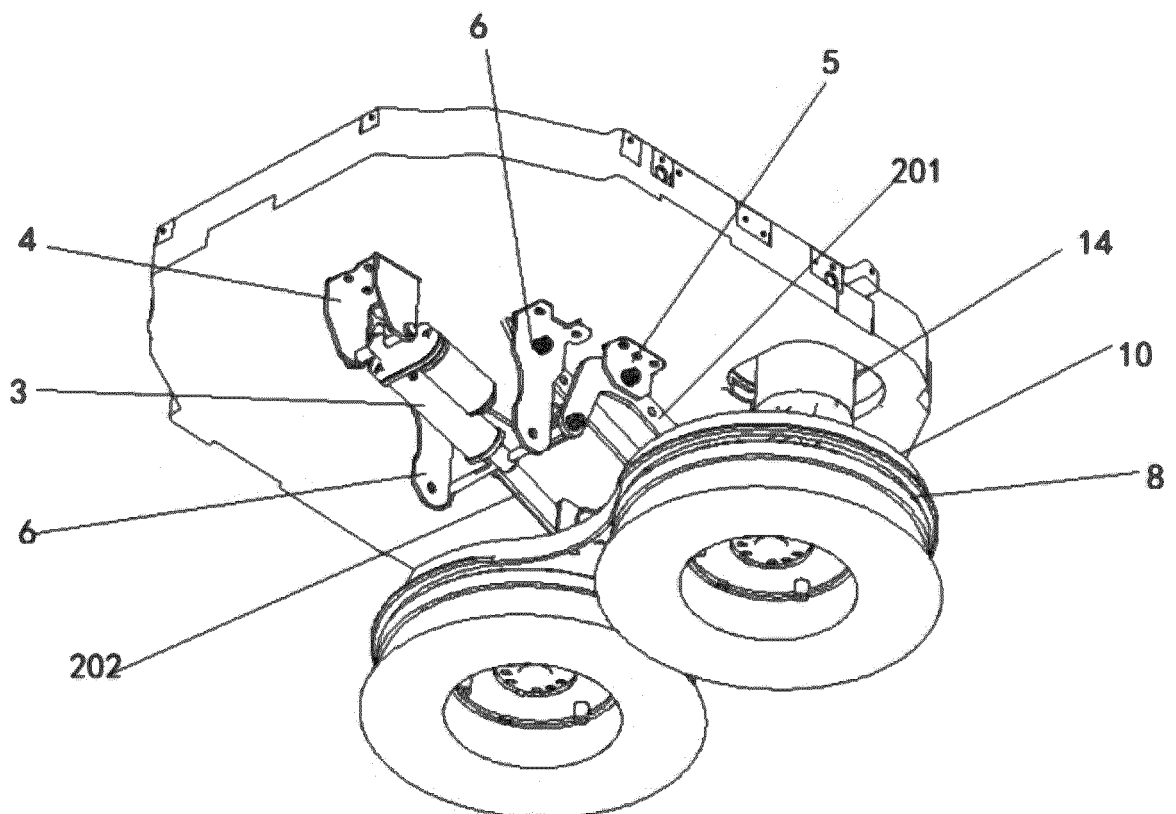


FIG. 6

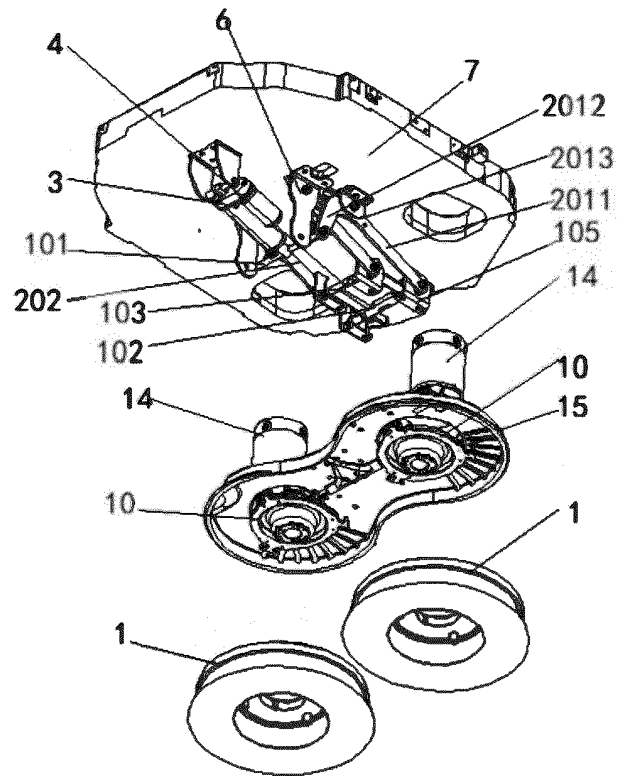


FIG. 7

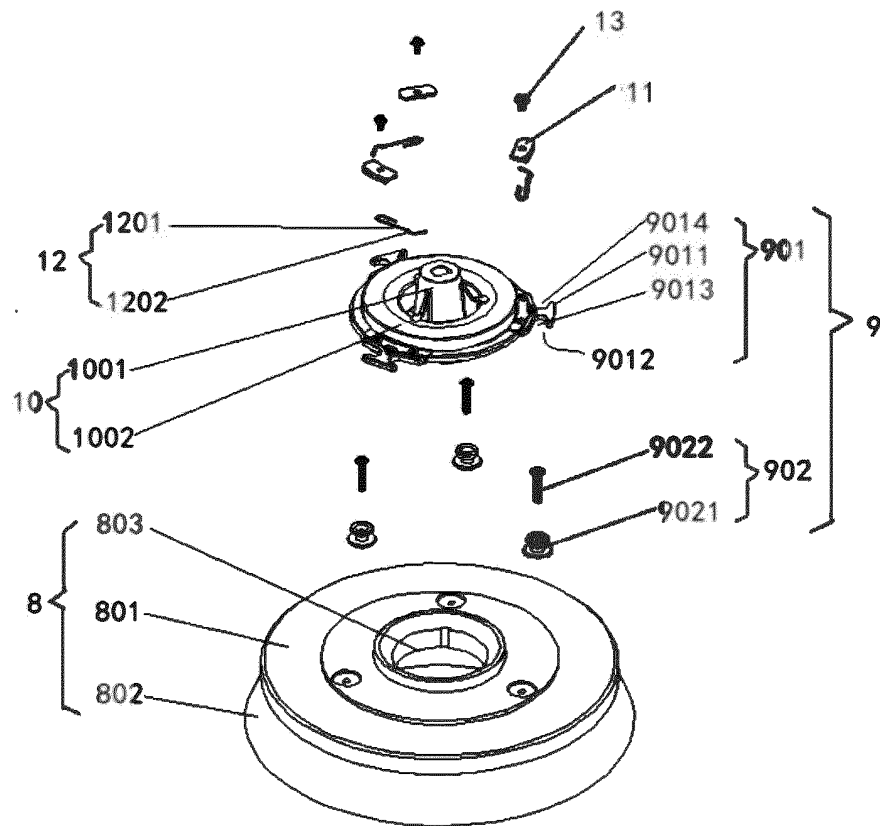


FIG. 8

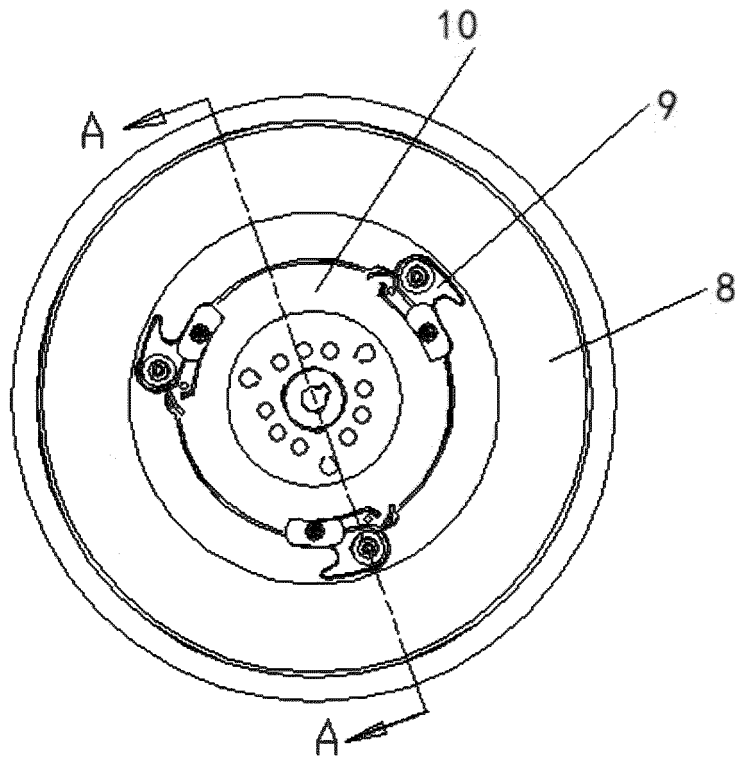


FIG. 9

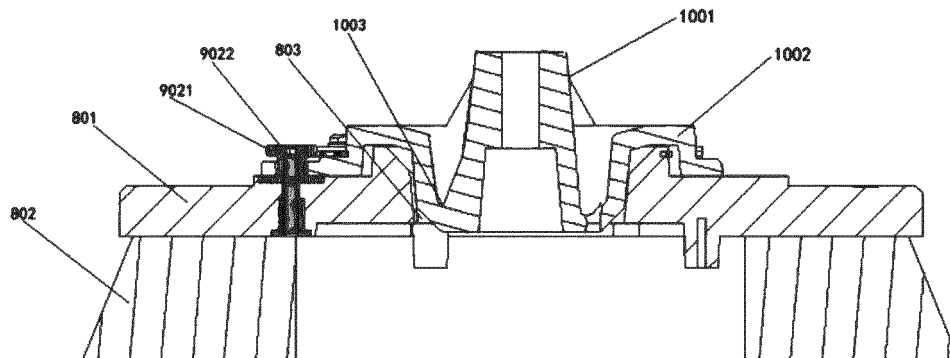
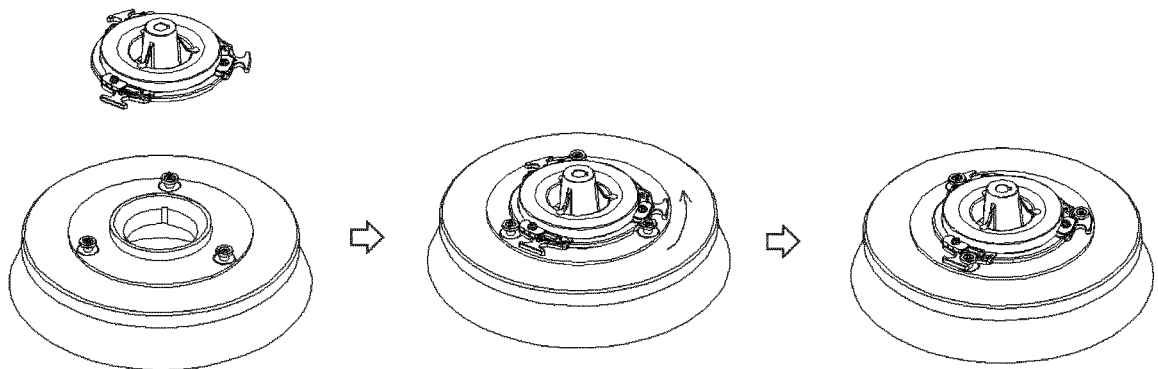
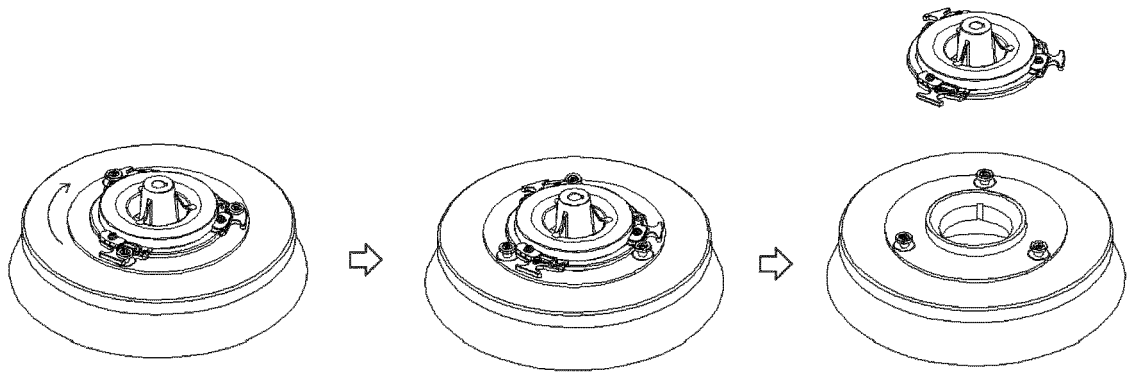


FIG. 10



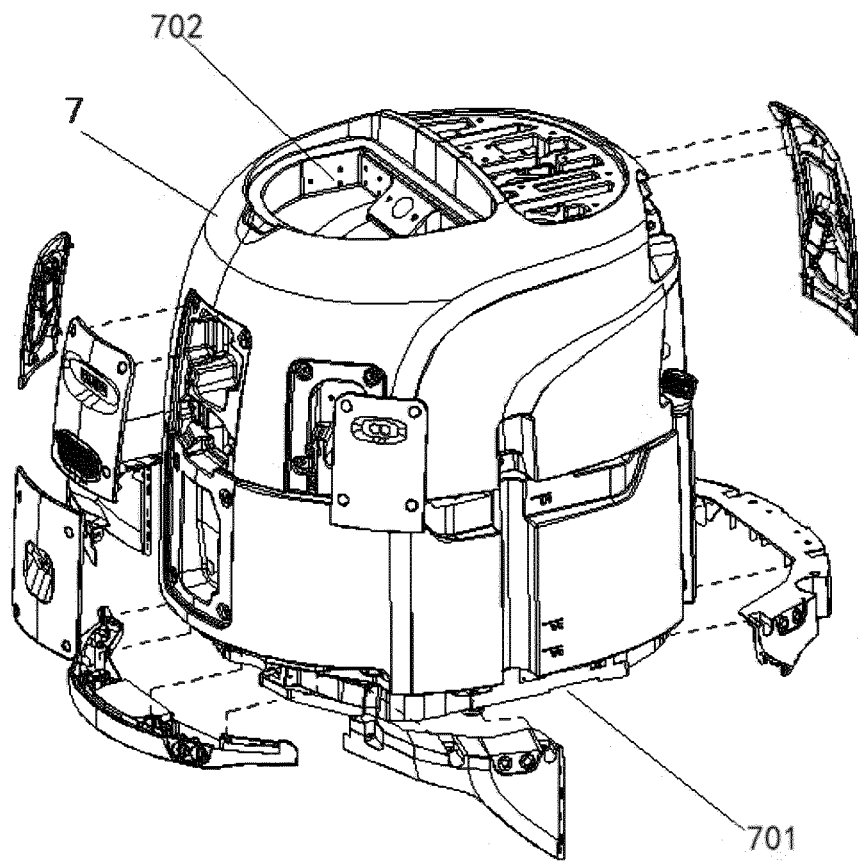


FIG. 13



FIG. 14

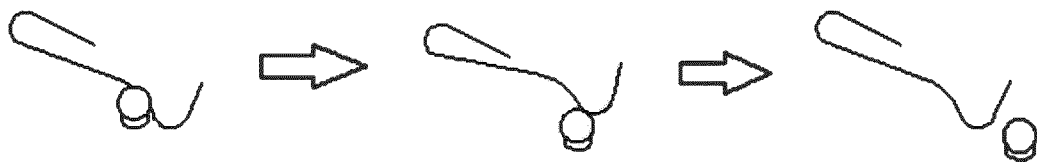


FIG. 15

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2021/127143

A. CLASSIFICATION OF SUBJECT MATTER

A47L 11/40(2006.01)i; A47L 11/24(2006.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A47L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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

CNTXT; CNABS; VEN; WPABSC; ENTXTC: 清洁, 清洗, 清扫, 清除, 扫除, 升降, 提升, 抬升, 抬高, 降低, 传动, 联动, 连杆, clean+, sweep+, mop+, wip+, elevat+, lift+, up, tansmission, linkage, connecting rod, connecting bar, connecting lever

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 110215166 A (SUZHOU GAOZHIXIAN AUTOMATION TECHNOLOGY CO., LTD. et al.) 10 September 2019 (2019-09-10) description, paragraphs 27-36, and figures 1-8	1-16
X	CN 207755227 U (SHANGHAI JIECHI CLEANING EQUIPMENT CO., LTD.) 24 August 2018 (2018-08-24) description, paragraphs 17-18, and figure 1	1-16
A	CN 108774982 A (ANHUI AIRUITE ENVIRONMENTAL TECHNOLOGY LLC) 09 November 2018 (2018-11-09) entire document	1-16
A	CN 107960952 A (HEFEI UNIVERSITY OF TECHNOLOGY) 27 April 2018 (2018-04-27) entire document	1-16
A	CN 103649415 A (HOWA MACHINERY LTD.) 19 March 2014 (2014-03-19) entire document	1-16
A	CN 110772181 A (SHANGHAI GAUSSIAN AUTOMATION TECHNOLOGY DEVELOPMENT CO., LTD.) 11 February 2020 (2020-02-11) entire document	1-16

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

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

20 December 2021

Date of mailing of the international search report

13 January 2022

Name and mailing address of the ISA/CN

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Authorized officer

Facsimile No. (86-10)62019451

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2021/127143

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 1352066 A (BRITISH MUNICIPAL CORP OF BIRM) 15 May 1974 (1974-05-15) entire document	1-16
PX	CN 113208505 A (BEIJING ROBOROCK TECHNOLOGY CO., LTD.) 06 August 2021 (2021-08-06) claims 1-10, and description, paragraphs 122-133	1-16

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2021/127143

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
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CN 207755227 U	24 August 2018	None	
CN 108774982 A	09 November 2018	None	
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		IN 201311028 P1	26 December 2014
		WO 2013001648 A1	03 January 2013
		JP 5821957 B2	24 November 2015
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GB 1352066 A	15 May 1974	None	
CN 113208505 A	06 August 2021	None	

Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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