(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 4 393 367 A1

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

(43) Date of publication:
03.07.2024 Bulletin 2024/27

(21) Application number: **22860663.8**

(22) Date of filing: **27.08.2022**

(51) International Patent Classification (IPC):
A47L 9/28 *(2006.01)* ***A47L 11/24*** *(2006.01)*
A47L 11/40 *(2006.01)* ***A47L 9/04*** *(2006.01)*
A47L 5/00 *(2006.01)* ***A47L 11/18*** *(2006.01)*

(52) Cooperative Patent Classification (CPC):
A47L 5/00; A47L 9/04; A47L 9/28; A47L 11/18; A47L 11/24; A47L 11/40

(86) International application number:
PCT/CN2022/115335

(87) International publication number:
WO 2023/025317 (02.03.2023 Gazette 2023/09)

(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: **27.08.2021 CN 202111000353**
20.05.2022 CN 202210551234

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(54) CLEANING ROBOT

(57) The present invention relates to a cleaning robot. At least a first cleaning roller brush and a second cleaning roller brush are disposed to perform beating and cleaning on garbage on a to-be-cleaned surface, which is equivalent to beating and cleaning the to-be-cleaned surface at least twice, so that a miss of garbage is effectively prevented. In addition, a high-power fan is used in combination to quickly and effectively suck garbage that is agitated by the cleaning roller brushes into a dust box, thereby greatly improving the cleaning efficiency of the cleaning robot and achieving a better cleaning effect.

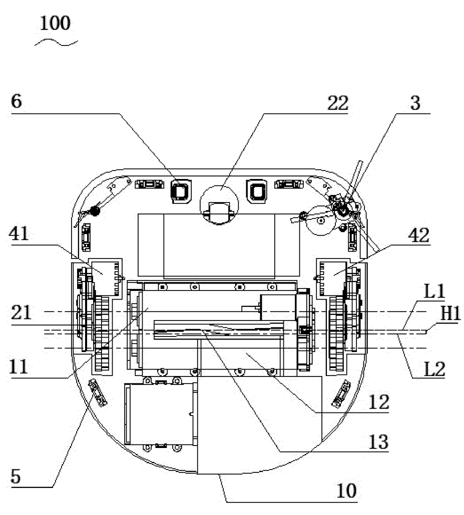

FIG. 1

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Description

TECHNICAL FIELD

[0001] The present invention relates to small household products, and in particular, to a cleaning robot.

BACKGROUND

[0002] With the development of science and technology, robots are playing increasingly important roles in our lives. Household robots, in particular, help to free people from heavy housework. Cleaning robots are relatively widely applicable and are therefore widely popular among users.

[0003] Existing cleaning robots can move autonomously, do not require manual direct control and operations during working, and further have functions such as path planning, automatic obstacle avoidance, human-machine interaction, and return for charging, so that people's daily ground cleaning requirements can be met. When moving autonomously indoors, a cleaning robot uses a vacuum dust suction principle to clean a to-be-cleaned surface on which the cleaning robot has moved. At present, commercially available cleaning robots have an ordinary ground cleaning effect, and especially have a low cleaning efficiency for carpets or mats that are difficult to clean, and as a result such cleaning robots cannot meet users' cleaning requirements.

SUMMARY

[0004] To overcome deficiencies in existing technologies, a problem to be resolved by embodiments of the present disclosure is to provide a cleaning robot with a good cleaning effect.

[0005] A cleaning robot includes: a body, having a front end; a movement mechanism, including at least one driving wheel, and configured to support and drive the cleaning robot to move on a to-be-cleaned ground; a cleaning mechanism, including a roller brush, and configured to perform cleaning work on the to-be-cleaned ground; a dust suction mechanism, including a fan, and configured to suck garbage cleaned off by the cleaning mechanism into the body; a dust collection mechanism, including a dust box, and configured to collect the garbage sucked into the body; and a controller, configured to control the cleaning robot to move on the to-be-cleaned ground, to implement autonomous cleaning of the to-be-cleaned ground, where the roller brush includes at least a first cleaning roller brush and a second cleaning roller brush, the first cleaning roller brush and the second cleaning roller brush are disposed at a bottom of the body, and are at least partially exposed from the body; the first cleaning roller brush and the second cleaning roller brush are configured to clean off garbage on the to-be-cleaned ground during rotation, to facilitate the suction by the dust suction mechanism; and the fan is disposed inside the body, and a power of the fan is greater than or equal to 65 W.

[0006] As an optional implementation, the power of the fan is greater than or equal to 65 W, and is less than 120 W.

[0007] As an optional implementation, a value range of a flow rate at an inlet of the fan when the fan is fully open is 0.7 m^3/min to 0.9 m^3/min; a value range of a flow rate at the inlet of the fan when the fan is fully open is 0.7 m^3/min to 0.9 m^3/min; and a static pressure at the inlet of the fan when the fan is fully blocked ranges from 6.5 Kpa to 12 Kpa.

[0008] As an optional implementation, a fan with a rated input power of 80 W is selected for the fan, and at the rated input power, a degree of vacuum of the fan ranges from 7.6 Kpa to 8.2 Kpa; and a test value of a flow rate at an inlet when the fan is fully open approximately ranges from 0.72 m^3/min to 0.75 m^3/min.

[0009] As an optional implementation, the fan accounts for 0.5% to 1% of a total volume of the cleaning robot.

[0010] As an optional implementation, the body includes a chassis, and a chassis height at a position of the fan is smaller than a chassis height at another position at which the fan is not disposed of the body.

[0011] As an optional implementation, a value range of the chassis height at the position of the fan is 8 mm to 12 mm; and a value range of the chassis height at the another position at which the fan is not disposed of the body is 12 mm to 18 mm.

[0012] As an optional implementation, rotational speeds of the first cleaning roller brush and the second cleaning roller brush are both greater than or equal to 1500 r/min.

[0013] As an optional implementation, the cleaning mechanism includes a roller brush motor configured to drive the first cleaning roller brush and the second cleaning roller brush to rotate, and a value range of a power of the roller brush motor is 30 W to 35 W.

[0014] As an optional implementation, the dust suction mechanism further includes a dust suction port, provided at the bottom of the body; the first cleaning roller brush and the second cleaning roller brush both rotate toward the dust suction port, to agitate garbage in a cleaning region; and the fan sucks the garbage agitated into the body through the dust suction port, and the garbage is collected by the dust box.

[0015] As an optional implementation, the dust suction port is located between the first cleaning roller brush and the second cleaning roller brush, a rotation direction of the first cleaning roller brush is a first direction, a rotation direction of the second cleaning roller brush is a second direction, and the first direction is opposite to the second direction.

[0016] As an optional implementation, the first cleaning roller brush and the second cleaning roller brush are disposed in a traveling direction of the body, a rotation axis of the first cleaning roller brush and a rotation axis of the second cleaning roller brush are parallel to each other, and the rotation axis of the first cleaning roller brush and the rotation axis of the second cleaning roller brush are both perpendicular to a traveling direction of the cleaning robot, where a value range of a length of at least one of the first cleaning roller brush and the second cleaning roller brush in a direction of the rotation axis is 190 mm to 195 mm.

[0017] As an optional implementation, the first cleaning roller brush is a hard roller brush, and the second cleaning roller brush is a bristle roller brush.

[0018] As an optional implementation, a value range of a degree of interference of the first cleaning roller brush is 1.5 mm to 2.5 mm; and a value range of a degree of interference of the second cleaning roller brush is 3 mm to 5 mm, where the degree of interference is a depth by which a cleaning portion of the roller brush extends into an upper surface of the to-be-cleaned ground.

[0019] As an optional implementation, the hard roller brush is a rubber roller brush, and the bristle roller brush includes at least bristles.

[0020] As an optional implementation, in a traveling direction of the body, the first cleaning roller brush is located in front of the second cleaning roller brush.

[0021] As an optional implementation, the cleaning robot further includes the power supply mechanism, including a rechargeable battery, and configured to provide energy to the cleaning robot.

[0022] As an optional implementation, a capacity of the battery ranges from 140 Wh to 200 Wh.

[0023] As an optional implementation, a ratio of a capacity of the battery to a power of the cleaning robot is greater than or equal to 2500 J/W.

[0024] As an optional implementation, a ratio of a capacity of the battery to a volume of the cleaning robot ranges from 0.017 Wh/cm^3 to 0.024 Wh/cm^3; or a ratio of a capacity of the battery to the height of the cleaning robot ranges from 1.2 Wh/mm to 2.1 Wh/mm.

[0025] As an optional implementation, a battery cycle count of the battery for a cleaning robot with a rated input power PE being greater than or equal to 100 W ranges from 640 to 960.

[0026] As an optional implementation, a proportion of a volume of the battery relative to a volume of the cleaning robot is at least 1/25.

[0027] As an optional implementation, the battery has a cylindrical shape, and the battery is disposed on the body in an assembly direction during installation, where the assembly direction is a direction that makes an axis of the battery perpendicular to a horizontal plane.

[0028] As an optional implementation, a percentage of the battery in a total weight of the cleaning robot is greater than or equal to 10%.

[0029] As an optional implementation, the cleaning robot further includes a driving motor configured to drive the movement mechanism to move, and a value range of a power of the driving motor is 4 W to 6 W.

[0030] As an optional implementation, the movement mechanism is configured to drive the cleaning robot to move at a preset movement speed, where a value range of the preset movement speed is 0.1 m/s to 0.2 m/s.

[0031] As an optional implementation, the movement mechanism is configured to: when the to-be-cleaned ground is a soft ground, drive the cleaning robot to move at a first movement speed; and when the to-be-cleaned ground is a hard ground, drive the cleaning robot to move at a second movement speed, where the first movement speed is less than the second movement speed.

[0032] As an optional implementation, a value range of the first movement speed is 0.24 m/s to 0.36 m/s; and a value range of the second movement speed is 0.12 m/s to 0.18 m/s.

[0033] As an optional implementation, an energy input per unit area of the cleaning robot is at least 4000 J/m^2.

[0034] As an optional implementation, a ratio of an energy input per unit area of the cleaning robot to a height of the cleaning robot is greater than or equal to 11.7 Wh/m^3; or a ratio of an energy input per unit area of the cleaning robot to a volume of the cleaning robot is greater than or equal to 158.7 Wh/m^5.

[0035] As an optional implementation, the movement mechanism is configured to drive the cleaning robot to move at a preset movement speed, where a ratio of a power of the cleaning robot to the preset movement speed is at least 50 J/m.

[0036] As an optional implementation, the movement mechanism is configured to drive the cleaning robot to move at a preset movement speed, where a proportion of a sum of the power of the fan and a power of a roller brush motor configured to drive the roller brush to rotate relative to the preset movement speed is at least 45 J/m.

[0037] As an optional implementation, the cleaning robot further includes a driving motor, disposed in the body, and configured to drive the movement mechanism to rotate, where a proportion of a sum of the power of the fan and a power of a roller brush motor configured to drive the roller brush to rotate relative to a power of the driving motor is at least 15.

[0038] As an optional implementation, for a standard test carpet, a cleaning efficiency of the cleaning robot is greater than or equal to 80%.

[0039] As an optional implementation, for a standard test carpet, a ratio of a cleaning efficiency of the cleaning robot to a height of the cleaning robot is greater than or equal to 7/m; or for a standard test carpet, a ratio of a cleaning efficiency of the cleaning robot to a volume of the cleaning robot is greater than or equal to $72.7/m^3$.

[0040] As an optional implementation, for a standard test carpet, a ratio of a cleaning efficiency of the cleaning robot to a power of the cleaning robot is greater than or equal to 0.004/W.

[0041] As an optional implementation, a power of the cleaning robot is at least 100 W.

[0042] As an optional implementation, a ratio of a power of the cleaning robot to a volume of the cleaning robot is at least 0.01 W/cm^3.

[0043] As an optional implementation, the cleaning robot has a hard ground cleaning mode and a soft ground cleaning mode,

where a power of the cleaning robot in the hard ground cleaning mode is less than or equal to a power of the cleaning robot in the soft ground cleaning mode.

[0044] As an optional implementation, the power of the cleaning robot in the soft ground cleaning mode ranges from 105 W to 155 W; and the power of the cleaning robot in the hard ground cleaning mode ranges from 60 W to 100 W.

[0045] As an optional implementation, a ratio of the power of the cleaning robot in the soft ground cleaning mode to the power of the cleaning robot in the hard ground cleaning mode ranges from 1.55 to 1.75.

[0046] As an optional implementation, the cleaning robot further includes a ground detection mechanism, detecting a ground type of the to-be-cleaned ground.

[0047] As an optional implementation, the controller is configured to control the cleaning robot according to the ground type of the to-be-cleaned ground to switch to a corresponding ground cleaning mode.

[0048] The present application further provides a cleaning robot, including: a body, having a front end; a movement mechanism, supporting and driving the cleaning robot to move on a to-be-cleaned ground; a beating mechanism, performing beating work on the to-be-cleaned ground; a dust suction mechanism, sucking garbage agitated by the beating mechanism into the body; a dust collection mechanism, collecting the sucked garbage; and a power supply mechanism, providing energy to the cleaning robot, where the cleaning robot has a first cleaning effect, the first cleaning effect is used for representing a cleaning effect produced by cleaning the to-be-cleaned ground once by the cleaning robot by using the beating mechanism and the dust suction mechanism and driven by the movement mechanism, where the first cleaning effect is represented by a single-time cleaning efficiency; and for a standard test carpet, a ratio of the single-time cleaning efficiency of the cleaning robot to a height of the cleaning robot is greater than or equal to 7/m.

[0049] Beneficial effects of the present invention lie in that for a cleaning robot of the present application, at least a first cleaning roller brush and a second cleaning roller brush are disposed to perform beating and cleaning on garbage on a to-be-cleaned surface, which is equivalent to beating and cleaning the to-be-cleaned surface at least twice, so that a miss of garbage is effectively prevented. In addition, a fan with a power greater than 65 W is used in combination to quickly and effectively suck garbage that is agitated by the cleaning roller brushes into a dust box, thereby greatly improving a cleaning efficiency of the cleaning robot and achieving a better cleaning effect.

[0050] The foregoing description is merely the general description of the technical solutions of the present invention. For clearer understanding of the technical measures of the present invention and implementation according to the content of the description, the preferred implementations of the present invention are described below in detail with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0051] The foregoing objectives, technical solutions, and beneficial effects of the present invention can be clearly obtained with reference to the following detailed description that can be used to implement specific embodiments of the present invention in combination with the description of the accompanying drawings.

[0052] The same numerals and symbols in the accompanying drawings and description are used to represent the same or equivalent elements.

FIG. 1 is a bottom view of a cleaning robot in an implementation according to the present application;

FIG. 2 is a schematic diagram of an internal structure of the cleaning robot shown in FIG. 1;

FIG. 3a is a side view of a cleaning roller brush and a first driving assembly of a cleaning robot according to an implementation of the present application;

FIG. 3b is a view of the cleaning roller brush and the first driving assembly of the cleaning robot shown in FIG. 3a from another viewing angle;

FIG. 4a is a side view of a cleaning roller brush and a first driving assembly of a cleaning robot according to an implementation of the present application;

FIG. 4b is a view of the cleaning roller brush and the first driving assembly of the cleaning robot shown in FIG. 4a from another viewing angle;

FIG. 5 is a schematic diagram of a cleaning robot parking at a base station to perform wired charging according to an implementation of the present application;

FIG. 6 is a schematic diagram of a cleaning robot parking at a base station to perform wireless charging according to an implementation of the present application;

FIG. 7 is a schematic diagram of a path along which a cleaning robot moves to clean a second type surface twice according to an implementation of the present application;

FIG. 8 is a curve graph of a cleaning efficiency of a carpet when a single cleaning roller brush is disposed and two cleaning roller brushes are disposed in a cleaning robot in an experimental process according to the present application;

FIG. 9 is a comparison diagram of a cleaning efficiency of a carpet when a single cleaning roller brush is disposed and two cleaning roller brushes are disposed in a cleaning robot with a same rotational speed, different materials, and different powers of a fan in an experimental process according to the present application;

FIG. 10a is a curve graph of impacts of a rotational speed of a single cleaning roller brush made of a first material (labeled in brackets) and a power of a fan on a cleaning efficiency of a carpet when the cleaning roller brush is disposed in a cleaning robot in an experimental process according to the present application;

FIG. 10b is a curve graph of impacts of a rotational speed of a single cleaning roller brush made of a second material (labeled in brackets) and a power of a fan on a cleaning efficiency of a carpet when the cleaning roller brush is disposed in a cleaning robot in an experimental process according to the present application;

FIG. 10c is a curve graph of impacts of rotational speeds of two cleaning roller brushes made of a first material labeled in the brackets and a power of a fan on a cleaning efficiency of a carpet when the cleaning roller brushes are disposed in a cleaning robot in an experimental process according to the present application;

FIG. 10d is a curve graph of impacts of rotational speeds of two cleaning roller brushes made of a second material labeled in the brackets and a power of a fan on a cleaning efficiency of a carpet when the cleaning roller brushes are disposed in a cleaning robot in an experimental process according to the present application;

FIG. 11 is a comparison diagram of hair cleaning rates and hair entanglement rates of a carpet when a single cleaning roller brush is disposed and two cleaning roller brushes are disposed in a cleaning robot for cleaning roller brushes made of different materials and combinations of cleaning roller brushes made of different materials in an experimental process according to the present application;

FIG. 12 is a comparison diagram of dust removal rates of a floor when a single cleaning roller brush is disposed and two cleaning roller brushes are disposed in a cleaning robot for cleaning roller brushes made of different materials and combinations of cleaning roller brushes made of different materials in an experimental process according to the present application;

FIG. 13 is a schematic bottom view of a cleaning robot in another implementation according to the present application; and

FIG. 14 is a schematic front view of a cleaning robot in another implementation according to the present application.

DETAILED DESCRIPTION

[0053] The following clearly and completely describes the technical solutions of the present invention with reference to the accompanying drawings. Apparently, the described implementations are some of the implementations of the present invention rather than all of the implementations. All other implementations obtained by a person of ordinary skill in the art based on the implementations of the present invention without creative efforts shall fall within the scope of protection of the present invention.

[0054] In the description of the present invention, it should be described that orientation or position relationships indicated by the terms such as "center", "on", "below", "left", "right", "vertical", "horizontal", "inside", and "outside" are based on orientation or position relationships shown in the accompanying drawings, and are used only for ease and brevity of illustration and description of the present invention, rather than indicating or implying that the mentioned apparatus or component must have a particular orientation or must be constructed and operated in a particular orientation. Therefore, such terms should not be construed as limiting of the present invention. In addition, terms "first", "second", and "third" are only used to describe the objective and cannot be understood as indicating or implying relative importance.

[0055] In the description of the present invention, it should be noted that unless otherwise explicitly specified or defined, the terms such as "mount", "connect", and "connection" should be understood in a broad sense. For example, the connection may be a fixed connection, a detachable connection, or an integral connection; or the connection may be a mechanical connection or an electrical connection; or the connection may be a direct connection, an indirect connection through an intermediary, or internal communication between two components. Persons of ordinary skill in the art may understand the specific meanings of the foregoing terms in the present invention according to specific cases.

[0056] In addition, technical features involved in different implementations of the present invention described below may be combined together if there is no conflict.

[0057] The terms in the present invention are first briefly described below.

[0058] Cleaning efficiency (CE): If there are 100 units of dust on a to-be-cleaned surface, and after cleaning once, 1 unit of dust is cleaned, or in other words, the dust is reduced by 1 unit, it is defined that the cleaning efficiency is 1%.

[0059] The cleaning efficiency CE is related to test conditions such as a carpet type and a dust distribution. The test conditions of the cleaning efficiency CE are described below:

1. 1. Carpet type

[0060] The following two carpet types are separately selected for test in the present disclosure:

(1) Standard test carpet:

[0061] A Wilton carpet is used as a preferred experimental carpet and is used for internal comparison experiments.

[0062] In this test, a pile length of the Wilton carpet is approximately 8 mm.

(2) Nonstandard test carpet:

[0063] A full-piece carpet is a shag carpet with medium-length tufts, and is usually not easy to clean compared with a Wilton carpet, an indoor laboratory experiment and a consumer experiment may be selected.

[0064] In this test, a pile length of the full-piece carpet is approximately 12 mm.

1.2. Weighing device

[0065] A weighing device is used to associate a dust removal capability with a pre-cleaning degree of an experimental carpet. A precision of the weighing device should be 0.01 g.

1.3. Dust embedding roller

[0066] The roller has a diameter of 50 mm and a length of 380 mm, which is at least 20 mm greater than a dust distribution width. The roller is made of a steel material and polished. The roller should be provided with a handle or a motor to drive the roller to move. The roller has a mass of 10 kg/m. The roller may be mounted in a dust dispenser.

1.4. Experimental region and running length

[0067] A running direction in an experimental region is kept consistent with a carpet pile direction, and the experimental region has a length of (700±5) mm.

[0068] To improve a test precision, in this test, a cleaning region has a width of B-20 mm, where B denotes a width of a cleaning head. It is to be noted that a width of the experimental region may be set to the width of B mm of the cleaning head according to the National Standard GB/T20291.1-2014/IEC60312-1:2010, IDT.

[0069] At least running lengths of 200 mm and 300 mm are respectively added in front and rear of the experimental region for acceleration and deceleration of the cleaning head.

[0070] In this way, the length of the experimental region is 700 mm, and a length of a running region is at least 1200 mm. The first 200 mm of the running region is used for acceleration, and a central point of a front edge of the cleaning head should be at one line with a central line of a starting edge of an acceleration region. The cleaning head should run to a final end of the running region. A rear edge of the effective depth of the cleaning head at least exceeds a rear edge of the experimental region 200 mm, so that an appropriate distance is kept for deceleration. The same method is still used during return and running until the front edge of the cleaning head and the starting edge of the acceleration region in front of a test region are in one same line.

[0071] The effective depth of the cleaning head should pass through the entire test region at a stable running speed of 0.50±0.02 m/s.

[0072] This test is performed according to a running speed of 0.15 m/s of a vacuum cleaner.

[0073] It is to be noted that, the vacuum cleaner is provided with a driving apparatus, and may also operate at a specified running speed of 0.50±0.02 (a running speed of a handheld cleaner) m/s.

1.5. Removal of residual dust:

[0074] If a carpet beater is not used, a carpet should be placed on a hard gauze support, and is cleaned through manual beating or with a power cleaning head. After cleaning, a vacuum cleaner with a good dust cleaning capability is used to perform one cycle of residual dust cleaning. A surface of a carpet used for an experiment of a passive cleaning head can only be cleaned by using the passive cleaning head (the power cleaning head may be used to clean an opposite surface).

[0075] In this test, manual beating is used.

1.6. Distribution of experimental dust:

[0076] Experimental dust is uniformly distributed according to 125±0.1 g/m^2, and covers the entire experimental region as uniformly as possible.

[0077] In this test, a dust amount is calculated according to a formula (B-20)/100×0.7 m×125 g/m^2. B in the formula is the width of the cleaning head, and the length of the experimental region is 0.7 m. It is to be noted that if the width of the experimental region is set to the width of B mm of the cleaning head according to the National Standard GB/T20291.1-2014/IEC60312-1:2010, IDT, a dust amount is calculated according to the formula B/100×0.7 m×125 g/m^2.

[0078] In this test, a dust sieve is used to manually scatter dust.

[0079] Certainly, to ensure that dust is uniformly distributed in the experimental region, a dust dispenser is recommended. The dust dispenser is adjusted by observing a dust distribution status on a carpet.

1.7. Embedding of a dust in a carpet:

[0080] The foregoing dust embedding roller is used to press dust into a carpet through 10 times of reciprocal running in the carpet pile direction. The roller runs forward in the carpet pile direction and press the entire experimental region at a uniform speed of 0.50±0.02 m/s. It is ensured that the entire region is completely and evenly pressed, and then the carpet is placed for 10 min.

1.8 Determination of a dust removal capability:

[0081] Before testing, a weight m of scattered dust and a weight M1 of a dust box (a dust collection mechanism) are weighed and recorded.

[0082] In a test process, before the vacuum cleaner is turned off, the cleaning head should be lifted from a test surface by at least 50 mm. The dust box should not be removed before the motor completely stops.

[0083] Once the cleaner completely stops, the dust box is carefully removed and weighed again to obtain M2. In a dust removal process of the vacuum cleaner, due to the generation of static electricity, it should be ensured that the dust box is already completely stable and has no static electricity before weighing.

[0084] A dust removal capability K is denoted by a percentage of a mass change in the dust box after running in the test region with dust distributed.

[0085] In this test, repeated measurements are performed, and K is calculated according to the following Formulas (1) and (2). At least two measurements are performed.

$$K_i = \frac{M2_i - M1_i}{m_i} \quad (1),$$

and

$$\mathrm{K} = \frac{\sum_1^i K_i}{i} \quad (2),$$

where the cleaning efficiency CE may be represented by using the foregoing dust removal capability K. A relationship between the two is, for example, CE = K × 100%.

[0086] Power: Powers in the present disclosure are all rated input powers of energy consuming devices (for example, a fan, a roller brush motor, and a driving motor), unless specially described.

[0087] Rotational speed: Rotational speeds in the present disclosure are all rotational speeds of rotatable devices when being loaded. For example, a rotational speed of a cleaning roller brush is a rotational speed of the cleaning roller brush when contacting a to-be-cleaned ground, unless otherwise specially described.

[0088] Dust agitation: Garbage such as dust, hair, and debris is at least partially separated or temporarily separated from a to-be-cleaned ground.

[0089] Battery charging and discharging life: The life is use duration when power that can be discharged from the battery that is charged 100% is reduced to 80% of a capacity of the battery due to a battery loss.

[0090] Battery cycle count: A complete process in which the battery is charged to 100% and then discharged to 0 is referred to as one cycle.

[0091] At present, an existing cleaning robot may perform cleaning work in a to-be-cleaned work region, to reduce the cleaning burden of a user to a certain extent. However, a cleaning effect of a ground by the cleaning robot is ordinary, especially for carpet or mat cleaning. A soft material such as a carpet (or a mat) usually has pile. Therefore, when the cleaning robot cleans a carpet, a cleaning effect is not adequate. As a result, the user still needs to use a handheld cleaner (an upright) to perform deep cleaning on the carpet or mat every week or every two weeks. As can be seen, the existing cleaning robot cannot free the user from manual cleaning for real.

[0092] In view of this, the applicant intends to design a cleaning robot, which can replace a handheld cleaner and free a user from manual cleaning for real. The cleaning robot includes a body, a movement mechanism disposed on the body, a beating mechanism disposed on the body, and a dust suction mechanism disposed on the body. The movement mechanism is configured to drive the cleaning robot to move. The beating mechanism is configured to beat a surface of a to-be-cleaned ground, to agitate garbage such as dust, hair, and debris on the surface of the to-be-cleaned ground. The dust suction mechanism is configured to perform dust suction in a to-be-cleaned region, to suck garbage such as dust, hair, and debris on a surface of the to-be-cleaned region into the body. The ground includes a hard ground and a soft ground. The hard ground is a ground formed by a material with a large hardness and a flat surface, for example, a floor, or a tile. The soft ground is a ground formed by a material with a small hardness and a non-flat surface, for example, a carpet, or a mat.

[0093] That is, the cleaning robot has a good cleaning effect for a to-be-cleaned surface with high cleaning difficulty, especially a carpet region or a mat region, and a cleaning effect of the cleaning robot is equivalent to a cleaning effect of a handheld cleaner. The "equivalent" may be understood as that the cleaning effect by the cleaning robot reaches or basically reaches the cleaning effect of the handheld cleaner. The "basically reaches" may be understood as that the cleaning effect of the cleaning robot is equal to a preset percentage of the cleaning effect of the handheld cleaner. For example, the cleaning effect of the cleaning robot is greater than 60% of the cleaning effect of the handheld cleaner, and it may be considered that the cleaning robot basically reaches the cleaning effect of the handheld cleaner. Certainly, the preset percentage may be chosen or determined according to design requirements, carpet types, and target handheld cleaners. For this, this is not specifically limited in this embodiment.

[0094] In consideration of how to reflect the cleaning effect, in an embodiment, the cleaning effect may be represented by a cleaning efficiency CE.

[0095] The hard ground and the soft ground have different cleaning difficulty, for example, for a same cleaning robot, a cleaning efficiency of a soft ground such as a carpet is higher than a cleaning efficiency of a hard ground such as a floor. Therefore, to better reflect an improvement in a cleaning effect, in an embodiment, a cleaning efficiency CE of vacuum cleaners (including a handheld cleaner and a cleaning robot) on a soft ground (for example, a carpet) that is difficult to clean is used for description.

[0096] First, to facilitate intuitive understanding of a cleaning effect of a handheld cleaner, a CE value of cleaning a nonstandard test carpet (for example, a full-piece carpet) once by the handheld cleaner is 45%, and a CE value of cleaning a standard test carpet (for example, a Wilton carpet) once by the handheld cleaner is 90%.

[0097] Therefore, if the cleaning effect of the cleaning robot of the present application is to be equivalent to the one-time cleaning effect of the handheld cleaner, it indicates that a CE value of cleaning a nonstandard test carpet in a same working cycle by the cleaning robot needs to reach 45% or above, or basically reaches 45% (for example, 25%); or a CE value of cleaning a standard test carpet reaches 90% or more, or basically reaches 90% (for example, 80%).

[0098] For a problem of how to improve the cleaning efficiency CE of the cleaning robot to make the CE of the cleaning robot equivalent to that of the handheld cleaner, in an aspect, an improvement may be made to factors associated with the cleaning efficiency CE (for example, dust agitation, and dust suction); and in another aspect, an improvement may be implemented by improving an energy input per unit area (EI) of the cleaning robot.

For the first aspect:

[0099] Because the cleaning effect associated with factors such as a dust agitation effect, a dust suction effect, and a movement strategy of the cleaning robot, the cleaning efficiency CE may be improved in at least one direction of the dust agitation effect, the dust suction effect, and the movement strategy.

[0100] It is considered that the dust agitation effect is related to the foregoing beating mechanism configured to agitate dust, the dust suction effect is related to the foregoing dust suction mechanism configured to suck dust, and the movement strategy is related to the foregoing movement mechanism configured to drive the cleaning robot to move.

[0101] Therefore, the cleaning efficiency of the cleaning robot may be improved in at least one of the following several manners:

1. From the angle of the dust agitation effect.

[0102] The beating mechanism agitates dust through beating. Therefore, it is considered to improve a beating effect of the to-be-cleaned ground by the beating mechanism.

[0103] It is considered that the dust agitation effect is related to parameters such as a beating frequency, a beating direction, a beating force, and a length of contacting a to-be-cleaned surface by a single beat (referred to as a single beat length for short) of the beating mechanism. Therefore, at least one aspect of the beating frequency, the beating direction, the beating force, the single beat length, and the like of the beating mechanism may be improved.

[0104] The beating frequency is a quantity of beats on the to-be-cleaned ground within a unit time.

[0105] The foregoing parameters of the beating mechanism are separately described below as follows:

A. Beating frequency

[0106] It is considered that a small amount of garbage such as dust is agitated when the beating frequency is low. Therefore, more garbage can be agitated by increasing the beating frequency, thereby improving the dust agitation effect.

B. Beating direction

[0107] It is considered that a gap in a hard ground (for example, a floor, or a tile) or a material of a soft ground (for example, a carpet, or a mat) has a high adsorbability to garbage, if only beaten in one direction, this type of garbage may fail to be agitated, affecting the cleaning effect. Therefore, in an embodiment, the beating direction includes at least a first direction and a second direction. Preferably, the first direction is opposite to the second direction. Through beating in two opposite directions, the agitation of garbage in a gap in a hard ground, in carpet pile or deep in a carpet can be improved, which helps to improve the dust agitation effect.

C. Beating force

[0108] It is considered that a small beating force is not conducive to the agitation of garbage. Therefore, the dust agitation effect can be improved by increasing the beating force.

[0109] It is usually not easy to directly measure the beating force, and direct measurement requires the addition of an additional measurement assembly, resulting in an increase in costs. Therefore, it is considered to indirectly represent the beating force in the design of the present application.

[0110] In an embodiment, the beating force may be represented by a degree of interference generated in a to-be-cleaned ground by a beating work head in contact with to-be-cleaned ground of the beating mechanism. The degree of interference may be understood as a distance between a head portion of the beating work head away from a chassis of the body and a surface of the to-be-cleaned ground.

[0111] When the to-be-cleaned ground is a hard ground such as a floor, a spacing exists between the head portion of the beating work head away from the chassis of the body and the surface of the floor. In this case, the degree of interference represents a value of the spacing, and is represented by a negative value. For example, the degree of interference is -1 mm, indicating that a spacing exists between the head portion of the beating work head away from the chassis of the body and the surface of the floor, and the spacing is 1 mm.

[0112] When the to-be-cleaned ground is a soft ground such as a carpet, the head portion of the beating work head away from the chassis of the body extends into a surface formed by a top of the carpet pile by a depth, and in this case, the degree of interference represents the depth, and is represented by a positive value. For example, a spacing from a surface of the carpet is positive, indicating a depth into the surface (for example, inside the surface formed by the carpet pile). For example, the length of the pile is 8 mm, and the degree of interference is 4 mm, indicating that the depth by which the head portion of the beating work head away from the chassis of the body extends into the surface formed by the top of the carpet pile is 4 mm.

[0113] It is to be noted that, when the beating force is larger, wear of the beating mechanism may be increased, and maintenance and replacements costs are also increased. Therefore, the beating force should be controlled within an appropriate range.

D. Single beat length

[0114] It is considered that when the single beat length is short, a small amount of garbage is agitated. Therefore, the dust agitation effect can be improved by increasing the single beat length.

[0115] It is to be noted that the single beat length affects a size of the cleaning robot. That is, when the size of the designed cleaning robot is fixed, a restriction of the size of the cleaning robot needs to be considered for the single beat length.

[0116] In an embodiment of the present application, the beating mechanism includes a cleaning roller brush.

[0117] Certainly, in another embodiment, the beating mechanism may be a rod, a stick, a shovel or another object, provided that the beating mechanism can achieve the effect of beating the to-be-cleaned ground.

[0118] To facilitate understanding of the foregoing parameters associated with beating of the beating mechanism, the foregoing parameters are described below as follows by using an example in which the beating mechanism is a cleaning roller brush and the cleaning roller brush includes a brush body and a cleaning portion or a cleaning work head (for example, a brush head such as a rubber strip or bristles assembled on the brush body) that is located at the brush body:

First, the beating frequency is related to a rotational speed of the cleaning roller brush, a quantity of cleaning roller brushes, and a quantity of cleaning portions (for example, brush heads) on the cleaning roller brush that contact a to-be-cleaned ground.

[0119] In an embodiment, a quantity of beats is approximately equal to a product of multiplying the rotational speed, the quantity of roller brushes, and the quantity of brush heads. According to that the beating frequency and the quantity of beats have a reciprocal relationship, the beating frequency can be calculated.

[0120] The beating frequency may be increased in one of the following manners or a combination thereof:

(a1) increasing the rotational speed of the cleaning roller brush;

(a2) increasing the quantity of cleaning roller brushes; and

(a3) increasing the quantity of brush heads on the cleaning roller brush.

[0121] Therefore, in an embodiment of the present application, the cleaning robot may increase the beating frequency by increasing the rotational speed of the cleaning roller brush, thereby improving the dust agitation effect, which is conducive to the improvement of the cleaning effect.

[0122] The rotational speed of the roller brush is related to a (motor) power of the roller brush. Therefore, the rotational speed of the roller brush can be increased by increasing the power of the roller brush.

[0123] In an implementation solution, the rotational speed of the roller brush is greater than or equal to 1200 r/min. A range of the power of the roller brush of the present application is 25 W to 50 W. Preferably, the power of the roller brush is 30 W.

[0124] It is considered that the soft ground and the hard ground have different cleaning difficulty. In an embodiment, when the to-be-cleaned ground is a hard ground or when the cleaning robot is in a hard ground cleaning mode of cleaning a hard ground, the power of the roller brush is a first power. When the to-be-cleaned ground is a soft ground or when the cleaning robot is in a soft ground cleaning mode of cleaning the soft ground, the power of the roller brush is a second power. The first power is less than or equal to the second power.

[0125] For example, a value range of the first power is 20 W to 30 W, and a value range of the second power is 25 W to 50 W.

[0126] Further, the first power is less than the second power. For example, the first power is 25 W, and the second power is 30 W.

[0127] In another embodiment of the present application, to increase the beating frequency to improve the dust agitation effect and therefore improve the cleaning effect, the quantity of cleaning roller brushes may be improved. For example, the cleaning robot is cleaned by using double roller brushes. The double roller brushes include a first cleaning roller brush and a second cleaning roller brush. The first cleaning roller brush and the second cleaning roller brush are configured to agitate garbage such as dust on the to-be-cleaned ground, to facilitate the suction of the dust suction mechanism.

[0128] To implement cleaning of the hard ground and the soft ground and help to further improve the cleaning effect, in an embodiment, one cleaning roller brush in the double roller brushes is a hard roller brush, and the other cleaning roller brush is a bristle roller brush. The hard roller brush is a rubber roller brush, and the bristle roller brush includes at least bristles. That is, in the double roller brushes, one cleaning roller brush is a rubber roller brush, and the other cleaning roller brush may be a roller brush including bristles, for example, a pure bristle roller brush with only bristles or a rubber bristle roller brush with both rubber and bristles.

[0129] To reduce hair entanglement, an arrangement position of the cleaning roller brush may be refined. For example, in the traveling direction of the body, the hard roller brush is disposed in front, and the bristle roller brush is disposed in rear.

[0130] It is to be noted that rotational speeds of the first cleaning roller brush and the second cleaning roller brush may be the same. For example, the rotational speeds of the first cleaning roller brush and the second cleaning roller brush are equal and are both greater than or equal to 1500 r/min.

[0131] Certainly, in another embodiment, the rotational speeds of the first cleaning roller brush and the second cleaning roller brush may be different. For example, when the first cleaning roller brush is a hard roller brush and the second cleaning roller brush is a bristle roller brush, a rotational speed of the hard roller brush located at a front portion of the body may be greater than a rotational speed of the bristle roller brush located at a rear portion of the body, thereby improving a beating effect of the carpet pile, which helps to agitate dust.

[0132] To drive the first cleaning roller brush and the second cleaning roller brush to rotate, two roller brush motors may be selected to respectively drive the first cleaning roller brush and the second cleaning roller brush, or one roller brush motor may be used in combination with a transmission mechanism (for example, a gear transmission mechanism) to drive the first cleaning roller brush and the second cleaning roller brush. In consideration of a cost problem, in an embodiment, one roller brush motor is used to drive the first cleaning roller brush and the second cleaning roller brush.

[0133] In still another embodiment of the present application, the quantity of brush heads on the cleaning roller brush may be improved to increase the quantity of beats.

[0134] In an implementation solution, a range of the quantity of brush heads is 3 to 8.

[0135] It is considered that a carpet and a floor have different cleaning difficulty. In an embodiment, a quantity of brush heads of the bristle roller brush should be greater than a quantity of brush heads of the hard roller brush. For example, a range of the quantity of brush heads of the bristle roller brush is 6 to 8, and a range of the quantity of brush heads of the hard roller brush is 3 to 5. Further, the quantity of brush heads of the bristle roller brush is 6, and the quantity of brush heads of the hard roller brush is 4.

[0136] Next, to improve the dust agitation effect, a beating direction of the cleaning roller brush may be improved.

[0137] In an embodiment, when one cleaning roller brush is used, to improve the dust agitation effect, the cleaning roller brush is controlled to perform beating in two directions. For example, for a same position, the cleaning roller brush beats the position in the first direction, makes a direction change, and beats the position again in the second direction after a direction change, where the first direction is opposite to the second direction.

[0138] In an embodiment, if two cleaning roller brushes are used, the two cleaning roller brushes may perform beating in one same direction, for example, both perform beating in the first direction, where the first direction is a direction facing a dust suction port of the dust suction mechanism, to facilitate the suction of the dust suction mechanism.

[0139] To improve the cleaning effect, further, the dust suction port is located between the first cleaning roller brush and the second cleaning roller brush, a rotation direction of the first cleaning roller brush is the first direction, and a rotation direction of the second cleaning roller brush is the second direction, where the first direction is opposite to the second direction, and the first direction and the second direction both face the dust suction port of the dust suction mechanism.

[0140] Again, to improve the dust agitation effect, a beating force of the cleaning roller brush may be improved, where the beating force is represented by a degree of interference of the brush head on the cleaning roller brush.

[0141] For example, when the cleaning roller brush is a hard roller brush, a value range of a degree of interference of the hard roller brush is 2 mm to 4 mm. When the cleaning roller brush is a bristle roller brush, a value range of a degree of interference of the bristle roller brush is 0 to 6 mm.

[0142] Due to different types of to-be-cleaned grounds (a hard ground and a soft ground), degrees of interference of the grounds are also different. For example, a degree of interference of a cleaning roller brush when the to-be-cleaned ground is a hard ground (or the cleaning robot is in a hard ground cleaning mode) is less than a degree of interference of a cleaning roller brush when the to-be-cleaned ground is a soft ground (or the cleaning robot is in a soft ground cleaning mode), where the cleaning roller brushes are of the same type.

[0143] When cleaning roller brushes are made of different materials, degrees of interference are different. For example, a degree of interference of a hard roller brush is less than a degree of interference of a bristle roller brush, where to-be-cleaned grounds are of the same type.

[0144] Further, when the cleaning roller brush is a hard roller brush and the brush head is made of rubber, a degree of interference of the hard roller brush on the to-be-cleaned ground being a hard ground (for example, a floor) is -1 mm, and a degree of interference of the hard roller brush on the to-be-cleaned ground being a soft ground (for example, a carpet) is 2 mm. When the cleaning roller brush is a bristle roller brush, a degree of interference of the bristle roller brush on the to-be-cleaned ground being the hard ground (for example, a floor) is 1 mm, and a degree of interference of the cleaning roller brush on the to-be-cleaned ground being a soft ground (for example, a carpet) is 4 mm.

[0145] Finally, to improve the dust agitation effect, a width (that is, a length of contacting the to-be-cleaned ground by a single beat) of the cleaning roller brush may be improved, where the width of the cleaning roller brush is a length of the brush head or the brush body in a direction of the rotation axis of the cleaning roller brush.

[0146] For example, in an embodiment, the length of the brush head is equal to the length of the brush body.

[0147] In an embodiment, a range of the width of the cleaning roller brush is 185 mm to 205 mm. Further, the width of the cleaning roller brush is 195 mm.

2. From the angle of the dust suction effect.

[0148] The dust suction mechanism may suck garbage on the to-be-cleaned ground through a suction force, to clean off the garbage. Therefore, the dust suction effect can be improved by increasing the suction force of the dust suction mechanism, to further improve the cleaning efficiency.

[0149] It is considered that the suction force of the dust suction mechanism is associated with a power of a fan of the dust suction mechanism. Therefore, in an embodiment of the present application, the dust suction effect can be improved by improving the power of the fan of the dust suction mechanism.

[0150] In an embodiment, the power of the fan is greater than or equal to 65 W.

[0151] Further, the power of the fan is greater than or equal to 65 W and less than 120 W. A value range of a flow rate at an inlet of the fan when the fan is fully open is 0.7 m^3/min to 0.9 m^3/min, and a static pressure at the inlet of the fan when the fan is fully blocked ranges from 6.5 Kpa to 12 Kpa.

[0152] In an embodiment, the power of the fan is 80 W.

[0153] In an embodiment, the fan is a centrifugal fan. When a power of the centrifugal fan is 80 W, a test value of a degree of vacuum (the static pressure at the inlet when the fan is fully blocked) of the centrifugal fan is approximately 8.2 Kpa, a test value of a flow rate at an inlet of the centrifugal fan when the fan is fully open is approximately 0.72 m^3/min.

[0154] In an embodiment, a volume of the centrifugal fan is approximately 50 cm^3.

[0155] In another embodiment, the fan is a mixed flow fan. When a power of the mixed flow fan is 80 W, a test value of a degree of vacuum (the static pressure at the inlet when the fan is fully blocked) of the mixed flow fan is approximately 7.6 Kpa, a test value of a flow rate at an inlet of the mixed flow fan when the fan is fully open is approximately 0.75 m^3/min.

[0156] In an embodiment, a volume of the mixed flow fan is approximately 75 cm^3.

[0157] In another embodiment of the present application, the cleaning robot may use a dust suction mechanism with a large suction force to perform dust suction. The dust suction mechanism with a large suction force may be, for example, implemented by using a high-power fan. The high-power fan is a fan with a power greater than or equal to 100 W.

[0158] A fan power is related to a degree of vacuum and a flow rate. For example, in an embodiment, a relationship among the three is basically as follows: W (fan power) = P (degree of vacuum) $\times$ Q (flow rate). As can be seen from the formula of the relationship, a required fan power may be obtained in consideration of the two aspects of the degree of vacuum and the flow rate. That is, for a same fan power, a fan with a high degree of vacuum and a low flow rate may be selected, or a fan with a high flow rate and a low degree of vacuum may be chosen. The high flow rate is that the flow rate at the inlet of the fan is greater than or equal to 1.2 m3/min, and the low flow rate is that the flow rate at the inlet of the fan is less than 1.2 m3/min. The high degree of vacuum is that the static pressure at the inlet when the fan is fully blocked is greater than 15 Kpa, and the low degree of vacuum is that the static pressure at the inlet when the fan is fully blocked is less than or equal to 15 Kpa.

[0159] In an embodiment, in view of requirements such as the size of the cleaning robot and noise, a value range of the power of the fan is 100 W to 200 W. Preferably, the value range of the power of the fan is 100 W to 150 W. Further, the power selected for the fan is 125 W.

[0160] During model selection of the fan, the fan may be a fan with a high flow rate (the flow rate at the inlet of the fan ranges from 1.2 m^3/min to 1.6 m^3/min) and a low degree of vacuum (the static pressure at the inlet when the fan is fully blocked ranges from 10 Kpa to 15 Kpa). Alternatively, the fan is a fan with a low flow rate (the flow rate at the inlet of the fan ranges from 0.8 m^3/min to 1.2 m^3/min) and a high degree of vacuum (the static pressure at the inlet when the fan is fully blocked ranges from 15 Kpa to 20 Kpa).

[0161] As can be seen from an aerodynamical equation, a flow power of dust or the like is proportional to the square of a speed of an air flow, that is, is proportional to the square of a flow rate. Therefore, the fan is preferably a fan with a high flow rate. In this way, the dust suction effect is good. In addition, it is considered that the degree of vacuum does not greatly benefit the flowing of dust, to save energy, the fan is preferably a fan with a low degree of vacuum. Therefore, the fan is a fan with a high flow rate and a low degree of vacuum.

[0162] In view of that the volume of the fan increases as the fan power increases, therefore, the volume of the fan or a volume proportion of the fan in the cleaning robot needs to be controlled. In an embodiment, a value range of the volume of the fan is 40 cm^3 to 100 cm^3.

[0163] Further, the value range of the volume of the fan is 50 cm^3 to 90 cm^3.

[0164] In an embodiment, a value range of a volume of the cleaning robot is 7000 cm^3 to 100 cm^3.

[0165] Further, the value range of the volume of the cleaning robot is 8000 cm^3 to 10000 cm^3.

[0166] In an embodiment, a ratio of the volume of the fan to an overall volume of the cleaning robot is 0.005 to 0.01.

[0167] To control the volume of the cleaning robot, a mounting position of the fan may be refined. In an embodiment, the chassis is low at a position of the fan. That is, a chassis height at a position of the fan is smaller than a chassis height at another position at which the fan is not disposed of the body of the cleaning robot. The chassis height is a height relative to a horizontal plane.

[0168] In an embodiment, the chassis height at the position of the fan ranges from 8 mm to 12 mm, and the chassis height at another position at which the fan is not disposed of the body of the cleaning robot ranges from 12 mm to 18 mm.

[0169] Further, the chassis height at the position of the fan is 10 mm, and the chassis height at another position at which the fan is not disposed of the body of the cleaning robot is 15 mm.

[0170] It is considered that generated noise increases as the power of the fan increases. Therefore, the fan is a high-power, low-noise fan.

3. The dust agitation effect and/or the dust suction effect is improved from the angle of the movement strategy.

[0171] It is considered that a low movement speed can increase a quantity of beats on a to-be-cleaned ground by the beating mechanism within a unit time, especially a quantity of beats on every cluster of carpet fiber or pile, thereby improving the dust agitation effect.

[0172] It is considered that if a movement speed is excessively fast, the dust suction mechanism stays at every position of the to-be-cleaned ground for a short time, which is especially not conducive to suction for every cluster of carpet fiber or pile, affecting the dust suction effect. Therefore, the dust suction effect can be improved by improving the movement speed.

[0173] In an embodiment, a movement distance within a unit time or a cleaning area within a unit time may be controlled by controlling the movement speed of the cleaning robot. For example, the to-be-cleaned ground is cleaned at a low movement speed, for example, a movement speed of 0.1 m/s to 0.2 m/s, especially a movement speed of the cleaning robot on a soft ground such as a carpet is reduced, thereby improving the dust agitation effect and/or the dust suction effect.

[0174] The cleaning efficiency can be improved by controlling a ratio of a sum of a power of the dust suction mechanism (for example, the fan) and a power of the dust agitation mechanism (for example, the roller brush) of the cleaning robot relative to the movement speed.

[0175] In an embodiment, a value range of the power of the dust suction mechanism (for example, the fan) is 65 W to 150 W; and further, the value range of the power of the dust suction mechanism (for example, the fan) is 80 W to 120 W.

[0176] In an embodiment, a value range of the power of the dust agitation mechanism (for example, the roller brush) is 25 W to 45 W. Further, the value range of the power of the dust agitation mechanism (for example, the roller brush) is 30 W to 40 W.

[0177] In an embodiment, the ratio of the sum of the dust suction mechanism (for example, the fan) and the power of the dust agitation mechanism (for example, the roller brush) of the cleaning robot to the movement speed is at least 90 W/0.2 m/s = 45 J/m.

[0178] The cleaning efficiency can be improved by controlling a ratio of a power of the cleaning robot relative to the movement speed.

[0179] In an embodiment, a value range of the power of the cleaning robot is 100 W to 160 W; and further, the value range of the power of the cleaning robot is 120 W to 135 W.

[0180] In an embodiment, the ratio of the power of the cleaning robot to the movement speed is at least 100 W/0.2 m/s = 50 J/m.

[0181] It is considered that a reduction in the movement speed affects a working efficiency of the cleaning robot. Therefore, the movement speed of the cleaning robot cannot be excessively small. An increase in the movement speed reduces the quantity of beats or the dust suction effect of the to-be-cleaned ground and affects the cleaning effect of the cleaning robot. Therefore, the movement speed of the cleaning robot cannot be excessively large.

[0182] To take both the cleaning effect and the working efficiency into consideration, the movement speed of the cleaning robot needs to be controlled within a certain range. In an embodiment, a value range of the movement speed is 0.12 m/s to 0.18 m/s.

[0183] In view of that the movement speed is related to a power of a driving motor of the movement mechanism, therefore, the power of the driving motor is adjusted to make the cleaning robot move at a movement speed that meets requirements.

[0184] In an embodiment of the present application, a value range of the power of the driving motor is 4 W to 6 W.

[0185] Therefore, to improve the cleaning efficiency, the ratio of the power of the cleaning robot relative to the power of the driving motor may be controlled, or a ratio of the sum of the power of the dust suction mechanism (for example, the fan) and the power of the dust agitation mechanism (for example, the roller brush) relative to the power of the driving motor may be controlled.

[0186] In an embodiment, the value range of the power of the cleaning robot is 105 W to 220 W.

[0187] Further, the value range of the power of the cleaning robot is 130 W to 200 W.

[0188] In an embodiment, the ratio of the power of the cleaning robot to the power of the driving motor is at least 17, or the ratio of the sum of the power of the dust suction mechanism (for example, the fan) and the power of the dust agitation mechanism (for example, the roller brush) to the power of the driving motor is greater than or equal to 15.

[0189] It is considered that the hard ground and the soft ground have different cleaning difficulty. Therefore, the movement speed of the cleaning robot may be controlled to be different. In an embodiment, the cleaning robot has a first movement speed in the hard ground cleaning mode and the cleaning robot has a second movement speed in the soft ground cleaning mode, where the first movement speed is greater than or equal to the second movement speed.

[0190] For example, a value range of the first movement speed is 0.24 m/s to 0.36 m/s; a value range of the second movement speed is 0.12 m/s to 0.18 m/s; and the first movement speed is 0.3 m/s.

[0191] The second movement speed is 0.15 m/s.

[0192] In an embodiment, a single-time cleaning efficiency of the cleaning robot is equivalent to a single-time cleaning efficiency of the handheld cleaner.

[0193] In other words, the cleaning robot uses a single-time cleaning strategy, that is, a working manner in which the cleaning robot cleans the entire region of the to-be-cleaned ground once, to directly make the cleaning effect of the cleaning robot equivalent to one-time cleaning effect of a handheld cleaner.

[0194] In an embodiment, when the carpet type is a standard test carpet (for example, a Wilton carpet), a value range of single-time CE of the cleaning robot is greater than or equal to 80%; further, the value range of the single-time CE is 80% to 95%; and preferably, the value range of the single-time CE is 85% to 90%.

[0195] For a nonstandard test carpet (for example, a full-piece carpet), a value range of single-time CE is greater than or equal to 25%; further, the value range of the single-time CE is 35% to 70%; and preferably, the value range of the single-time cleaning efficiency CE is 50% to 60%.

[0196] That is, the single-time cleaning efficiency of the cleaning robot can achieve an extent equivalent to that of the handheld cleaner.

[0197] As can be seen from above, a same cleaning robot has different cleaning effects for different carpets. For example, when a cleaning efficiency of a nonstandard test carpet by a same cleaning robot is 25%, and a cleaning efficiency of a standard test carpet by the cleaning robot may reach 80%; or certainly may be a cleaning efficiency determined with a carpet (for example, a nonstandard test carpet) that is difficult to clean as a reference, and a cleaning efficiency of another carpet (for example, a standard test carpet) is better.

[0198] It is to be noted that, for the cleaning robot designed by the applicant, while the cleaning efficiency is improved, the passability also needs to be ensured. For example, the cleaning robot can perform cleaning below furniture.

[0199] In an embodiment, a value range of a height of the cleaning robot is 95 mm to 115 mm. Further, the value range of the height of the cleaning robot is 105 mm to 110 mm.

[0200] In an embodiment, a value range of a volume of the cleaning robot is 7000 cm^3 to 11000 cm^3. Further, the value range of the volume of the cleaning robot is 8000 cm^3 to 10000 cm^3.

[0201] Therefore, in an embodiment, for a standard test carpet, a ratio of the cleaning efficiency CE of the cleaning robot to the height of the cleaning robot is greater than or equal to 7/m (80%/95 mm), or a ratio of the cleaning efficiency CE of the cleaning robot to the volume of the cleaning robot is greater than or equal to 80%/11000 cm^3 = 72.7/m^3.

[0202] For a nonstandard test carpet, the ratio of the cleaning efficiency CE of the cleaning robot to the height of the cleaning robot is greater than or equal to 2.2/m, or the ratio of the cleaning efficiency of the cleaning robot to the volume of the cleaning robot is greater than 22.7/m3.

[0203] In an embodiment, the value range of the power of the cleaning robot is 100 W to 200 W. Further, the value range of the power of the cleaning robot is 120 W to 180 W.

[0204] Certainly, while the cleaning efficiency of the cleaning robot is improved, power consumption of the cleaning robot also needs to be controlled, thereby improving user experience. In an embodiment of the present application, for a standard test carpet, a ratio of the cleaning efficiency CE of the cleaning robot to the power of the cleaning robot is greater than or equal to 80%/200 W = 0.004/W.

[0205] For a nonstandard test carpet, the ratio of the cleaning efficiency CE of the cleaning robot to the power of the cleaning robot is greater than or equal to 0.00125/W.

For the second aspect:

[0206] In the present disclosure, the cleaning efficiency CE can be improved by increasing an energy input per unit area.

[0207] The energy input EI per unit area is energy inputted by the cleaning robot in every unit of cleaning area. The inputted energy is related to a power P0 of the cleaning robot and a time t of cleaning. The power P0 of the cleaning robot is related to a power p1 of the dust suction mechanism (for example, the fan), a power p2 of the beating mechanism (for example, the roller brush), a power p3 of the movement mechanism (for example, the driving motor), a power p4 of another member, and the like. A cleaning area S is related to a movement speed v of the cleaning robot, the time t of cleaning, a length (for example, a width of the roller brush) B of contacting a to-be-cleaned ground by a single beat of the beating mechanism.

[0208] In an embodiment, a relationship of the parameters may be, for example:

$$EI = P0t/S = (p1 + p2 + p3 + p4)t(vt \times kB) \approx (p1 + p2 + p3)t/(vt \times kB) = (p1 + p2 +| p3)/(v \times kB).$$

k is a non-overlapping coefficient and is used for representing whether there is an overlap between cleaning areas of roller brushes (especially when there are a plurality of roller brushes) and a non-overlapping amount after the overlapping amount is eliminated.

[0209] It is to be noted that because p4 is usually a fixed value, and is small relative to a sum of p1+p2+p3. Therefore, in the foregoing formula, to facilitate calculation, p4 is omitted.

[0210] As can be seen from the foregoing formula, EI is related to parameters of the machine such as the power p1 of the dust suction mechanism (for example, the fan), the power p2 of the beating mechanism (for example, the roller brush), the power p3 of the movement mechanism (for example, the driving motor configured to drive a driving wheel), the movement speed v, the length B of contacting a to-be-cleaned ground by a single beat, but is not related to a test condition such as a carpet type. Therefore, EI may reflect the cleaning efficiency CE more intuitively, to represent the cleaning effect.

[0211] It is to be noted that, in another implementation, a cleaning effect of each time may be represented by an efficiency ratio. The efficiency ratio is used for representing a ratio of the cleaning efficiency to the energy input per unit area. For example, an efficiency ratio r = a cleaning efficiency CE/an energy input EI per unit area. Therefore, an efficiency ratio of each time may be obtained according to corresponding value ranges the cleaning efficiency of each time and the energy input per unit area. For this, this is not excessively described in this embodiment.

[0212] In addition, it may be understood that when one roller brush is used, no overlap of cleaning areas exists, and therefore, a value of k is 1.

[0213] In an embodiment, a range of a single-time energy input EI per unit area of the cleaning robot is greater than or equal to 4000 J/m^2; further, the range of the energy input per unit area is 4000 J/m^2 to 6000 J/m^2; and preferably, the value range of the energy input per unit area is 4500 J/m^2 to 5500 J/m^2.

[0214] To facilitate understanding, a process of calculating the energy input per unit area is briefly described below by using an example in which the power of the fan is 80 W, the power of the roller brush is 30 W, the power of the driving motor is 5 W, the width of the roller brush is 195 mm = 0.195 m, the quantity of roller brushes is 2, an overlap between cleaning areas of two roller brushes is 20%, and the movement speed is 0.15 m/s:

A clean area S per unit time may be calculated by using the following formula: 0.195 × 0.15 × (1% to 20%) × 60 = 1.4 m^2/min.

[0215] The energy input per unit area is EI ≈ (80 + 30 + 5)/60/1.4 = 1.4 Wh/m^2 = 5040 J/m^2.

[0216] Consumed fan energy per unit area is 80/60/1.37 = 0.974 Wh/m^2.

[0217] Certainly, to accurately calculate an input per unit area, p4 may also be taken into consideration. A sum of powers of other members of the cleaning robot is 15 W. The energy input per unit area is EI = (80 + 30 + 5 + 15)/60/1.4 = 1.6 Wh/m^2.

[0218] In an embodiment, a range of a single-time energy input EI per unit area of the cleaning robot is greater than or equal to 5500 J/m^2; further, the range of the energy input per unit area is 5500 J/m^2 to 8500 J/m^2; and preferably, the value range of the energy input per unit area is 6000 J/m^2 to 8000 J/m^2.

[0219] The process of calculating the energy input per unit area is briefly described below by using an example in which the power of the fan is 125 W, the power of the roller brush is 30 W, the power of the driving motor is 5 W, the width of the roller brush is 190 mm = 0.19 m, the quantity of roller brushes is 2, an overlap between cleaning areas of two roller brushes is 20%, and the movement speed is 0.15 m/s:

A clean area S per unit time may be calculated by using the following formula: 0.19 × 0.15 × (1% to 20%) × 60 = 1.37 m^2/min.

[0220] The energy input per unit area is EI ≈ (125 + 30 + 5)/60/1.37 = 1.95 Wh/m^2 = 7000 J/m^2.

[0221] Certainly, to accurately calculate an input per unit area, p4 may also be taken into consideration. A sum of powers of other members of the cleaning robot is 20 W. The energy input per unit area is EI = (125 + 30 + 5 + +20)/60/1.4 = 2.14 Wh/m^2.

[0222] In an embodiment, a value range of a height of the cleaning robot is 95 mm to 115 mm. Further, the value range of the height of the cleaning robot is 105 mm to 110 mm.

[0223] In an embodiment, a value range of a volume of the cleaning robot is 7000 cm^3 to 11000 cm^3. Further, the value range of the volume of the cleaning robot is 8000 cm^3 to 10000 cm^3.

[0224] For the cleaning robot designed by the applicant, while the cleaning efficiency is improved, the passability also needs to be ensured. For example, the cleaning robot can perform cleaning below furniture. Therefore, in an embodiment, a ratio of an energy input per unit area of the cleaning robot to a height of the cleaning robot is greater than or equal to 4000/0.095 J/m^3 (that is, 11.7 Wh/m^3); or a ratio of an energy input per unit area of the cleaning robot to a volume of the cleaning robot is greater than or equal to 4000/0.007 J/m^5 (that is, 158.7 Wh/m^5).

[0225] For a problem of how to improve the energy input EI per unit area of the cleaning robot, as can be seen from the foregoing formula, an improvement may be made in at least one of the following several manners:

(1) From a power of the beating mechanism.

[0226] It is considered that the power of the beating mechanism affects the dust agitation effect and the dust agitation effect is related to parameters such as a beating frequency, a beating direction, a beating force, and a length of contacting a to-be-cleaned surface by a single beat of the beating mechanism. Therefore, the dust agitation effect may be improved from an aspect of affecting the power of the beating mechanism by at least one aspect of the beating frequency, the beating direction, the beating force, the length of contacting a to-be-cleaned surface by a single beat (referred to as a single beat length for short), and the like of the beating mechanism may be improved. That is, the power of the beating mechanism is added to the aspects such as the beating frequency, the beating force, the beating direction, and the length of contacting a to-be-cleaned surface by a single beat. It may be understood that the beating direction (for example, beating by changing directions or beating in at least two directions) may affect the beating frequency, and therefore may indirectly affect the power of the beating mechanism.

[0227] In an embodiment of the present application, the beating mechanism uses a cleaning roller brush.

[0228] The foregoing parameters are described below by using an example in which the beating mechanism uses a cleaning roller brush and the cleaning roller brush includes a brush body and a cleaning portion or a cleaning work head that is located at the brush body:

The beating frequency is related to a rotational speed of the cleaning roller brush, a quantity of cleaning roller brushes, and a quantity of brush heads on the cleaning roller brush that contact a to-be-cleaned ground.

[0229] In an embodiment, the beating frequency is approximately equal to a reciprocal of a product of multiplying the rotational speed, the quantity of roller brushes, and the quantity of brush heads.

[0230] The quantity of beats may be increased in one of the following manners or a combination thereof to increase the beating frequency: increasing the rotational speed of the cleaning roller brush, increasing the quantity of cleaning roller brushes or increasing the quantity of brush heads on the cleaning roller brush.

[0231] In an embodiment of the present application, the cleaning robot may increase the beating frequency by increasing the rotational speed of the cleaning roller brush, thereby improving the dust agitation effect.

[0232] In an implementation solution, the rotational speed of the roller brush is greater than or equal to 1200 r/min. Further, a value range of the rotational speed of the roller brush is 1200 r/min to 1900 r/min.

[0233] To reach the foregoing rotational speed, in an embodiment, a value range of the power of the roller brush of the present application is 25 W to 45 W. Preferably, the power of the roller brush ranges from 30 W to 35 W.

[0234] In another embodiment of the present application, to increase the beating frequency to improve the dust agitation effect, the quantity of cleaning roller brushes may be improved. For example, the cleaning robot is cleaned by using double roller brushes. The double roller brushes include a first cleaning roller brush and a second cleaning roller brush. The first cleaning roller brush and the second cleaning roller brush are configured to agitate garbage such as dust on the to-be-cleaned ground, to facilitate the suction of the dust suction mechanism.

[0235] It is to be noted that rotational speeds of the first cleaning roller brush and the second cleaning roller brush may be the same. For example, the rotational speeds of the first cleaning roller brush and the second cleaning roller brush are equal and are both greater than or equal to 1500 r/min.

[0236] Certainly, in another embodiment, the rotational speeds of the first cleaning roller brush and the second cleaning roller brush may be different. For example, when the first cleaning roller brush is a hard roller brush and the second cleaning roller brush is a bristle roller brush, a rotational speed of the hard roller brush located at a front portion of the body may be greater than a rotational speed of the bristle roller brush located at a rear portion of the body, thereby improving a beating effect of the carpet pile, which helps to agitate dust.

[0237] In still another embodiment of the present application, the quantity of brush heads on the cleaning roller brush may be improved to increase the quantity of beats.

[0238] In an implementation solution, a range of the quantity of brush heads is 3 to 8.

[0239] It is considered that a carpet and a floor have different cleaning difficulty. In an embodiment, a quantity of brush heads of the bristle roller brush should be greater than a quantity of brush heads of the hard roller brush. For example, a range of the quantity of brush heads of the bristle roller brush is 6 to 8, and a range of the quantity of brush heads of the hard roller brush is 3 to 5. Further, the quantity of brush heads of the bristle roller brush is 6, and the quantity of brush heads of the hard roller brush is 4.

[0240] To improve the dust agitation effect, a beating direction of the cleaning roller brush may be improved.

[0241] For example, when only one cleaning roller brush is used, the cleaning roller brush is controlled to perform beating in two directions to improve the dust agitation effect. For example, for a same position, the cleaning roller brush beats the position in the first direction, makes a direction change, and beats the position again in the second direction after a direction change, where the first direction is opposite to the second direction.

[0242] When two cleaning roller brushes are used, a dust suction port at a bottom of the body is provided between the two cleaning roller brushes. A rotation direction of one cleaning roller brush is the first direction, and a rotation direction of the other cleaning roller brush is a direction opposite to the first direction. The first direction and the second direction both face the dust suction port.

[0243] Next, to improve dust agitation, the beating force may be improved. Because it is not easy to measure the beating force, the beating force is represented by the degree of interference of the brush head on the cleaning roller brush.

[0244] For example, when the cleaning roller brush is a hard roller brush, a value range of a degree of interference of the hard roller brush is -2 mm to 4 mm. When the cleaning roller brush is a bristle roller brush, a value range of a degree of interference of the bristle roller brush is 0 to 6 mm.

[0245] When the to-be-cleaned surface is a hard ground, the value range of a degree of interference of the hard roller brush is -2 mm to -0.5 mm. When the cleaning roller brush is a bristle roller brush, a value range of a degree of interference of the bristle roller brush is 0.5 mm to 1.5 mm.

[0246] Further, when the to-be-cleaned surface is a soft ground, the value range of a degree of interference of the hard roller brush is 1.5 mm to 2.5 mm. A value range of a degree of interference of the bristle roller brush is 3 mm to 5 mm.

[0247] It may be understood that when the beating force is larger, the power of the beating mechanism is increased.

[0248] Due to different types of to-be-cleaned grounds, degrees of interference are also different. For example, cleaning roller brushes of a same type are used as an example. A degree of interference of the cleaning roller brush on the to-be-cleaned ground being a hard ground is less than a degree of interference of the cleaning roller brush on the to-be-cleaned ground being a soft ground.

[0249] It is considered that when cleaning roller brushes are made of different materials, degrees of interference are different. For example, in a case of to-be-cleaned grounds of a same type, the degree of interference of the hard roller brush is less than the degree of interference of the bristle roller brush.

[0250] In an embodiment, when the cleaning roller brush is a hard roller brush and the brush head is made of rubber, a degree of interference of the hard roller brush on the to-be-cleaned ground being a hard ground (for example, a floor) is -2 mm, and a degree of interference of the hard roller brush on the to-be-cleaned ground being a soft ground (for example, a carpet) is 4 mm. When the cleaning roller brush is a bristle roller brush, a degree of interference of the bristle roller brush on the to-be-cleaned ground being the hard ground (for example, a floor) is 0 mm, and a degree of interference of the cleaning roller brush on the to-be-cleaned ground being a soft ground (for example, a carpet) is 6 mm.

[0251] Finally, to improve the dust agitation effect, a width (that is, a length of contacting the to-be-cleaned ground by a single beat) of the cleaning roller brush may be improved, where the width of the cleaning roller brush is a length of the brush head or the brush body in a direction of the rotation axis of the cleaning roller brush.

[0252] For example, in an embodiment, the length of the brush head is equal to the length of the brush body.

[0253] In an embodiment, a range of the width of the cleaning roller brush is 185 mm to 205 mm. Further, the width of the cleaning roller brush ranges from 190 mm to 195 mm.

(2) From a power of the dust suction mechanism.

[0254] In an embodiment, the dust suction mechanism includes a fan. Therefore, the dust suction effect can be improved by improving the power of the fan.

[0255] In an embodiment, the power of the fan is greater than or equal to 65 W.

[0256] Further, the power of the fan is greater than or equal to 65 W and less than 120 W. A value range of a flow rate at an inlet of the fan when the fan is fully open is 0.7 m^3/min to 0.9 m^3/min; a value range of a flow rate at the inlet of the fan when the fan is fully open is 0.7 m^3/min to 0.9 m^3/min; and a static pressure at the inlet of the fan when the fan is fully blocked ranges from 6.5 Kpa to 12 Kpa.

[0257] In an embodiment, the power of the fan is 80 W.

[0258] In an embodiment, the fan is a centrifugal fan. When a power of the centrifugal fan is 80 W, a test value of a degree of vacuum (the static pressure at the inlet when the fan is fully blocked) of the centrifugal fan is approximately 8.2 Kpa, a test value of a flow rate at an inlet of the centrifugal fan when the fan is fully open is approximately 0.72 m^3/min.

[0259] In an embodiment, a volume of the centrifugal fan is approximately 50 cm^3.

[0260] In another embodiment, the fan is a mixed flow fan. When a power of the mixed flow fan is 80 W, a test value of a degree of vacuum (the static pressure at the inlet when the fan is fully blocked) of the mixed flow fan is approximately 7.6 Kpa, and a test value of a flow rate at an inlet of the mixed flow fan when the fan is fully open is approximately 0.75 m^3/min.

[0261] In an embodiment, a volume of the mixed flow fan is approximately 75 cm^3.

[0262] In another embodiment of the present application, the cleaning robot may use a high-power fan. The high-power fan is a fan with a power greater than or equal to 100 W.

[0263] A fan power is related to a degree of vacuum and a flow rate. For example, in an embodiment, a relationship among the three is basically as follows: W = P × Q. As can be seen from the formula, a required fan power may be obtained in consideration of the two aspects of the degree of vacuum and the flow rate. That is, for a same fan power, a fan with a high degree of vacuum and a low flow rate may be selected, or a fan with a high flow rate and a low degree of vacuum may be chosen. The high flow rate is that the flow rate at the inlet of the fan is greater than or equal to 1.2 m3/min, and the low flow rate is that the flow rate at the inlet of the fan is less than 1.2 m3/min. The high degree of vacuum is that the static pressure at the inlet when the fan is fully blocked is greater than 15 Kpa, and the low degree of vacuum is that the static pressure at the inlet when the fan is fully blocked is less than or equal to 15 Kpa.

[0264] In an embodiment, in view of requirements such as the size of the cleaning robot and noise, a value range of the power of the fan is 100 W to 200 W. Preferably, the value range of the power of the fan is 100 W to 150 W. Further, the power selected for the fan is 125 W.

[0265] During model selection of the fan, the fan may be a fan with a high flow rate (the flow rate at the inlet of the fan ranges from 1.2 m^3/min to 1.6 m^3/min) and a low degree of vacuum (the static pressure at the inlet when the fan is fully blocked ranges from 10 Kpa to 15 Kpa). Alternatively, the fan is a fan with a low flow rate (the flow rate at the inlet of the fan ranges from 0.8 m^3/min to 1.2 m^3/min) and a high degree of vacuum (the static pressure at the inlet when the fan is fully blocked ranges from 15 Kpa to 20 Kpa).

[0266] As can be seen from an aerodynamical equation, a flow power of dust or the like is proportional to the square of a flow rate. To improve the dust suction effect, the fan is preferably a fan with a high flow rate. In addition, in view of that the degree of vacuum does not greatly benefit the flowing of dust, the fan is preferably a fan with a low degree of vacuum, so that energy can be saved. Therefore, in an embodiment of the present disclosure, the fan is a fan with a high flow rate and a low degree of vacuum.

[0267] It needs to be pointed out that it is considered that the power of the dust suction mechanism affects the dust suction effect. Therefore, the dust suction effect can be improved by increasing the power of the dust suction mechanism.

[0268] In view of that the volume of the fan increases as the fan power increases, therefore, the volume of the fan or a volume proportion of the fan in the cleaning robot needs to be controlled. In an embodiment, a value range of the volume of the fan is 40 cm^3 to 100 cm^3.

[0269] Further, the value range of the volume of the fan is 50 cm^3 to 90 cm^3.

[0270] In an embodiment, a value range of a volume of the cleaning robot is 7000 cm^3 to 11000 cm^3.

[0271] Further, the value range of the volume of the cleaning robot is 8000 cm^3 to 10000 cm^3.

[0272] In an embodiment, a ratio of the volume of the fan to an overall volume of the cleaning robot ranges from 0.005 to 0.01.

[0273] For how to control the volume of the cleaning robot, in an embodiment, a mounting position of the fan may be improved. For example, the chassis is low at a position of the fan. In this way, a chassis height at a position of the fan is smaller than a chassis height at another position at which the fan is not disposed of the body of the cleaning robot. The chassis height is a height relative to a horizontal plane.

[0274] In an embodiment, the chassis height at the position of the fan ranges from 8 mm to 12 mm, and the chassis height at another position at which the fan is not disposed of the body of the cleaning robot ranges from 12 mm to 18 mm.

[0275] Further, the chassis height at the position of the fan is 10 mm, and the chassis height at another position at which the fan is not disposed of the body of the cleaning robot is 15 mm.

[0276] In view of a noise problem that may occur when the power of the fan increases, therefore, during model selection of a fan, the fan may be a high-power, low-noise fan.

(3) From a power of the movement mechanism.

[0277] It is considered that the power of the movement mechanism affects the dust agitation effect and/or the dust suction effect. The dust agitation effect and/or the dust suction effect is related to parameters such as a rotational speed of the driving motor of the movement mechanism, and the rotational speed of the driving motor determines different movement speed. Therefore, the dust agitation effect and/or the dust suction effect can be improved in consideration of the aspects that the movement speed or the like affects the power of the movement mechanism. That is, the power of the movement mechanism is added to the aspects such as the movement speed. It may be understood that when a movement speed is low, a quantity of beats on a to-be-cleaned ground by the beating mechanism within a unit time, especially a quantity of beats on every cluster of fiber or pile of a soft ground (for example, a carpet), thereby improving the dust agitation effect.

[0278] When the movement speed is excessively fast, the dust suction mechanism stays at every suction position of the to-be-cleaned ground for a short time, which is especially not conducive to suction of dust adsorbed on every cluster of fiber or pile of the carpet, affecting the dust suction effect. Therefore, the dust suction effect can be improved by improving the movement speed.

[0279] In an embodiment, a movement distance within a unit time or a cleaning area within a unit time may be controlled by controlling the movement speed of the cleaning robot. For example, the to-be-cleaned ground is cleaned at a low movement speed, for example, a movement speed of 0.1 m/s to 0.2 m/s, especially a movement speed of the cleaning robot on a soft ground such as a carpet is reduced, thereby improving the dust agitation effect and/or the dust suction effect.

[0280] In an embodiment, the value range of the power of the cleaning robot is 100 W to 250 W.

[0281] Further, the value range of the power of the cleaning robot is 100 W to 200 W.

[0282] In an embodiment, the value range of the power of the fan is 65 W to 120 W. Further, the range of the power of the fan is 80 W to 100 W.

[0283] In an embodiment, a value range of the power of the roller brush is 25 W to 50 W; and further, the power of the fan ranges from 30 W to 35 W.

[0284] In an embodiment, a value range of a sum of the power of the fan and the power of the roller brush is 90 W to 170 W.

[0285] Further, the value range of the sum of the power of the fan and the power of the roller brush is 110 W to 135 W.

[0286] The energy input per unit area can be improved by controlling a ratio of the sum of the powers of the fan and the roller brush of the cleaning robot relative to the movement speed. In an embodiment, the ratio of the sum of the powers of the fan and the roller brush of the cleaning robot relative to the movement speed is at least 45 J/m.

[0287] To increase the energy input per unit area, the cleaning efficiency can be improved by controlling a ratio of a power of the cleaning robot relative to the movement speed. In an embodiment, the ratio of the sum of the powers of the fan and the roller brush of the cleaning robot relative to the movement speed is at least 50 J/m.

[0288] It is considered that a reduction in the movement speed affects a working efficiency of the cleaning robot. Therefore, the movement speed of the cleaning robot cannot be excessively small. An increase in the movement speed reduces the quantity of beats or the dust suction effect of the to-be-cleaned ground and affects the cleaning effect of the cleaning robot. Therefore, the movement speed of the cleaning robot cannot be excessively large.

[0289] To take both the cleaning effect and the working efficiency into consideration, the movement speed of the cleaning robot needs to be controlled within a certain range. In an embodiment, a value range of the movement speed is 0.12 m/s to 0.18 m/s. Further, a value of the movement speed is 0.15 m/s.

[0290] In view of that the movement speed is related to a power of a driving motor of the movement mechanism, therefore, the power of the driving motor is adjusted to make the cleaning robot move at a movement speed that meets requirements.

[0291] In an embodiment of the present application, a value range of the power of the driving motor is 4 W to 6 W. Further, the power of the driving motor is 5 W.

[0292] In an embodiment, the value range of the power of the cleaning robot is 100 W to 250 W.

[0293] Further, the value range of the power of the cleaning robot is 100 W to 200 W.

[0294] In an embodiment, the value range of the power of the fan is 65 W to 150 W. Further, the range of the power of the fan is 100 W to 120 W.

[0295] In an embodiment, a value range of the power of the roller brush is 25 W to 50 W; and further, the power of the fan ranges from 30 W to 35 W.

[0296] In an embodiment, a value range of a sum of the power of the fan and the power of the roller brush is 90 W to 200 W.

[0297] Further, the value range of the sum of the power of the fan and the power of the roller brush is 130 W to 155 W.

[0298] Therefore, to improve the energy input per unit area, the ratio of the power of the cleaning robot relative to the power of the driving motor may be controlled to be at least 100/6 = 17, or the ratio of the sum of the powers of the fan and the roller brush relative to the power of the driving motor may be controlled to be at least 90/6 = 15.

[0299] It is considered that the hard ground and the soft ground have different cleaning difficulty. Therefore, the movement speed of the cleaning robot may be controlled to be different. In an embodiment, a movement speed of the cleaning robot in the hard ground cleaning mode is greater than or equal to a movement speed of the cleaning robot in the soft ground cleaning mode.

[0300] In an embodiment, a value range of the movement speed of the cleaning robot in the hard ground cleaning mode is 0.2 m/s to 0.4 m/s, and a value range of the movement speed of the cleaning robot in the soft ground cleaning mode is 0.1 m/s to 0.2 m/s.

[0301] For example, the movement speed of the cleaning robot in the hard ground cleaning mode is 0.3 m/s.

[0302] The movement speed of the cleaning robot in the soft ground cleaning mode is 0.15 m/s.

[0303] In the present disclosure, the cleaning effect is improved by using at least one improvement measure in the foregoing, to make the cleaning effect of the cleaning robot better than the cleaning effect of a conventional cleaning robot, so that the cleaning effect of the cleaning robot is equivalent to the cleaning effect of a handheld cleaner.

[0304] Further, a combination of the foregoing improvement measures has a better improvement effect than only using a single measure, for example, using a fan.

[0305] As can be seen from the above, the cleaning effect of the cleaning robot is closely associated with members such as the fan, the roller brush, and the movement mechanism. Therefore, when the power of the fan increases or the rotational speed of the roller brush increases (it indicates that the power of the roller brush increases). This raises higher requirements for the power supply mechanism of the cleaning robot. When the movement speed of the cleaning robot is reduced, a cleaning time is increased compared with cleaning of a same to-be-cleaned area at a high speed. This also raises higher requirements for the power supply mechanism.

[0306] In summary, to adapt to an improvement of the cleaning effect, the power supply mechanism needs to be improved.

[0307] In an embodiment, to meet a range requirement of the cleaning robot, in one aspect, a requirement is raised for a capacity of the battery. For example, after being charged once, the battery can support cleaning of a to-be-cleaned ground with an area not less than a large area (for example, not less than 60 m^2) once by the cleaning robot. Therefore, the battery needs to be improved. For example, a battery with a higher capacity is used to supply power to the cleaning robot, thereby improving a range capability of the cleaning robot and reducing a charge count.

[0308] In an embodiment, the value range of the power of the cleaning robot is 100 W to 200 W.

[0309] In an embodiment, a value range of a volume of the cleaning robot is 7000 cm^3 to 10000 cm^3.

[0310] In an embodiment, a value range of a weight of the cleaning robot is 4 kg to 6 kg.

[0311] In an embodiment, the capacity of the battery is not less than 140 Wh, or a ratio of the capacity of the battery to the power of the cleaning robot is not less than 2500 J/W.

[0312] Because the capacity of the battery affects a volume and a weight of the battery, to ensure the range, in an embodiment, the weight of the battery is greater than or equal to 640 g, or a ratio of the weight of the battery to the weight of the cleaning robot is greater than or equal to 0.10.

[0313] In an embodiment, the volume of the battery is greater than or equal to 400 cm^3, or a ratio of the volume of the battery to the volume of the cleaning robot is greater than or equal to 0.04.

[0314] In view of that the volume and the weight of the battery increase as the capacity of the battery increases, which affects the volume and weight of the cleaning robot, this is not conducive to miniaturization (passability) and light-weight design requirements of the cleaning robot. Therefore, to meet the design requirements of the cleaning robot, the capacity of the battery also cannot be excessively large.

[0315] In an embodiment, the capacity of the battery is not greater than 200 Wh, or a ratio of the capacity of the battery to the power of the cleaning robot is not greater than 7200 J/W.

[0316] Because the capacity of the battery affects a volume and a weight of the battery, to ensure the range, in an embodiment, the weight of the battery is less than or equal to 960 g, or a ratio of the weight of the battery to the weight of the cleaning robot is less than or equal to 0.24.

[0317] In an embodiment, the volume of the battery is less than or equal to 600 cm^3, or a ratio of the volume of the battery to the volume of the cleaning robot is greater than or equal to 0.086.

[0318] In addition, as the capacity of the battery increases, the volume (referred to as the volume of the battery for short) of the battery also increases. The cleaning robot cannot be made excessively large or excessively high, or otherwise the passability is affected. Therefore, a ratio of the capacity of the battery to the volume of the cleaning robot needs to be controlled, or a ratio of the capacity of the battery to the height of the cleaning robot needs to be controlled, or a ratio of the volume of the battery to the volume of the cleaning robot needs to be controlled.

[0319] To take the range and the passability and light-weight design requirements of the cleaning robot into consideration, in an embodiment, the capacity of the battery ranges from 140 Wh to 200 Wh. Further, the capacity of the battery ranges from 160 Wh to 180 Wh. Specifically, the capacity of the battery is 170 Wh.

[0320] In an embodiment, the volume of the battery ranges from 400 cm^3 to 600 cm^3; and further, the volume of the battery is 500 cm^3.

[0321] In an embodiment, the volume of the cleaning robot ranges from 7000 cm^3 to 10000 cm^3; and further, the volume of the cleaning robot ranges from 7500 cm^3 to 8000 cm^3.

[0322] In an embodiment, the height of the cleaning robot ranges from 95 mm to 115 mm; and further, the height of the cleaning robot ranges from 105 mm to 110 mm.

[0323] In an embodiment, a range of the ratio of the volume of the battery to the volume of the cleaning robot is approximately 1/25 to 1/15.

[0324] In an embodiment, a range of the ratio of the capacity of the battery to the volume of the cleaning robot is approximately 0.017 Wh/cm^3 to 0.024 Wh/cm^3.

[0325] In an embodiment, a range of the ratio of the capacity of the battery to the height of the cleaning robot is approximately 1.2 Wh/mm to 2.1 Wh/mm.

[0326] It is considered that when the capacity of the battery is larger, the volume of the battery increases. To make it possible for the cleaning robot to accommodate a battery with a larger capacity without affecting the passability, in another aspect, the layout of the battery may be improved. For example, a battery with a cylindrical shape is installed on the body of the cleaning robot in a vertical direction. The vertical direction means that an axis of the battery is perpendicular to the horizontal plane.

[0327] The capacity of the battery used in the cleaning robot is usually limited. If a required battery capacity is increased or doubled, a quantity of batteries needs to be increased. To make it possible for a cleaning robot with a basically unchanged or slightly increased volume to accommodate more batteries, the arrangement of a plurality of batteries may be improved. For example, batteries with a cylindrical shape are arranged side by side on the body of the cleaning robot in the vertical direction. The vertical direction means that the axis of the battery is perpendicular to the horizontal plane.

[0328] It is considered that the weight of the battery usually increases as the capacity of the battery increases. The cleaning robot cannot be excessively heavy, or otherwise user experience is affected. Therefore, during the design, a percentage of weight of the battery accounts in the cleaning robot needs to be controlled or a percentage of the capacity of the battery in the weight of the cleaning robot needs to be controlled.

[0329] In an embodiment, the capacity of the battery ranges from 140 Wh to 200 Wh. Further, the capacity of the battery ranges from 160 Wh to 180 Wh. Specifically, the capacity of the battery is 170 Wh.

[0330] In an embodiment, the weight of the battery ranges from 640 g to 960 g. Further, the weight of the battery ranges from 700 g to 900 g. Specifically, the weight of the battery is 800 g.

[0331] In an embodiment, the weight of the cleaning robot ranges from 4 kg to 6 kg. Further, the weight of the battery is 5 kg.

[0332] In an embodiment, a range of a proportion of the capacity of the battery in the weight of the cleaning robot is 33 to 35.

[0333] In an embodiment, a proportion of the weight of the battery relative to the weight of the cleaning robot ranges from 0.10 to 0.24.

[0334] In another aspect, the battery life of the battery is associated with the life of the battery. For example, the capacity of the battery is increased, and after being charged once, the battery can meet cleaning of a large to-be-cleaned area once. In this way, a charge count of the cleaning robot is reduced. Therefore, a life requirement of the battery is correspondingly reduced. The life of the battery may be represented by a battery charging and discharging life or a battery cycle count (which is also referred to as a rechargeable count). To facilitate the understanding of the battery charging and discharging life, in an embodiment, the capacity of the battery is 160 Whether (watt-hour). The life of the battery is represented by the battery charging and discharging life. In this case, the battery charging and discharging life is use duration of the battery when the capacity of the battery is reduced to 128 Whether due to a battery loss.

[0335] In an embodiment, the battery life is represented by the battery cycle count. In an embodiment, under a condition of high-power charging and high-power discharging, the battery cycle count of the battery approximately ranges from 640 times to 960. The "high-power" means that the power is greater than or equal to 100 W.

[0336] It is to be noted that, during the design, the volume (or weight) of the cleaning robot should be controllable. In one aspect, the volume (or weight) of the cleaning robot cannot be excessively large. For example, the volume (or weight) of the cleaning robot should meet a miniaturization (or light-weight) requirement, or otherwise the passability (or user experience) is affected. In another aspect, the volume (or weight) of the cleaning robot is associated with members of the cleaning robot, is especially affected by volumes (or weights) of a dust suction apparatus (for example, a fan), a beating apparatus (for example, a roller brush), and other power members that are associated with the cleaning effect, and is further affected by a volume (or a weight) of an energy apparatus (for example, the battery) that supports cleaning work of the cleaning robot. Therefore, to ensure the cleaning effect of the cleaning robot, the cleaning robot cannot be made excessively small.

[0337] The volume (or weight) of the fan is related to model selection for the fan, and the model selection for the fan is mainly to meet a power requirement.

[0338] In an embodiment of the present application, the range of the power of the fan is greater than or equal to 65 W, and preferably, the range of the power of the fan is 65 W to 150 W.

[0339] In another embodiment of the present application, the power of the cleaning robot ranges from 100 W to 200 W, and the power of the fan accounts for 65% to 75% of the overall power.

[0340] The beating apparatus includes a cleaning unit configured to perform a cleaning task, where the cleaning unit includes at least at least one of a roller brush and an edge brush. In this embodiment, the cleaning unit includes a roller brush. A volume of the beating apparatus mainly depends on a volume of the roller brush. In an embodiment of the present application, the roller brush is double roller brushes, and a range of a width of every roller brush is 130 mm to 280 mm. Preferably, the range of the width of every roller brush is 180 mm to 230 mm. Further, the width of the roller brush ranges from 190 mm to 215 mm.

[0341] Certainly, in another embodiment, the cleaning robot may further include a mopping unit configured to perform a mopping task. Further, the mopping unit is at least partially detachably connected to the cleaning robot. This is not limited in this embodiment.

[0342] The volume of the battery is related to the model selection for the battery. The model selection for the battery is mainly to make the capacity of the battery meet power supply and battery life requirements, and in addition the use life of the battery is taken into consideration. In an embodiment of the present application, the battery is a 18650 battery with a large capacity. The "large capacity" means that the battery has a capacity greater than 140 Wh.

[0343] In addition, the volume of the cleaning robot is further affected by some sensor mechanisms, for example, a laser radar (Laser Direct Structuring, LDS) for distance detection, and mounting positions of the sensor mechanisms.

[0344] To take both the passability and the cleaning effect into consideration, further, a range of the volume (length×width×height) of the cleaning robot is $330\times310\times105\ mm^3$ to $340\times320\times110\ mm^3$.

[0345] Because the volume of the cleaning robot is related to the length L, width W, and height H of the cleaning robot, description is provided below from the three aspects: the length L, the width W, and the height H:

First, it is considered that when the cleaning robot performs cleaning work indoors, the volume (especially in a height direction) of the cleaning robot is restricted by a height of indoor furniture. Therefore, a body height of the cleaning robot should be less than a furniture height. The body height is a distance between a top of the body of the cleaning robot and a horizontal ground. The furniture height is a distance between a bottom of the furniture and the horizontal ground. It is considered that the height of the furniture (for example, an ordinary chair, or a table) is approximately 150 mm. Therefore, in an embodiment, the body height of the cleaning robot is less than or equal to 150 mm. Further, it is considered that some special furniture (for example, a couch, or a bed stand) has a low height, and is generally 115 mm. Further, the body height of the cleaning robot is less than or equal to 115 mm, so that the cleaning robot can meet the passability of the height direction.

[0346] In addition, because the cleaning robot is restricted by the members (for example, the driving wheel, the battery, the fan, the roller brush, or the dust box) of the cleaning robot in the height direction, the height of the cleaning robot also cannot be excessively small. In an embodiment, a value range of the cleaning robot in the height direction is greater than or equal to 80 mm. It is considered that the LDS is usually installed at the top of the body and has a certain height. Therefore, preferably, the value range of the cleaning robot in the height direction is greater than or equal to 95 mm.

[0347] In summary, in an embodiment, a value range of a height of the cleaning robot is 95 mm to 115 mm. Preferably, the value range of the height of the cleaning robot is 105 mm to 110 mm.

[0348] In view of that the cleaning robot is also restricted by furniture (a table, a chair, or the like) and a door, a step, a corridor, or the like on a to-be-cleaned ground in the width direction, to ensure the passability in the width direction, it is considered that a width of furniture (for example, an ordinary chair or table), a door, a corridor, or the like is approximately 500 mm. Therefore, in an embodiment, a body width of the cleaning robot is less than or equal to 500 mm. In consideration of some special furniture (for example, a couch, or a bed stand) with a small width, further, the body width of the cleaning robot is less than or equal to 350 mm.

[0349] It is considered that the cleaning robot is restricted by members (for example, the driving wheel, the battery, the fan, the roller brush, and the dust box) of the cleaning robot in the width direction. Therefore, a width of the cleaning robot also cannot be excessively small. In an embodiment, a value range of the cleaning robot in the width direction is greater than or equal to 270 mm. It is considered that some other functional requirements, for example, an edge brush, and an anti-collision board, exist in the width direction, and a certain width is occupied. Therefore, preferably, the value range of the cleaning robot in the width direction is greater than or equal to 290 mm.

[0350] In summary, to enable the cleaning robot to meet functional requirements (for example, a cleaning effect, and multiple functions) and meet the passability in the width direction, in an embodiment, the value range of the cleaning robot in the width direction is 290 mm to 350 mm; and preferably, a value range of the width of the cleaning robot is 310 mm to 330 mm.

[0351] It is considered that if the cleaning robot is excessively long in a length direction and has an incompact structure, this is not conducive to obstacle avoidance of the cleaning robot and steering in a narrow region. In an embodiment, the value range of the cleaning robot in the length direction is 310 mm to 350 mm; and preferably, a value range of the length of the cleaning robot is 330 mm to 340 mm.

[0352] In an embodiment of the present application, the volume of the cleaning robot is 8000 cm^3, and the overall power of the cleaning robot ranges from 120 W to 200 W, and a value range of a power-to-volume ratio is 120/8000 to 200/8000 (W/cm^3).

[0353] In another embodiment, a range of the overall power of the cleaning robot is 100 W to 200 W; and a range of the volume of the cleaning robot is 7000 cm^3 to 10000 cm^3; and therefore, a range of ratio of the overall power to the volume (referred to as a power-to-volume ratio for short) of the cleaning robot is 100/10000 W/cm^3 to 200/7000 W/cm^3.

[0354] To facilitate understanding, the cleaning robot provided in the present application is described below with reference to the accompanying drawings:

The present application provides a cleaning robot. The cleaning robot uses a structure that combines double roller brushes with a high-power fan to implement a cleaning effect better than a cleaning effect of an existing cleaning robot.

[0355] Referring to FIG. 1 and FIG. 2, a cleaning robot 100 is configured to perform cleaning work on a to-be-cleaned surface. The cleaning robot 100 includes: a body 10; a dust box 7, configured to collect garbage cleaned off by the cleaning robot 100, where in this implementation, the dust box 7 is disposed inside the body 10 and is detachable relative to the body 10, making it convenient to clear garbage in the dust box 7 out of the body 10, and in another implementation, the dust box 7 may be disposed outside the body 10; at least one driving wheel 21, configured to support and drive the cleaning robot 100 to move on the to-be-cleaned surface; a cleaning roller brush, including at least a first cleaning roller brush 11 and a second cleaning roller brush 12, disposed at a bottom of the body 10 and at least partially exposed from a bottom surface of the body 10, where during rotation, the first cleaning roller brush 11 and the second cleaning roller brush 12 sweep garbage on the to-be-cleaned surface over which the cleaning robot 100 has moved into the body 10; and a fan 8, forming a negative pressure inside the dust box 7, and sucking garbage into the dust box 7. In an embodiment, a power of the fan 8 is not less than 80 W.

[0356] The cleaning robot 100 further includes a control module, to perform targeted control when the cleaning robot 100 is in different working states.

[0357] In the cleaning robot 100, at least the first cleaning roller brush 11 and the second cleaning roller brush

12 are disposed to perform beating and cleaning on garbage on a to-be-cleaned surface, which is equivalent to beating and cleaning the to-be-cleaned surface at least twice, so that a miss of garbage is effectively prevented. In addition, the fan 8 with a power above 80 W is used in combination to quickly and effectively suck garbage that is agitated by the cleaning roller brushes into the dust box 7, so that compared with the arrangement of only a single cleaning roller brush, the cleaning efficiency of the cleaning robot 100 is greatly improved, a better cleaning effect is achieved, especially for a carpet or mat.

[0358] Referring to experimental data in FIG. 8, in a case that the power of the fan 8 is the same, compared with the arrangement of only a single cleaning roller brush, the cleaning robot 100 in which two cleaning roller brushes are disposed has a better cleaning efficiency on a carpet.

[0359] When two cleaning roller brushes are disposed in the cleaning robot 100, as the power of the fan 8 increases, the cleaning efficiency of the cleaning robot 100 gradually increases. When the power of the fan 8 increases to 250 W, the cleaning efficiency of the cleaning robot 100 may reach 67.97%. Therefore, when double roller brushes are disposed in the cleaning robot 100 and the fan 8 with a power greater than or equal to 100 W is combined, the cleaning effect of the cleaning robot can be better. In addition, when two cleaning roller brushes are disposed in the cleaning robot 100 and the power of the fan 8 is increased to 250 W, if the power of the fan 8 continues to be increased, the cleaning efficiency of the cleaning robot 100 increases slowly. In consideration of the performance and price of a fan and a noise problem that may occur by increasing the power of the fan, the fan is preferably a fan with a power of 200 W or less.

[0360] Further, the body 10 further includes a dust suction port 13. The dust suction port 13 is disposed at the bottom of the body 10, is located between the first cleaning roller brush 11 and the second cleaning roller brush 12, and is in communication with the dust box 7. The first cleaning roller brush 11 and the second cleaning roller brush 12 are parallel to each other and rotate in opposite directions, to gather and sweep garbage into the dust suction port 13 between the two cleaning roller brushes. In this implementation, the first cleaning roller brush 11 and the second cleaning roller brush 12 are disposed perpendicularly relative to a moving direction of the cleaning robot 100. Preferably, the first cleaning roller brush 11 and the second cleaning roller brush 12 have a same width B (in a direction of a rotation axis) and are bilaterally symmetrical relative to a central axis of the body 10. The first cleaning roller brush 11 and the second cleaning roller brush 12 are disposed in parallel, so that the cleaning robot can be more steady in a movement process. The first cleaning roller brush 11 and the second cleaning roller brush 12 rotate in opposite directions. Through the rotation of the first cleaning roller brush 11 and the second cleaning roller brush 12 in opposite directions, the carpet pile can be beaten in two directions, and a dust agitation effect is better. In addition, a miss of garbage can be prevented more effectively, and garbage passes through the dust suction port 13 to eventually enter the dust box 7.

[0361] Furthermore, the cleaning robot 100 further includes an edge brush 3 disposed at the bottom of the body 10. With the moving direction of the cleaning robot 100 being front, the edge brush 3 is disposed in the lateral front of the body 10. The edge brush 3 is configured to sweep garbage on the to-be-cleaned surface toward the first cleaning roller brush 11 and the second cleaning roller brush 12.

[0362] In one of the implementations, the cleaning robot 100 includes a first driving assembly, configured to drive the first cleaning roller brush 11 and/or the second cleaning roller brush 12 to rotate. In this implementation, the first driving assembly drives the first cleaning roller brush 11 to rotate, and the first cleaning roller brush 11 drives the second cleaning roller brush 12 to rotate. Further, referring to FIG. 3a and FIG. 3b, the first driving assembly includes a first motor 14, a first transmission gear 141, a second transmission gear 142, and a third transmission gear 143. An output shaft of the first motor 14 is engaged with the first transmission gear 141 to transfer a torque to the first transmission gear 141. The first transmission gear 141 is engaged with the second transmission gear 142. The second transmission gear 142 is engaged with the first cleaning roller brush 11 to drive the first cleaning roller brush 11 to rotate, and the second transmission gear 142 is engaged with the third transmission gear 143. The third transmission gear 143 drives the second cleaning roller brush 12 to rotate, to eventually separately transfer the torque outputted by the first motor 14 to the first cleaning roller brush 11 and the second cleaning roller brush 12, to implement the rotation of the first cleaning roller brush 11 and the second cleaning roller brush 12 in opposite directions.

[0363] Alternatively, in another embodiment, referring to FIG. 4a and FIG. 4b, the output shaft of the first motor 14 is directly engaged with the second transmission gear 142, the second transmission gear 142 is engaged with the third transmission gear 143, and the second transmission gear 142 and/or the third transmission gear 143 is not directly engaged with the first cleaning roller brush 11 and the second cleaning roller brush 12, and may respectively drive the first cleaning roller brush 11 and the second cleaning roller brush 12 to rotate through a transmission belt 144, to implement the rotation of the first cleaning roller brush 11 and the second cleaning roller brush 12 in opposite directions. Certainly, in another implementation, the first motor 14 may simultaneously directly drive the first cleaning roller brush 11 and the second cleaning roller brush 12 to rotate, or the first driving assembly may include two driving motors to separately drive the first cleaning roller brush 11 and the second cleaning roller brush 12.

[0364] In one of the implementations, the first cleaning roller brush 11 is a hard roller brush, and the second cleaning roller brush 12 is a bristle roller brush, or the first cleaning roller brush 11 and the second cleaning roller brush 12 are both hard roller brushes, or the first cleaning roller brush 11 and the second cleaning roller brush 12 are both bristle roller brushes. Further, the hard roller brush is a rubber roller brush, or the hard roller brush may include another hard material, for example, non-woven fabric. The bristle roller brush includes at least bristles. The bristle roller brush may only have bristles, or may have both a hard material such as rubber or non-woven fabric and bristles. Preferably, the rubber roller brush includes a rubber brush body and a rubber sheet extending from one end of the rubber brush body to the other end. The rubber sheet includes a plurality of sections, an angle is formed between every two adjacent rubber sheet sections, and the rubber sheet scrapes the to-be-cleaned surface when the rubber roller brushes rotate. When the bristle roller brush only has bristles, the bristle roller brush includes a bristle brush body. Bristles are distributed between two ends of the bristle brush body and extend outward from the bristle brush body. The bristles include a plurality of sections. An angle is formed between every two adjacent bristle sections. When the bristle roller brush rotates, at least a part of the bristles does not sweep a part of the to-be-cleaned surface. If the bristle roller brush has both a hard material such as rubber or non-woven fabric and bristles, the bristle roller brush includes a roller brush body. Rubber, non-woven fabric, and bristles disposed on the roller brush body are the same those in the foregoing manner. Details are not described herein again.

[0365] Preferably, the bristles include hard bristles, and the to-be-cleaned surface includes a first type surface and/or a second type surface. When the cleaning robot cleans the first type surface, the hard bristles do not contact the to-be-cleaned surface. The first type surface may be a surface prone to scratches or wear, for example, a wooden floor. The hard bristles do not contact the first type surface to avoid scratches or wear of the first type surface. A manner in which the hard bristles do not contact the first type surface may be that a length of the hard bristles is slightly shorter than those of other materials in the cleaning roller brush, so that when the cleaning robot 100 moves on the wooden floor, the hard bristles do not contact the wooden floor. When the cleaning robot 100 cleans the second type surface, the hard bristles contact the to-be-cleaned surface. The second type surface may be a surface that is difficult to clean, for example, a carpet or a mat. The hard bristles contact the second type surface, and beat out and clean off garbage in the carpet or mat that is difficult to clean. When the cleaning robot 100 moves on the carpet or ground, the driving wheel 21 sinks into the carpet or mat, and the other materials and the hard bristles in the cleaning roller brush may contact the carpet or mat, to beat out and clean off garbage in the carpet or mat that is difficult to clean. Certainly, the bristles may include soft bristles, for example, pile, and the like. The bristles may only include bristles of one materials or may be a combination of bristles made of various materials. The soft bristles cause little wear to the first type surface, and may contact the first type surface and the second type surface. The hard bristles in the bristles partially do not contact the first type surface, and contact, beat, and clean the second type surface.

[0366] Preferably, with the moving direction of the cleaning robot 100 being the front, when the first cleaning roller brush 11 is a hard roller brush and the second cleaning roller brush 12 is a bristle roller brush, the first cleaning roller brush 11 and the second cleaning roller brush 12 are sequentially disposed in a longitudinal direction. In this implementation, the first cleaning roller brush 11 is a rubber roller brush, the second cleaning roller brush 12 is a bristle roller brush including hard bristles, and a cleaning effect of cleaning hair by the bristle roller brush is better than that of the hard roller brush. However, hair is more easily entangled on the bristle roller brush and is difficult to clean. In a movement process of the cleaning robot 100, garbage on the to-be-cleaned surface is mostly cleaned by the hard roller brush to the dust suction port 13 to enter the dust box 7, and a residual small part of garbage is cleaned by the bristle roller brush to the dust suction port 13 to enter the dust box 7. Therefore, most hair may be entangled on the hard roller brush. The cleaning efficiency of the cleaning robot 100 can be improved, and a hair entanglement rate on the cleaning roller brush can be reduced, to facilitate cleaning of the cleaning robot 100.

[0367] Referring to experimental data in FIG. 11, 30-CM long hair is used as an experimental object. In a case that the power of the fan 8 is the same, compared with arrangement of a single rubber roller brush, when two rubber roller brushes are disposed in the cleaning robot 100, the cleaning robot 100 has a better hair cleaning rate. When the rubber roller brushes and the hard bristle/non-woven fabric roller brush are sequentially disposed in the longitudinal direction, the hair cleaning rate may reach 100%, and the hair entanglement rate is 48%. When the rubber roller brushes and the soft bristle roller brush are sequentially disposed in the longitudinal direction, the hair cleaning rate may reach 100%, and the hair entanglement rate is 25%. The two arrangement manners have a good cleaning effect, and the hair entanglement rate is low. It is considered that a hard material in the cleaning roller brush has a better cleaning effect for dust, large-particle garbage, and the like on the to-be-cleaned surface. Compared with the soft bristle roller brush, the hard bristle/non-woven fabric roller brush has a better cleaning effect for dust, large-particle garbage, and the like on the to-be-cleaned surface. Therefore, a manner of sequentially arranging the rubber roller brush and the hard bristles/non-woven fabric roller brush in a longitudinal direction is used in this implementation.

[0368] In one of the implementations, the cleaning robot 100 further includes a floating apparatus (not shown). The floating apparatus is at least connected to one of the first cleaning roller brush 11 and the second cleaning roller brush 12, and at least enables one of the first cleaning roller brush 11 and the second cleaning roller brush 12 to float relative to the body 10. When the cleaning robot 100 moves to a non-flat to-be-cleaned surface, the floating apparatus may make the first cleaning roller brush 11 and/or the second cleaning roller brush 12 better joined to the to-be-cleaned surface, thereby improving the cleaning efficiency of the cleaning robot 100.

[0369] For example, the floating apparatus is connected to the first cleaning roller brush 11 and the second cleaning roller brush 12, and at least enables the first cleaning roller brush 11 and the second cleaning roller brush 12 to both float relative to the body 10. When the cleaning robot 100 moves to a non-flat to-be-cleaned surface, the floating apparatus may make the first cleaning roller brush 11 and the second cleaning roller brush 12 better joined to the to-be-cleaned surface.

[0370] In one of the implementations, when the cleaning robot 100 works, the first cleaning roller brush 11 has a preset first rotational speed, and the second cleaning roller brush 12 has a preset second rotational speed. The preset first rotational speed and the preset second rotational speed are associated with types of the first cleaning roller brush 11 and the second cleaning roller brush 12 and/or the power of the fan 8. In this implementation, the preset first rotational speed and the preset second rotational speed range from 1500 r/min to 2500 r/min. Preferably, the preset first rotational speed and the preset second rotational speed are both 1500 r/min. When the cleaning robot 100 works, the rotational speeds of the first cleaning roller brush 11 and/or the second cleaning roller brush 12 are adjustable. When the cleaning robot 100 detects that a movement speed of the cleaning robot decreases, the rotational speeds of the first cleaning roller brush 11 and/or the second cleaning roller brush 12 are reduced. When the cleaning robot 100 detects that the movement speed of the cleaning robot increases, the rotational speeds of the first cleaning roller brush 11 and/or the second cleaning roller brush 12 are increased. With this arrangement, the power consumption of the cleaning robot 100 can be reduced while the cleaning effect of the cleaning robot 100 is ensured, thereby extending working duration of the cleaning robot 100. The rotational speeds of the first cleaning roller brush 11 and/or the second cleaning roller brush 12 may be adjusted by using PWM technologies. This is not described in detail in the present application.

[0371] Referring to experimental data in FIG. 10a to FIG. 10d, in a case that the power of the fan 8 is the same, compared with the arrangement of only a single cleaning roller brush, the cleaning robot 100 in which two cleaning roller brushes are disposed has a better cleaning efficiency on a carpet. A change in a rotational speed of a single cleaning roller brush does not significantly affect the cleaning efficiency of the cleaning robot 100, and the rotational speeds of the two cleaning roller brushes significantly affect the cleaning efficiency of the cleaning robot 100. As the rotational speeds of the two cleaning roller brushes increase, the cleaning efficiency of the cleaning robot 100 also gradually increases. After the rotational speeds of the two cleaning roller brushes approximately reach or basically reach 2500 r/min, the cleaning efficiency of the cleaning robot 100 increases slowly. When the types of the two cleaning roller brushes are different or the power of the fan 8 varies, preferred rotational speeds of the cleaning roller brushes are also not the same, that is, the preset first rotational speed and the preset second rotational speed are not the same. Different transmission ratios may be configured for the two cleaning roller brushes to make the first rotational speed and the second rotational speed different. In an embodiment, when the first cleaning roller brush 11 is a hard roller brush and the second cleaning roller brush 12 is a bristle roller brush, the first cleaning roller brush 11 and the second cleaning roller brush 12 are sequentially disposed in the longitudinal direction. The first rotational speed of the first cleaning roller brush 11 is greater than the second rotational speed of the second cleaning roller brush 12, to improve a beating effect of the carpet pile, which help to agitate dust.

[0372] In one of the implementations, the power of the fan 8 is adjustable, and a preferred range of the power of the fan 8 is 100 W to 300 W. The cleaning robot 100 identifies a type of the to-be-cleaned surface, and adjusts the power of the fan 8 according to the type of the to-be-cleaned surface. The cleaning robot 100 include a ground type sensor 5, for example, an ultrasonic sensor. The ground type sensor 5 is disposed at the bottom of the body 10, and is configured to detect the type of the to-be-cleaned surface. The cleaning robot 100 identifies that the to-be-cleaned surface is the first type surface. The first type surface includes a hard ground, for example, may be a floor or tile. The cleaning robot 100 sets the power of the fan 8 to 100 W. The cleaning robot 100 identifies that the to-be-cleaned surface is the second type surface. The second type surface may be a surface that is difficult to clean, for example, may be a carpet or mat. The cleaning robot 100 sets the power of the fan 8 to 200 W. Because the carpet or mat has gaps that are difficult to clean, the power of the fan 8 is improved, that is, a suction capability of the fan 8 is improved, and in addition, the first cleaning roller brush 11 and the second cleaning roller brush 12 are used in combination to beat and clean the carpet or mat, so that the cleaning effect of the carpet or mat by the cleaning robot 100 can be significantly improved. When the first cleaning roller brush 11 and the second cleaning roller brush 12 of different materials are combined, the cleaning effects of the carpet or mat are different. Referring to experimental data in FIG. 9, in a case that the power of the fan 8 is the same and the rotational speed of the cleaning roller brush is the same, compared with the arrangement of only a single cleaning roller brush, the cleaning robot 100 in which two cleaning roller brushes are disposed has a better cleaning efficiency on a carpet. In a case that the power of the fan 8 is the same and the rotational speeds of the first cleaning roller brush 11 and the second cleaning roller brush 12 are the same, hard bristles and pile are disposed on the first cleaning roller brush 11, and hard bristles and non-woven fabric are disposed on the second cleaning roller brush 12. This combination manner of the first cleaning roller brush 11 and the second cleaning roller brush 12 has a higher cleaning efficiency on a carpet. In consideration of the hair entanglement rate of the cleaning roller brush, in this implementation, the first cleaning roller brush 11 is a rubber roller brush, and the second cleaning roller brush 12 is a bristle roller brush including hard bristles. When the cleaning robot 100 cleans a floor or tile, the power of the fan 8 is set to 100 W, and the cleaning efficiency of the cleaning robot 100 may reach or basically reach 95%. Referring to experimental data in FIG. 12, two cleaning roller brushes are disposed on the cleaning robot, and the power of the fan 8 is set to 100 W. When the rotational speeds of the two cleaning roller brushes are set to 2500 r/min, the cleaning efficiency on the floor by the two cleaning roller brushes can both reach 100%. Referring to the experimental data in FIG. 8, when the two cleaning roller brushes are disposed on the cleaning robot 100, and the power of the fan 8 is set to 200 W, a cleaning efficiency of cleaning a carpet or mat by the cleaning robot 100 may basically reach 60%.

[0373] Further, referring to FIG. 7, to achieve a higher cleaning efficiency, the cleaning robot 100 cleans the to-be-cleaned surface more than twice. Movement paths on the second type surface by the cleaning robot 100 during the cleaning twice intersect each other. For example, the cleaning robot 100 cleans the to-be-cleaned surface twice. When the cleaning robot 100 identifies that the to-be-cleaned surface is a second type surface, the cleaning robot moves on the second type surface along a path I S1. When the cleaning robot 100 identifies again that the to-be-cleaned surface is a second type surface, the cleaning robot moves on the second type surface along a path II S2. The path I S1 and the path II S2 intersect and are from each other. The path I S1 and the path II S2 may intersect perpendicularly, or may intersect at another angle. Movement paths of the cleaning robot 100 on the second type surface during the cleaning twice intersect each other. The first cleaning roller brush 11 and the second cleaning roller brush 12 may beat and clean the second type surface from different directions, so that the second type surface can be cleaned more thoroughly.

[0374] Further, when the cleaning robot 100 detects that the cleaning robot cannot continue to move, the power of the fan 8 is reduced. For example, when the cleaning robot 100 encounters an obstacle or is stuck and cannot move, the power of the fan 8 is reduced or the fan 8 is directly turned off, so that energy consumption of the cleaning robot 100 can be reduced. When the power of the fan 8 is excessively large, the cleaning robot 100 may skid or jam. When the cleaning robot 100 detects that the cleaning robot skids or jams, the power of the fan 8 is reduced, and a driving force for driving the driving wheel 21 may be simultaneously increased.

[0375] In one of the implementations, when identifying that the to-be-cleaned surface is the first type surface, the cleaning robot 100 identifies a cleanness level of the first type surface, and sets the power of the fan 8 corresponding to the cleanness level of the first type surface. The first type surface includes a hard ground, which may be, for example, a floor or a tile. When identifying that the to-be-cleaned surface is the second type surface, the cleaning robot 100 identifies a cleanness level of the second type surface, and sets the power of the fan 8 corresponding to the cleanness level of the second type surface. The second type surface may be a surface difficult to clean, which may be, for example, a carpet or a mat. The cleaning robot 100 includes a visual sensor (not shown). The visual sensor identifies a type of the to-be-cleaned surface and a cleanness level of a to-be-cleaned surface. The visual sensor identifies a cleanness level of a floor or tile, and may identify a dirty level of the floor or tile. The cleaning robot 100 sets the power of the fan 8 according to the dirty level of the floor or tile. When the floor or tile is dirtier, the power of the fan 8 is higher. The visual sensor identifies a cleanness level of a carpet or a mat. The visual sensor identifies a dirty level of the carpet or mat. The cleaning robot 100 sets the power of the fan 8 according to the dirty level of the carpet or mat. When the carpet or mat is dirtier, the power of the fan 8 is higher. Alternatively, the visual sensor may further identify a pile length of the carpet or mat, and the cleaning robot 100 adjusts the power of the fan 8 according to the pile length of the carpet or mat. For example, when the carpet or mat is a short bristle carpet or a short bristle mat, the cleaning robot 100 sets the power of the fan 8 to 150 W. When the carpet or mat is a medium bristle carpet or a medium bristle mat, the cleaning robot 100 sets the power of the fan 8 to 200 W. If the carpet or mat is a long bristle carpet or a long bristle mat, the cleaning robot 100 sets the power of the fan 8 to 250 W. Such an arrangement disposed can better reduce power consumption and noise pollution while the cleaning effect of the cleaning robot 100 is ensured.

[0376] In one of the implementations, referring to FIG. 1, two driving wheels 21 are included. The two driving wheels 21 have a same rotation axis L2. Vertical distances from a rotation shaft of the first cleaning roller brush 11 and a rotation shaft of the second cleaning roller brush 12 to a virtual straight line L1 are the same. A vertical distance H1 between the rotation axis L2 and the virtual straight line L1 does not exceed 50 mm. With such an arrangement, in one aspect, the cleaning robot 100 has a better balance in a movement process. In another aspect, during suction of the fan 8, a suction force generated at the dust suction port 13 is applied to the cleaning robot 100. When the two driving wheels 21 are close to the dust suction port 13, more of the suction force can be distributed on the two driving wheels 21. The two driving wheels 21 is subjected to a downward pressure, so that a possibility that the two driving wheels 21 skid on the to-be-cleaned surface can be reduced. The driving wheel 21 is driven by a second driving assembly. The second driving assembly includes a second motor 41 and a third motor 42. The two driving wheels 21 are respectively driven by the second motor 41 and the third motor 42 to rotate.

[0377] In one of the implementations, the cleaning robot 100 further includes a first elastic apparatus (not shown). The first elastic apparatus is connected to at least one driving wheel 21, so that the at least one driving wheel 21 can move up and down relative to the body 10. With such an arrangement, it is convenient for the cleaning robot 100 to move across an obstacle.

[0378] In one of the implementations, referring to FIG. 5, the body 10 includes a bottom surface, a top surface, and a lateral surface connecting the bottom surface and the top surface. In consideration of an obstacle avoidance problem and a suction problem of large-particle dust, a vertical distance from the bottom surface of the body 10 to the to-be-cleaned surface is at least 12 mm. Further, the bottom surface is obliquely disposed relative to the to-be-cleaned surface. A transitional chamfer is formed between a position at which the bottom surface and the cleaning roller brush are adjacent and a position at which the bottom surface and the lateral surface are connected. A vertical distance H2 between the position at which the bottom surface and the lateral surface are connected and the to-be-cleaned surface is at least 15 mm. The cleaning robot 100 may implement a better obstacle surmounting effect.

[0379] In one of the implementations, referring to FIG. 5 and FIG. 6, a rechargeable battery 9 disposed inside the body 10 provides electrical energy to the cleaning robot 100, to achieve objectives of movement on and cleaning of the to-be-cleaned surface. Preferably, the battery 9 is a sheet battery, for example, a sheet soft-pack lithium battery.

[0380] Referring to FIG. 5 and FIG. 6, the present disclosure further schematically shows a base station 200, used for parking of the cleaning robot 100, and at least providing a charging service. The charging service is a quick charging service. The charging service includes wired charging or wireless charging. Preferably, a charging current for charging the cleaning robot 100 by the base station 200 is above 2 A. When the power of the fan 8 is high, the power consumption of the cleaning robot 100 is high. Therefore, to reduce a charging time of the cleaning robot 100 and improve the working efficiency of the robot, the base station 200 provides the quick charging service for the cleaning robot 100.

[0381] Further, when the base station 200 performs wired charging on the cleaning robot 100, a large contact force is required at an interface between the cleaning robot 100 and the base station 200. The base station 200 includes a base station charging end 201, and the base station charging end 201 is joined to a charging end 101 of the cleaning robot. Preferably, novel terminals, for example, POGO PINs, are used for the charging end 101 of the cleaning robot and/or the base station charging end 201.

[0382] In an embodiment, referring to FIG. 5, a second elastic apparatus 202 is further disposed at the base station 200. The second elastic apparatus 202 is subjected to an external force from the cleaning robot 100, to make the charging end 101 of the cleaning robot joined to the base station charging end 201 more tightly. In this implementation, the charging end 101 of the cleaning robot is disposed at the bottom surface of the body 10. The cleaning robot 100 further includes an auxiliary wheel 22, disposed at the bottom of the body 10, and configured to support the body 10 on the to-be-cleaned surface and assist in steering of the body 10. When the cleaning robot 100 parks at the base station 200 to perform charging, at least one of the auxiliary wheel 22 and the driving wheel 21 is pressed against the second elastic apparatus 202, the second elastic apparatus 202 deforms, and the cleaning robot 100 presses the charging end 101 of the cleaning robot against the base station charging end 201 relying on the gravity of cleaning robot. Furthermore, the base station 200 further includes a pressure structure. When the cleaning robot 100 parks at the base station 200 for charging, the pressure structure applies an external force to the cleaning robot 100 to make the charging end of the cleaning robot 100 joined to the base station charging end 201 more tightly. In this implementation, the pressure structure includes a lever arm 203 that can move relative to the base station 200. When the cleaning robot 100 parks at the base station 200 to perform charging, the lever arm 203 applies an external force to the cleaning robot 100 to press the charging end 101 of the cleaning robot against the base station charging end 201. For example, when the cleaning robot 100 does not require charging, the lever arm 203 is in a lifted state. When the cleaning robot 100 parks at the base station 200 to perform charging, the lever arm 203 is in a lowered state and presses the cleaning robot 100, to provide the charging end 101 of the cleaning robot with a force for pressing against the base station charging end 201. Certainly, in addition to the foregoing manner of pressing downward through the lever arm 203 to increase the contact force, a motor (not shown) may further provide the base station charging end 201 with an upward force, to make the base station charging end 201 tightly pressed against the charging end 101 of the cleaning robot. For example, the motor may be disposed below the base station charging end 201.

[0383] In another embodiment, the second elastic apparatus may be replaced with a V-shaped lever (not shown). One end of the lever is connected to the auxiliary wheel 22, and the other end of the lever is connected to the base station charging end 201. When the auxiliary wheel 22 is pressed against the lever, the other end is subjected to a force to make the base station charging end 201 tightly pressed against the charging end 101 of the cleaning robot.

[0384] In another embodiment, to increase the contact force between the terminals, magnets may be further disposed at preset positions of the charging end 101 of the cleaning robot and the base station charging end 201, to increase the contact force through the attraction between the magnet.

[0385] In one of the implementations, referring to FIG. 6, the base station 200 collects garbage in the cleaning robot 100. The base station 200 includes a suction apparatus. The suction apparatus is joined to the dust box 7 of the cleaning robot 100, to suck and collect garbage in the dust box 7. The base station 200 may use another manner to collect the garbage in the dust box 7. For example, the garbage in the dust box 7 is poured and collected into the base station 200. Preferably, at least when the cleaning robot 100 is parked at the base station 200 for charging, the base station 200 collects the garbage in the cleaning robot 100.

[0386] Further, after the cleaning robot 100 has performed cleaning for a preset time or a preset quantity of times, the base station 200 collects the garbage in the cleaning robot 100. When the cleaning robot 100 cleans the to-be-cleaned surface at a high frequency or there is a lot of garbage on the to-be-cleaned surface, a frequency of collecting the garbage in the cleaning robot 100 by the base station 200 needs to be increased, to avoid overloading of the dust box 7. For example, during a molting phase of an animal, an amount of garbage on the to-be-cleaned surface significantly increases. Compared with normal times, the dust box 7 of the cleaning robot 100 is filled with garbage more quickly. After performing cleaning for a preset time, the cleaning robot 100 returns to the base station 200 to collect the garbage in the dust box 7, or after cleaning the to-be-cleaned surface for a preset number of times, the cleaning robot 100 returns to the base station 200 to collect the garbage in the dust box 7.

[0387] The present application further provides a cleaning robot, which has a cleaning effect equivalent to that of an upright.

[0388] Referring to FIG. 13, FIG. 14, and FIG. 15, the cleaning robot 100 includes:

a body 10, having a front end 110;

a movement mechanism 21, including at least one driving wheel, and configured to support and drive the cleaning robot to move on a to-be-cleaned ground, where further, the movement mechanism further includes an auxiliary wheel 22 located at the front end of the body;

a cleaning mechanism, including a roller brush 30, and configured to perform cleaning work on the to-be-cleaned ground;

a dust suction mechanism, including a fan 8, and configured to suck garbage cleaned off by the cleaning mechanism into the body;

a dust collection mechanism 7, including a dust box, and configured to collect the garbage sucked into the body;

a power supply mechanism, including a rechargeable battery 9, and configured to provide energy to the cleaning robot;

a controller, configured to control the cleaning robot to move on the to-be-cleaned ground, to implement autonomous cleaning of the to-be-cleaned ground,

where the roller brush includes at least a first cleaning roller brush 11 and a second cleaning roller brush 12, and the first cleaning roller brush and the second cleaning roller brush are disposed at a bottom of the body, and are at least partially exposed from the body; and the first cleaning roller brush and the second cleaning roller brush are configured to clean off garbage on the to-be-cleaned ground during rotation, to facilitate the suction of the dust suction mechanism. A rotation axis L1 of the first cleaning roller brush and a rotation axis L2 of the second cleaning roller brush are parallel to each other, and the rotation axis of the first cleaning roller brush and the rotation axis of the second cleaning roller brush are both perpendicular to a traveling direction of the cleaning robot.

[0389] The fan is disposed inside the body, and a power of the fan is greater than or equal to 65 W.

[0390] Further, the rotational speeds of the first cleaning roller brush and the second cleaning roller brush are both greater than or equal to 1200 r/min. Rotational speeds of the first cleaning roller brush and the second cleaning roller brush are both greater than or equal to 1500 r/min. Further, rotational speeds of the first cleaning roller brush and the second cleaning roller brush are both greater than or equal to 1500 r/min, and less than or equal to 1900 r/min.

[0391] Further, the power of the fan is greater than or equal to 80 W, and is less than or equal to 150 W.

[0392] Further, the body 10 includes a chassis 40, and a chassis height at a position of the fan is smaller than a chassis height at another position at which the fan is not disposed of the body.

[0393] Further, a value range of the chassis height h1 at the position of the fan is 8 mm to 12 mm; and a value range of the chassis height h2 at the another position at which the fan is not disposed of the body is 12 mm to 18 mm.

[0394] Further, the cleaning mechanism includes a roller brush motor configured to drive the first cleaning roller brush and the second cleaning roller brush to rotate, and a value range of a power of the roller brush motor is

30 W to 35 W.

[0395] Further, the dust suction mechanism further includes a dust suction port, provided at the bottom of the body; the first cleaning roller brush and the second cleaning roller brush both rotate toward the dust suction port, to agitate garbage in a cleaning region; and the fan sucks the garbage agitated into the body through the dust suction port, and the garbage is collected by the dust box. Further, the dust suction port is located between the first cleaning roller brush and the second cleaning roller brush, a rotation direction of the first cleaning roller brush is a first direction, a rotation direction of the second cleaning roller brush is a second direction, and the first direction is opposite to the second direction.

[0396] Further, the first cleaning roller brush and the second cleaning roller brush are disposed in a traveling direction of the body, and a value range of a length B of at least one of the first cleaning roller brush and the second cleaning roller brush in a direction of the rotation axis is 180 mm to 195 mm.

[0397] Further, the first cleaning roller brush is a hard roller brush, and the second cleaning roller brush is a bristle roller brush. Further, the hard roller brush is a rubber roller brush, and the bristle roller brush includes at least bristles.

[0398] Further, a value range of a degree of interference of the first cleaning roller brush is -2 mm to 4 mm; and a value range of a degree of interference of the second cleaning roller brush is 0 to 6 mm, where the degree of interference is a depth by which a cleaning portion of the roller brush extends into an upper surface of the to-be-cleaned ground.

[0399] Further, in a traveling direction of the body, the first cleaning roller brush is located in front of the second cleaning roller brush.

[0400] Further, a capacity of the battery is greater than or equal to 140 Wh. Further, the capacity of the battery ranges from 140 Wh to 200 Wh. Preferably, the capacity of the battery is 170 Wh.

[0401] Further, a power of the cleaning robot is at least 100 W. Furthermore, the power of the cleaning robot ranges from 100 W to 200 W. Preferably, the power of the cleaning robot ranges from 130 W to 170 W.

[0402] Further, a ratio of a power of the cleaning robot to a volume of the cleaning robot is at least 0.01 W/cm^3.

[0403] Further, a ratio of a capacity of the battery to a power of the cleaning robot is greater than or equal to 2500 J/W.

[0404] Further, a ratio of a capacity of the battery to a volume of the cleaning robot ranges from 0.017 Wh/cm^3 to 0.024 Wh/cm^3; or a ratio of a capacity of the battery to the height of the cleaning robot ranges from 1.2 Wh/mm to 2.1 Wh/mm.

[0405] Further, a battery cycle count of the battery for a cleaning robot with a rated input power PE being greater than or equal to 100 W ranges from 640 to 960.

[0406] Further, a proportion of a volume of the battery relative to a volume of the cleaning robot is at least 1/25.

[0407] Further, the battery 9 has a cylindrical shape, and the battery is disposed on the body in an assembly direction during installation, where the assembly direction is a direction that makes an axis X of the battery perpendicular to a horizontal plane.

[0408] Further, a percentage of the battery in a total weight of the cleaning robot is greater than or equal to 10%.

[0409] Further, the movement mechanism is configured to drive the cleaning robot to move at a preset movement speed, where a value range of the preset movement speed is 0.1 m/s to 0.2 m/s.

[0410] Further, the ratio of the power of the cleaning robot to the preset movement speed is at least 50 J/m.

[0411] A proportion of a sum of the power of the fan and a power of a roller brush motor configured to drive the roller brush to rotate relative to the preset movement speed is at least 45 J/m.

[0412] Further, the movement mechanism is configured to: when the to-be-cleaned ground is a soft ground, drive the cleaning robot to move at a first movement speed; and when the to-be-cleaned ground is a hard ground, drive the cleaning robot to move at a second movement speed, where the first movement speed is less than the second movement speed.

[0413] Further, a value range of the first movement speed is 0.24 m/s to 0.36 m/s; and a value range of the second movement speed is 0.12 m/s to 0.18 m/s.

[0414] Further, the cleaning robot further includes a driving motor configured to drive the movement mechanism to move, and a value range of a power of the driving motor is 4 W to 6 W. Preferably, the power of the driving motor is 5 W.

[0415] Further, the cleaning robot further includes a driving motor, disposed in the body, and configured to drive the movement mechanism to rotate, where a proportion of a sum of the power of the fan and a power of a roller brush motor configured to drive the roller brush to rotate relative to a power of the driving motor is at least 15.

[0416] Further, an energy input per unit area of the cleaning robot is at least 4000 J/m^2.

[0417] Further, a ratio of an energy input per unit area of the cleaning robot to a height of the cleaning robot is greater than or equal to 11.7 Wh/m^3; or a ratio of an energy input per unit area of the cleaning robot to a volume of the cleaning robot is greater than or equal to 158.7 Wh/m^5.

[0418] Further, for a standard test carpet, a cleaning efficiency of the cleaning robot is greater than or equal to 80%; and

for a nonstandard test carpet, the cleaning efficiency of the cleaning robot is greater than or equal to 25%.

[0419] Further, for a standard test carpet, a ratio of a cleaning efficiency of the cleaning robot to a power of the cleaning robot is greater than or equal to 0.004/W; and for a nonstandard test carpet, the cleaning efficiency of the cleaning robot is greater than or equal to 0.00125/W.

[0420] Furthermore, for a standard test carpet, a value range of the cleaning efficiency of the cleaning robot ranges from 80% to 95%; and

for a nonstandard test carpet, the cleaning efficiency of the cleaning robot is greater than or equal to 35% to 70%.

[0421] Further, for a standard test carpet, a ratio of a cleaning efficiency of the cleaning robot to a height of the cleaning robot is greater than or equal to 7/m; or for a standard test carpet, a ratio of a cleaning efficiency of the cleaning robot to a volume of the cleaning robot is greater than or equal to 72.7/m^3.

[0422] Further, the cleaning robot has a hard ground cleaning mode and a soft ground cleaning mode, where a power of the cleaning robot in the hard ground cleaning mode is less than or equal to a power of the cleaning robot in the soft ground cleaning mode.

[0423] Further, the power of the cleaning robot in the soft ground cleaning mode ranges from 105 W to 155 W; and the power of the cleaning robot in the hard ground cleaning mode ranges from 60 W to 100 W.

[0424] Further, a ratio of the power of the cleaning robot in the soft ground cleaning mode to the power of the cleaning robot in the hard ground cleaning mode ranges from 1.55 to 1.75.

[0425] Further, the cleaning robot further includes a ground detection mechanism, detecting a ground type of the to-be-cleaned ground.

[0426] Further, the controller is configured to control the cleaning robot according to the ground type of the to-be-cleaned ground to switch to a corresponding ground cleaning mode.

[0427] The foregoing embodiments only describe several implementations of the present invention, which are described specifically and in detail, but cannot be construed as a limitation to the patent scope of the present invention. It should be noted that for a person of ordinary skill in the art, several transformations and improvements can be made without departing from the idea of the present invention. Unless otherwise particularly indicated, the foregoing features may all be combined with each other to obtain new implementations without causing any conflict. These implementations belong to the scope of protection of the present invention.

Claims

1. A cleaning robot, **characterized in that**, comprising:

a body, having a front end;

a movement mechanism, comprising at least one driving wheel, and configured to support and drive the cleaning robot to move on a to-be-cleaned ground;

a cleaning mechanism, comprising a roller brush, and configured to perform cleaning work on the to-be-cleaned ground;

a dust suction mechanism, comprising a fan, and configured to suck garbage cleaned off by the cleaning mechanism into the body;

a dust collection mechanism, comprising a dust box, and configured to collect the garbage sucked into the body; and

a controller, configured to control the cleaning robot to move on the to-be-cleaned ground, to implement autonomous cleaning of the to-be-cleaned ground,

wherein the roller brush comprises at least a first cleaning roller brush and a second cleaning roller brush, the first cleaning roller brush and the second cleaning roller brush are disposed at a bottom of the body, and are at least partially exposed from the body;

the first cleaning roller brush and the second cleaning roller brush are configured to clean off garbage on the to-be-cleaned ground during rotation, to facilitate the suction by the dust suction mechanism; and

the fan is disposed inside the body, and a power of the fan is greater than or equal to 65 W.

2. The cleaning robot according to claim 1, **characterized in that** the power of the fan is greater than or equal to 65 W, and is less than 120 W.

3. The cleaning robot according to claim 2, **characterized in that** a value range of a flow rate at an inlet of the fan when the fan is fully open is 0.7 m^3/min to 0.9 m^3/min; a value range of a flow rate at the inlet of the fan when the fan is fully open is 0.7 m^3/min to 0.9 m^3/min; and a static pressure at the inlet of the fan when the fan is fully blocked ranges from 6.5 Kpa to 12 Kpa.

4. The cleaning robot according to claim 1, **characterized in that** a fan with a rated input power of 80 W is selected for the fan, and at the rated input power, a degree of vacuum of the fan ranges from 7.6 Kpa to 8.2 Kpa; and a test value of a flow rate at an inlet when the fan is fully open approximately ranges from 0.72 m^3/min to 0.75 m^3/min.

5. The cleaning robot according to claim 1, **characterized in that** the fan accounts for 0.5% to 1% of a total volume of the cleaning robot.

6. The cleaning robot according to claim 5, **characterized in that** the body comprises a chassis, and a chassis height at a position of the fan is smaller than a chassis height at another position at which the fan is not disposed of the body.

7. The cleaning robot according to claim 6, **characterized in that** a value range of the chassis height at the position of the fan is 8 mm to 12 mm; and a value range of the chassis height at the another position at which the fan is not disposed of the body is 12 mm to 18 mm.

8. The cleaning robot according to claim 1, **characterized in that** rotational speeds of the first cleaning roller brush and the second cleaning roller brush are both greater than or equal to 1500 r/min.

9. The cleaning robot according to claim 1, **characterized in that** the cleaning mechanism comprises a roller brush motor configured to drive the first cleaning roller brush and the second cleaning roller brush to rotate, and a value range of a power of the roller brush motor is 30 W to 35 W.

10. The cleaning robot according to claim 1, **characterized in that** the dust suction mechanism further comprises a dust suction port, provided at the bottom of the body; the first cleaning roller brush and the second cleaning roller brush both rotate toward the dust suction port, to agitate garbage in a cleaning region; and the fan sucks the garbage agitated into the body through the dust suction port, and the garbage is collected by the dust box.

11. The cleaning robot according to claim 10, **characterized in that** the dust suction port is located between the first cleaning roller brush and the second cleaning roller brush, a rotation direction of the first cleaning roller brush is a first direction, a rotation direction of the second cleaning roller brush is a second direction, and the first direction is opposite to the second direction.

12. The cleaning robot according to claim 1, **characterized in that** the first cleaning roller brush and the second cleaning roller brush are disposed in a traveling direction of the body, a rotation axis of the first cleaning roller brush and a rotation axis of the second cleaning roller brush are parallel to each other, and the rotation axis of the first cleaning roller brush and the rotation axis of the second cleaning roller brush are both perpendicular to a traveling direction of the cleaning robot,
wherein a value range of a length of at least one of the first cleaning roller brush and the second cleaning roller brush in a direction of the rotation axis is 190 mm to 195 mm.

13. The cleaning robot according to claim 1, **characterized in that** the first cleaning roller brush is a hard roller brush, and the second cleaning roller brush is a bristle roller brush.

14. The cleaning robot according to claim 13, **characterized in that** a value range of a degree of interference of the first cleaning roller brush is 1.5 mm to 2.5 mm; and a value range of a degree of interference of the second cleaning roller brush is 3 mm to 5 mm, wherein the degree of interference is a depth by which a cleaning portion of the roller brush extends into an upper surface of the to-be-cleaned ground.

15. The cleaning robot according to claim 13, **characterized in that** the hard roller brush is a rubber roller brush, and the bristle roller brush comprises at least bristles.

16. The cleaning robot according to claim 13, **characterized in that** in a traveling direction of the body, the first cleaning roller brush is located in front of the second cleaning roller brush.

17. The cleaning robot according to claim 1, **characterized in that** the cleaning robot further comprises a power supply mechanism, comprising a rechargeable battery, and configured to provide energy to the cleaning robot.

18. The cleaning robot according to claim 17, **characterized in that** a capacity of the battery ranges from 140 Wh to 200 Wh.

19. The cleaning robot according to claim 17, **characterized in that** a ratio of a capacity of the battery to a power of the cleaning robot is greater than or equal to 2500 J/W.

20. The cleaning robot according to claim 17, **characterized in that** a ratio of a capacity of the battery to a volume of the cleaning robot ranges from 0.017 Wh/cm^3 to 0.024 Wh/cm^3; or a ratio of a capacity of the battery to a height of the cleaning robot ranges from 1.2 Wh/mm to 2.1 Wh/mm.

21. The cleaning robot according to claim 17, **characterized in that** a battery cycle count of the battery for a cleaning robot with a rated input power PE being greater than or equal to 100 W ranges from 640 to 960.

22. The cleaning robot according to claim 18, **characterized in that** a proportion of a volume of the battery relative to a volume of the cleaning robot is at least 1/25.

23. The cleaning robot according to claim 22, **characterized in that** the battery has a cylindrical shape, and the battery is disposed on the body in an assembly direction during installation, wherein the assembly direction is a direction that makes an axis of the battery perpendicular to a horizontal plane.

24. The cleaning robot according to claim 18, **characterized in that** a percentage of the battery in a total weight of the cleaning robot is greater than or equal

to 10%.

25. The cleaning robot according to claim 1, **characterized in that** the cleaning robot further comprises a driving motor configured to drive the movement mechanism to move, and a value range of a power of the driving motor is 4 W to 6 W.

26. The cleaning robot according to claim 1, **characterized in that** the movement mechanism is configured to drive the cleaning robot to move at a preset movement speed, wherein a value range of the preset movement speed is 0.1 m/s to 0.2 m/s.

27. The cleaning robot according to claim 1, **characterized in that** the movement mechanism is configured to: when the to-be-cleaned ground is a soft ground, drive the cleaning robot to move at a first movement speed; and
when the to-be-cleaned ground is a hard ground, drive the cleaning robot to move at a second movement speed, wherein the first movement speed is less than the second movement speed.

28. The cleaning robot according to claim 27, **characterized in that** a value range of the first movement speed is 0.24 m/s to 0.36 m/s; and a value range of the second movement speed is 0.12 m/s to 0.18 m/s.

29. The cleaning robot according to claim 1, **characterized in that** an energy input per unit area of the cleaning robot is at least 4000 J/m^2.

30. The cleaning robot according to claim 1, **characterized in that** a ratio of an energy input per unit area of the cleaning robot to a height of the cleaning robot is greater than or equal to 11.7 Wh/m^3; or a ratio of an energy input per unit area of the cleaning robot to a volume of the cleaning robot is greater than or equal to 158.7 Wh/m^5.

31. The cleaning robot according to claim 1, **characterized in that** the movement mechanism is configured to drive the cleaning robot to move at a preset movement speed, wherein a ratio of a power of the cleaning robot to the preset movement speed is at least 50 J/m.

32. The cleaning robot according to claim 1, **characterized in that** the movement mechanism is configured to drive the cleaning robot to move at a preset movement speed, wherein a proportion of a sum of the power of the fan and a power of a roller brush motor configured to drive the roller brush to rotate relative to the preset movement speed is at least 45 J/m.

33. The cleaning robot according to claim 1, **characterized in that** the cleaning robot further comprises a driving motor, disposed in the body, and configured to drive the movement mechanism to rotate, wherein a proportion of a sum of the power of the fan and a power of a roller brush motor configured to drive the roller brush to rotate relative to a power of the driving motor is at least 15.

34. The cleaning robot according to claim 1, **characterized in that** for a standard test carpet, a cleaning efficiency of the cleaning robot is greater than or equal to 80%.

35. The cleaning robot according to claim 1, **characterized in that** for a standard test carpet, a ratio of a cleaning efficiency of the cleaning robot to a height of the cleaning robot is greater than or equal to 7/m; or for a standard test carpet, a ratio of a cleaning efficiency of the cleaning robot to a volume of the cleaning robot is greater than or equal to 72.7/m^3.

36. The cleaning robot according to claim 1, **characterized in that** for a standard test carpet, a ratio of a cleaning efficiency of the cleaning robot to a power of the cleaning robot is greater than or equal to 0.004/W.

37. The cleaning robot according to claim 1, **characterized in that** a power of the cleaning robot is at least 100 W.

38. The cleaning robot according to claim 1, **characterized in that** a ratio of a power of the cleaning robot to a volume of the cleaning robot is at least 0.01 W/cm^3.

39. The cleaning robot according to claim 1, **characterized in that** the cleaning robot has a hard ground cleaning mode and a soft ground cleaning mode,
wherein a power of the cleaning robot in the hard ground cleaning mode is less than or equal to a power of the cleaning robot in the soft ground cleaning mode.

40. The cleaning robot according to claim 39, **characterized in that** the power of the cleaning robot in the soft ground cleaning mode ranges from 105 W to 155 W; and the power of the cleaning robot in the hard ground cleaning mode ranges from 60 W to 100 W.

41. The cleaning robot according to claim 39, **characterized in that** a ratio of the power of the cleaning robot in the soft ground cleaning mode to the power of the cleaning robot in the hard ground cleaning mode ranges from 1.55 to 1.75.

42. The cleaning robot according to claim 39, **characterized in that** the cleaning robot further comprises a ground detection mechanism, detecting a ground type of the to-be-cleaned ground.

43. The cleaning robot according to claim 42, **characterized in that** the controller is configured to control the cleaning robot according to the ground type of the to-be-cleaned ground to switch to a corresponding ground cleaning mode.

44. A cleaning robot, **characterized in that**, comprising:

a body, having a front end;
a movement mechanism, supporting and driving the cleaning robot to move on a to-be-cleaned ground;
a beating mechanism, performing beating work on the to-be-cleaned ground;
a dust suction mechanism, sucking garbage agitated by the beating mechanism into the body;
a dust collection mechanism, collecting the sucked garbage; and
a power supply mechanism, providing energy to the cleaning robot,
the cleaning robot has a first cleaning effect, the first cleaning effect is used for representing a cleaning effect produced by cleaning the to-be-cleaned ground once by the cleaning robot by using the beating mechanism and the dust suction mechanism and driven by the movement mechanism, wherein
the first cleaning effect is represented by a single-time cleaning efficiency; and for a standard test carpet, a ratio of the single-time cleaning efficiency of the cleaning robot to a height of the cleaning robot is greater than or equal to 7/m.

45. The cleaning robot according to claim 44, **characterized in that**
the cleaning robot is configured to make the ratio of the single-time cleaning efficiency to the height of the cleaning robot greater than or equal to 7/m in at least one of the following manners:

A: a beating frequency of the beating mechanism is increased;
B: the beating mechanism beats a same strand of pile of the standard test carpet in at least two directions;
C: a length by which the beating mechanism contacts the standard test carpet in a single time of beating ranges from 190 mm to 195 mm;
D: the beating mechanism comprises a cleaning portion contacting a surface of the to-be-cleaned ground, and a degree of interference between the cleaning portion and the standard test carpet is 2 mm to 5 mm, wherein the degree of interference is used for representing a depth value by which the cleaning portion extends into a non-standard test carpet or the standard test carpet;
E: the dust suction mechanism comprises a fan disposed in the body, and a power of the fan is greater than or equal to 65 W; and
F: a movement speed of the cleaning robot is 0.1 m/s to 0.2 m/s.

46. The cleaning robot according to claim 45, **characterized in that**
the cleaning robot is configured to make the ratio of the single-time cleaning efficiency to the height of the cleaning robot greater than or equal to 7/m in a combination of the following manners:

A: the beating frequency of the beating mechanism is greater than or equal to 3000/min;
B: the beating mechanism beats each strand of pile of the standard test carpet in at least two directions; and
E: the dust suction mechanism comprises the fan disposed in the body, and the power of the fan is greater than or equal to 65 W.

47. The cleaning robot according to claim 46, **characterized in that** the beating frequency of the beating mechanism is increased in at least one of the following manners in A:

the beating mechanism comprises a cleaning roller brush, the cleaning roller brush comprises at least a first cleaning roller brush and a second cleaning roller brush, and the first cleaning roller brush and the second cleaning roller brush clean off garbage on the to-be-cleaned ground during rotation, to facilitate the suction by the dust suction mechanism; and
the beating mechanism comprises the cleaning roller brush, and a rotational speed of the cleaning roller brush is at least 1500 r/min.

48. The cleaning robot according to claim 47, **characterized in that** the beating mechanism comprises the cleaning roller brush, the cleaning roller brush comprises at least the first cleaning roller brush and the second cleaning roller brush, a rotational speed of the first cleaning roller brush is equal to a rotational speed of the second cleaning roller brush, and the rotational speed of the first cleaning roller brush and the rotational speed of the second cleaning roller brush are both 1500 r/min.

49. The cleaning robot according to claim 47, **characterized in that** the beating mechanism further comprises a roller brush motor, disposed in the body, and configured to drive the first cleaning roller brush and the second cleaning roller brush to rotate, and a power of the roller brush motor is 30 W to 35 W.

50. The cleaning robot according to claim 46, **characterized in that** a ratio of the power of the fan to a power of the cleaning robot is 80/130.

51. The cleaning robot according to claim 49, **characterized in that** a ratio of a sum of the power of the fan and the power of the roller brush motor to the movement speed of the cleaning robot is 45 J/m.

52. The cleaning robot according to claim 45, **characterized in that** the body comprises a chassis, and a chassis height at a position of the fan is smaller than a chassis height at another position at which the fan is not disposed of the body.

53. The cleaning robot according to claim 52, **characterized in that** a value range of the chassis height at the position of the fan is 8 mm to 12 mm; and a value range of the chassis height at the another position at which the fan is not disposed of the body is 12 mm to 18 mm.

54. The cleaning robot according to claim 44, **characterized in that** the cleaning robot further comprises the power supply mechanism, comprising a rechargeable battery, and configured to provide energy to the cleaning robot.

55. The cleaning robot according to claim 54, **characterized in that** a capacity of the battery ranges from 140 Wh to 200 Wh.

56. The cleaning robot according to claim 54, **characterized in that** a ratio of a capacity of the battery to a power of the cleaning robot is greater than or equal to 2500 J/W.

57. The cleaning robot according to claim 54, **characterized in that** a ratio of a capacity of the battery to a volume of the cleaning robot ranges from 0.017 Wh/cm^3 to 0.024 Wh/cm^3; or a ratio of a capacity of the battery to the height of the cleaning robot ranges from 1.2 Wh/mm to 2.1 Wh/mm.

58. The cleaning robot according to claim 54, **characterized in that** a battery cycle count of the battery for a cleaning robot with a rated input power PE being greater than or equal to 100 W ranges from 640 to 960.

59. The cleaning robot according to claim 55, **characterized in that** a proportion of a volume of the battery relative to a volume of the cleaning robot is at least 1/25.

60. The cleaning robot according to claim 59, **characterized in that** the battery has a cylindrical shape, and the battery is disposed on the body in an assembly direction during installation, wherein the assembly direction is a direction that makes an axis of the battery perpendicular to a horizontal plane.

61. The cleaning robot according to claim 55, **characterized in that** a percentage of the battery in a total weight of the cleaning robot is greater than or equal to 10%.

62. A cleaning robot, **characterized in that**, comprising:

a body, having a front end;
a movement mechanism, supporting and driving the cleaning robot to move on a to-be-cleaned ground;
a beating mechanism, performing beating work on the to-be-cleaned ground;
a dust suction mechanism, sucking garbage agitated by the beating mechanism into the body;
a dust collection mechanism, collecting the sucked garbage; and
a power supply mechanism, providing energy to the cleaning robot,
wherein the cleaning robot is configured to make a ratio of an energy input per unit area produced by cleaning the to-be-cleaned ground once by the cleaning robot by using the beating mechanism and the dust suction mechanism and driven by the movement mechanism to a height of the cleaning robot is greater than or equal to 11.7 Wh/m^3.

63. The cleaning robot according to claim 62, **characterized in that** the cleaning robot is configured to make the ratio of the energy input per unit area to the height of the cleaning robot greater than or equal to 11.7 Wh/m^3 in at least one of the following manners:

A: a beating frequency of the beating mechanism is increased;
B: the beating mechanism beats a same strand of pile of the standard test carpet in at least two directions;
C: a length by which the beating mechanism contacts the standard test carpet in a single time of beating ranges from 190 mm to 195 mm;
D: the beating mechanism comprises a cleaning portion contacting a surface of the to-be-cleaned ground, and a degree of interference between the cleaning portion and the standard test carpet is 2 mm to 5 mm, wherein the degree of interference is used for representing a depth value by which the cleaning portion extends into a non-standard test carpet or the standard test carpet;
E: the dust suction mechanism comprises a fan disposed in the body, and a power of the fan is greater than or equal to 65 W; and

F: a movement speed of the cleaning robot is 0.1 m/s to 0.2 m/s.

64. The cleaning robot according to claim 63, **characterized in that**
the cleaning robot is configured to make the ratio of the energy input per unit area to the height of the cleaning robot greater than or equal to 11.7 Wh/m^3 in a combination of the following manners:

A: the beating frequency of the beating mechanism is greater than or equal to 3000/min;
B: the beating mechanism beats each strand of pile of the standard test carpet in at least two directions; and
E: the dust suction mechanism comprises the fan disposed in the body, and the power of the fan is greater than or equal to 65 W.

65. The cleaning robot according to claim 64, **characterized in that** the beating frequency of the beating mechanism is increased in at least one of the following manners in A:

the beating mechanism comprises a cleaning roller brush, the cleaning roller brush comprises at least a first cleaning roller brush and a second cleaning roller brush, and the first cleaning roller brush and the second cleaning roller brush clean off garbage on the to-be-cleaned ground during rotation, to facilitate the suction by the dust suction mechanism; and
the beating mechanism comprises the cleaning roller brush, and a rotational speed of the cleaning roller brush is at least 1500 r/min.

66. The cleaning robot according to claim 65, **characterized in that** the beating mechanism comprises the cleaning roller brush, the cleaning roller brush comprises at least the first cleaning roller brush and the second cleaning roller brush, a rotational speed of the first cleaning roller brush is equal to a rotational speed of the second cleaning roller brush, and the rotational speed of the first cleaning roller brush and the rotational speed of the second cleaning roller brush are both 1500 r/min.

67. The cleaning robot according to claim 65, **characterized in that** the beating mechanism further comprises a roller brush motor, disposed in the body, and configured to drive the first cleaning roller brush and the second cleaning roller brush to rotate, and a power of the roller brush motor is 30 W to 35 W.

68. The cleaning robot according to claim 67, **characterized in that** a ratio of a sum of the power of the fan and the power of the roller brush motor to the movement speed of the cleaning robot is 45 J/m.

69. The cleaning robot according to claim 63, **characterized in that** the body comprises a chassis, and a chassis height at a position of the fan is smaller than a chassis height at another position at which the fan is not disposed of the body.

70. The cleaning robot according to claim 69, **characterized in that** a value range of the chassis height at the position of the fan is 8 mm to 12 mm; and a value range of the chassis height at the another position at which the fan is not disposed of the body is 12 mm to 18 mm.

71. The cleaning robot according to claim 62, **characterized in that** the cleaning robot further comprises the power supply mechanism, comprising a rechargeable battery, and configured to provide energy to the cleaning robot.

72. The cleaning robot according to claim 71, **characterized in that** a capacity of the battery ranges from 140 Wh to 200 Wh.

73. The cleaning robot according to claim 71, **characterized in that** a ratio of a capacity of the battery to a power of the cleaning robot is greater than or equal to 2500 J/W.

74. The cleaning robot according to claim 71, **characterized in that** a ratio of a capacity of the battery to a volume of the cleaning robot ranges from 0.017 Wh/cm^3 to 0.024 Wh/cm^3; or a ratio of a capacity of the battery to the height of the cleaning robot ranges from 1.2 Wh/mm to 2.1 Wh/mm.

75. The cleaning robot according to claim 71, **characterized in that** a battery cycle count of the battery for a cleaning robot with a rated input power PE being greater than or equal to 100 W ranges from 640 to 960.

76. The cleaning robot according to claim 72, **characterized in that** a proportion of a volume of the battery relative to a volume of the cleaning robot is at least 1/25.

77. The cleaning robot according to claim 76, **characterized in that** the battery has a cylindrical shape, and the battery is disposed on the body in an assembly direction during installation, wherein the assembly direction is a direction that makes an axis of the battery perpendicular to a horizontal plane.

78. The cleaning robot according to claim 72, **characterized in that** a percentage of the battery in a total weight of the cleaning robot is greater than or equal to 10%.

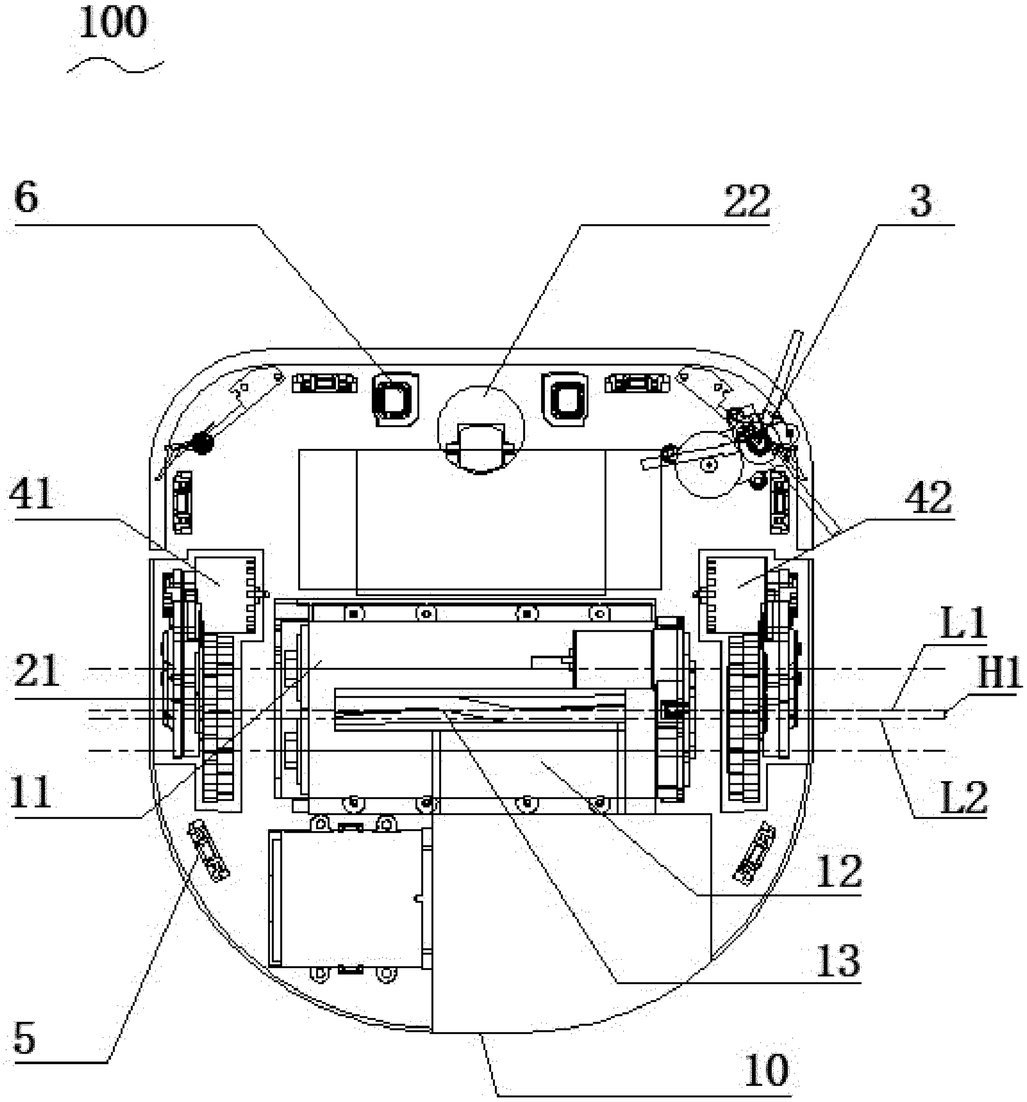


FIG. 1

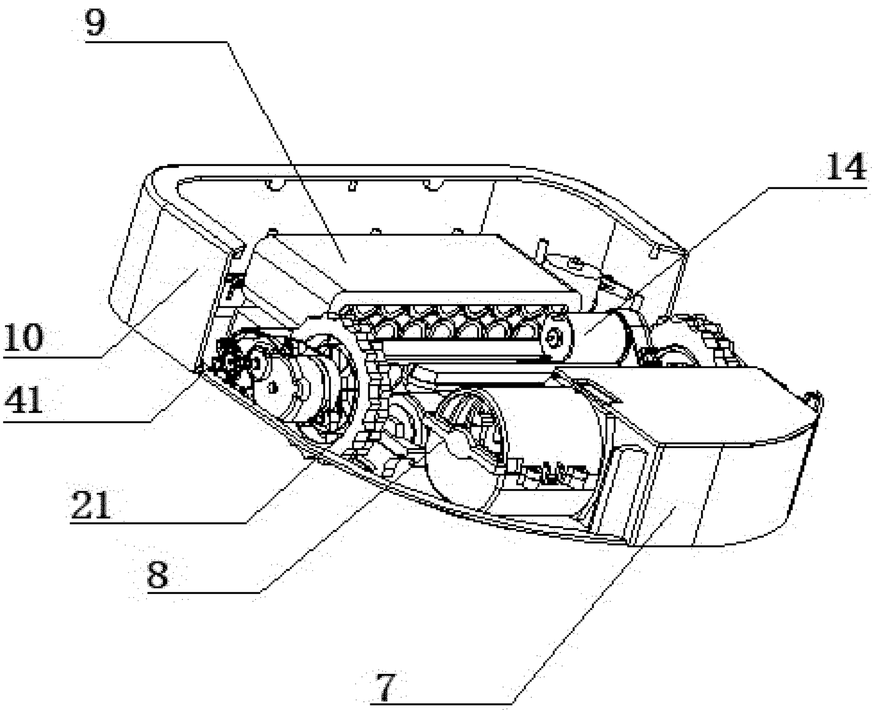


FIG. 2

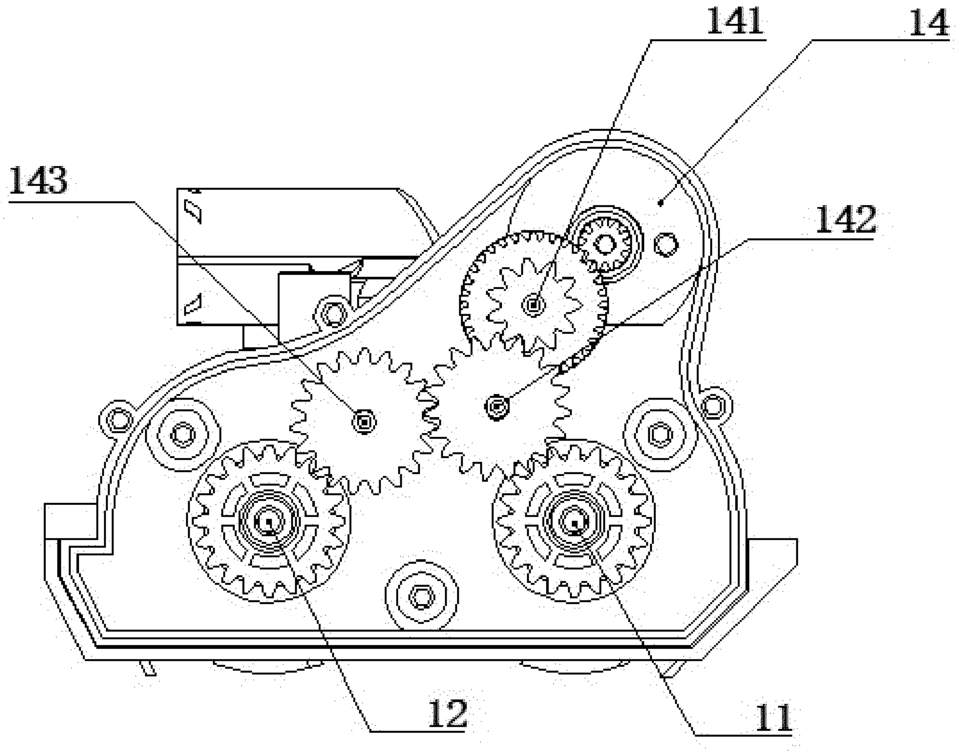


FIG. 3a

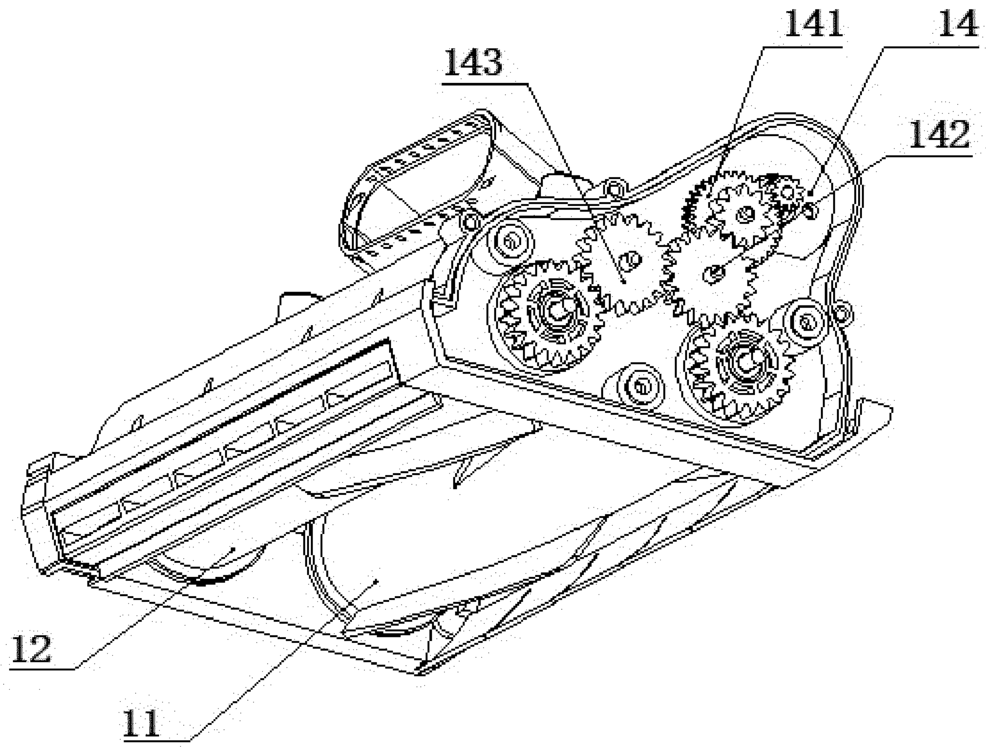


FIG. 3b

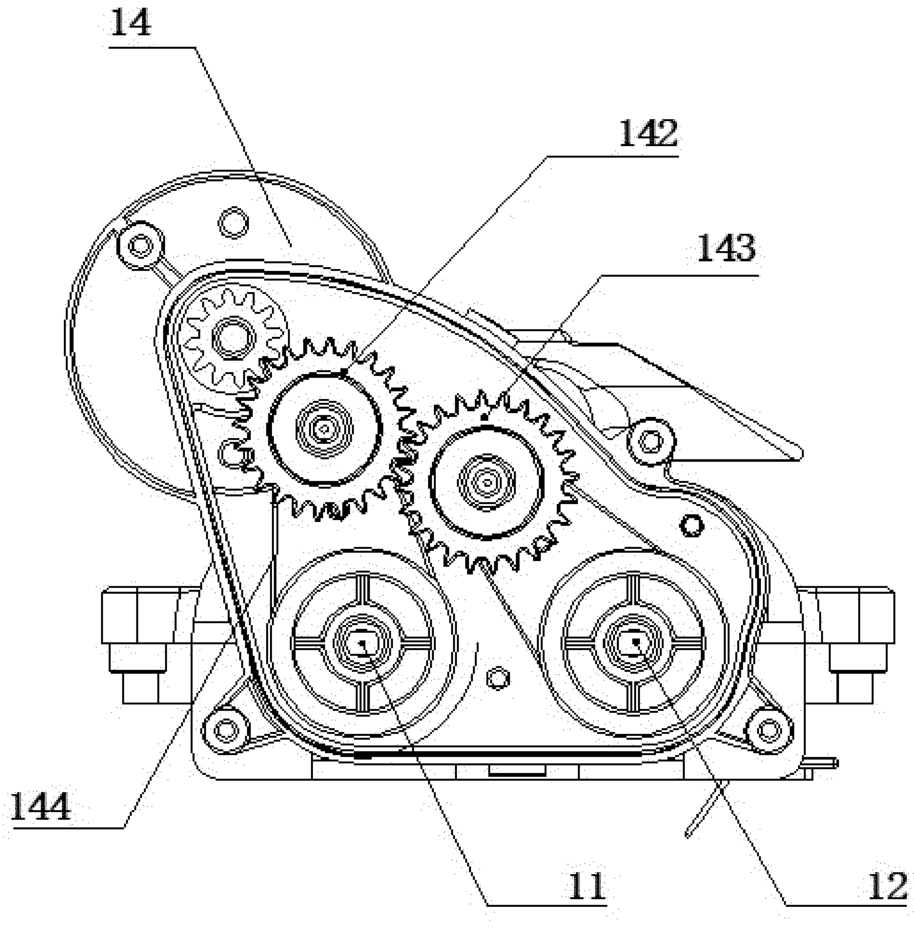


FIG. 4a

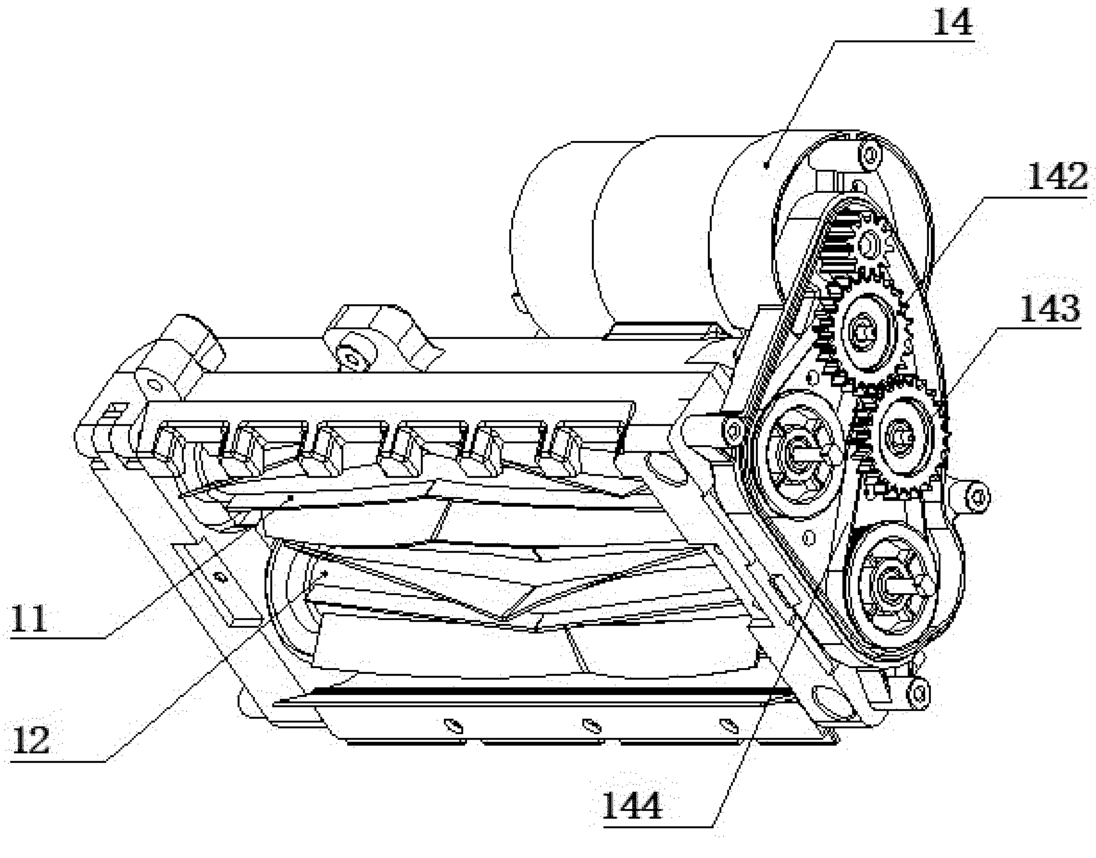


FIG. 4b

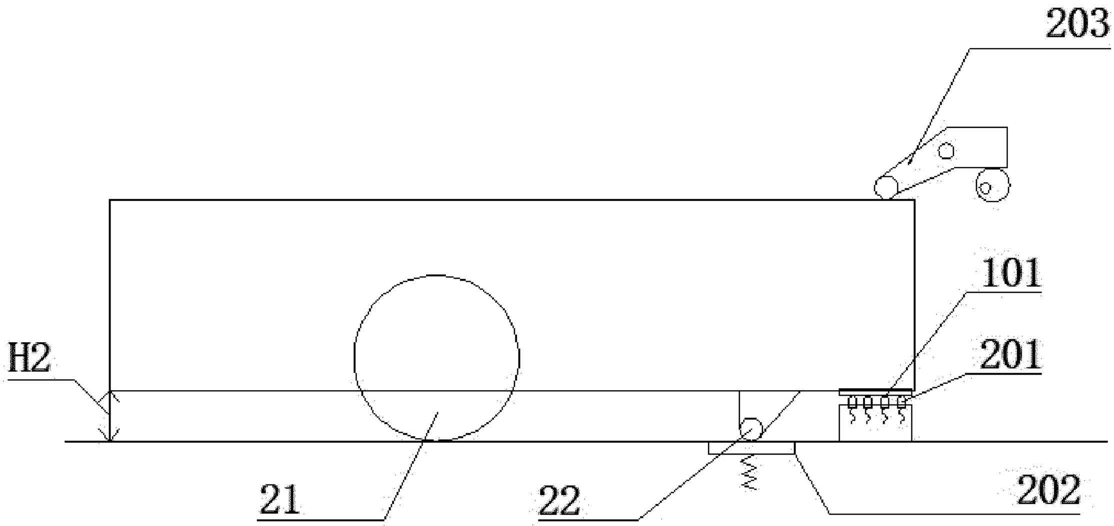


FIG. 5

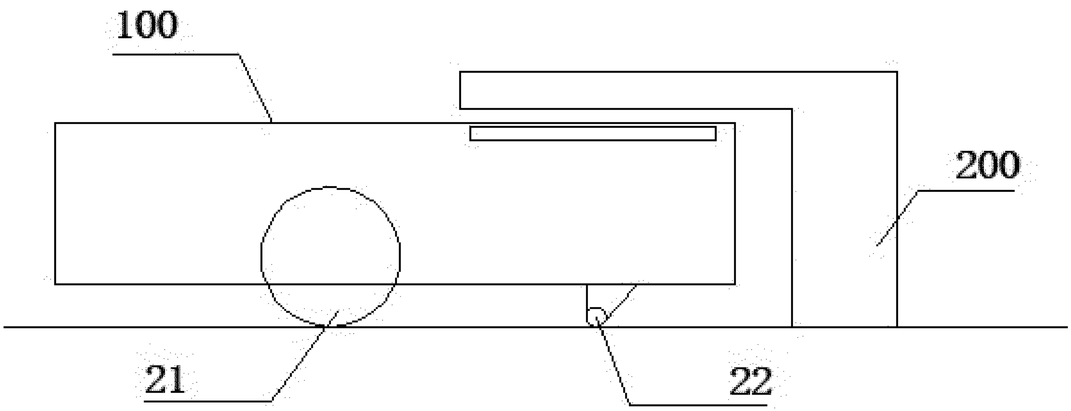


FIG. 6

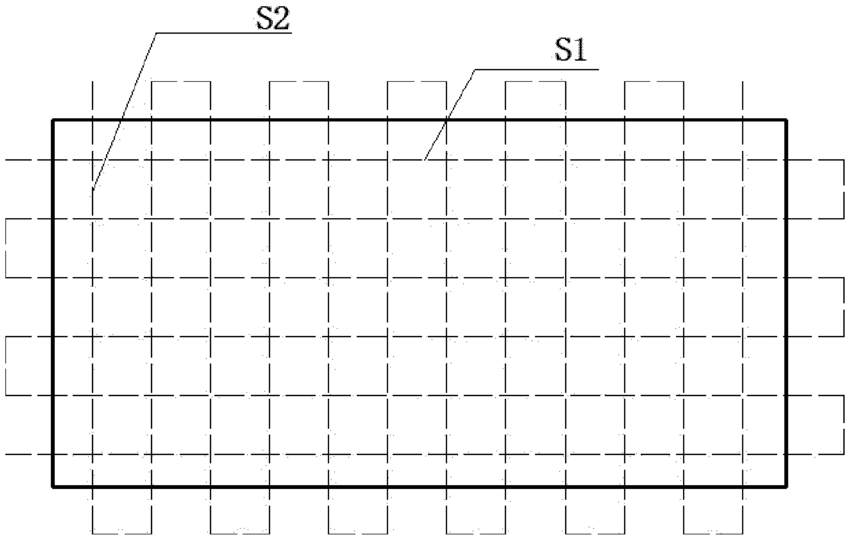

S2
S1

FIG. 7

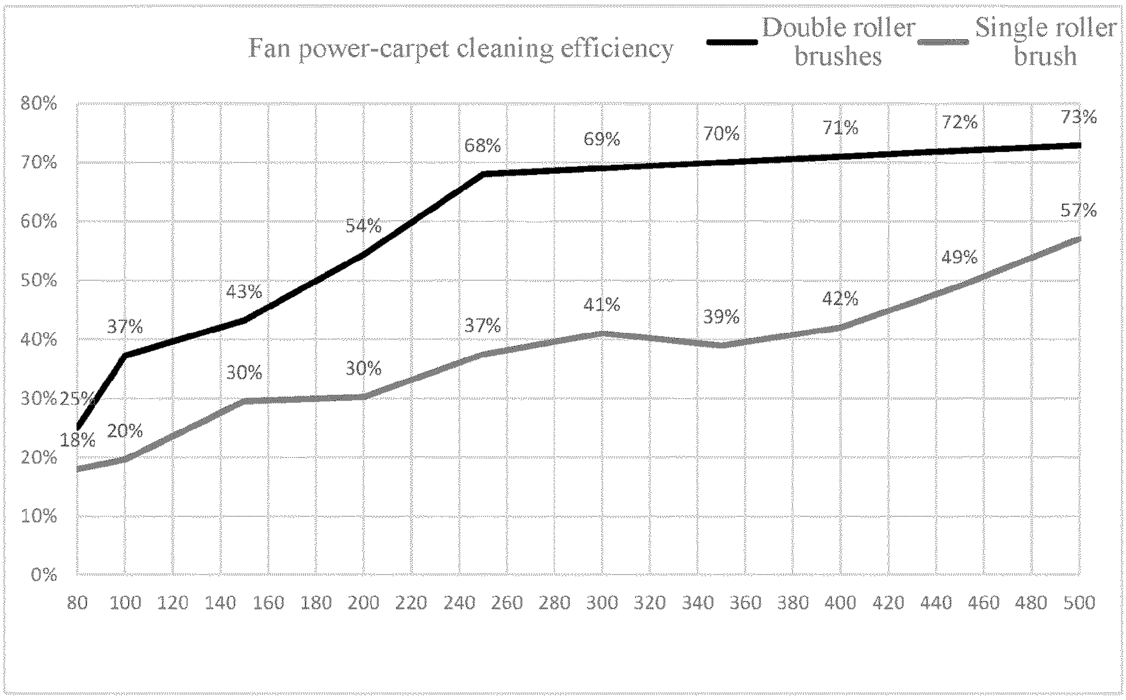
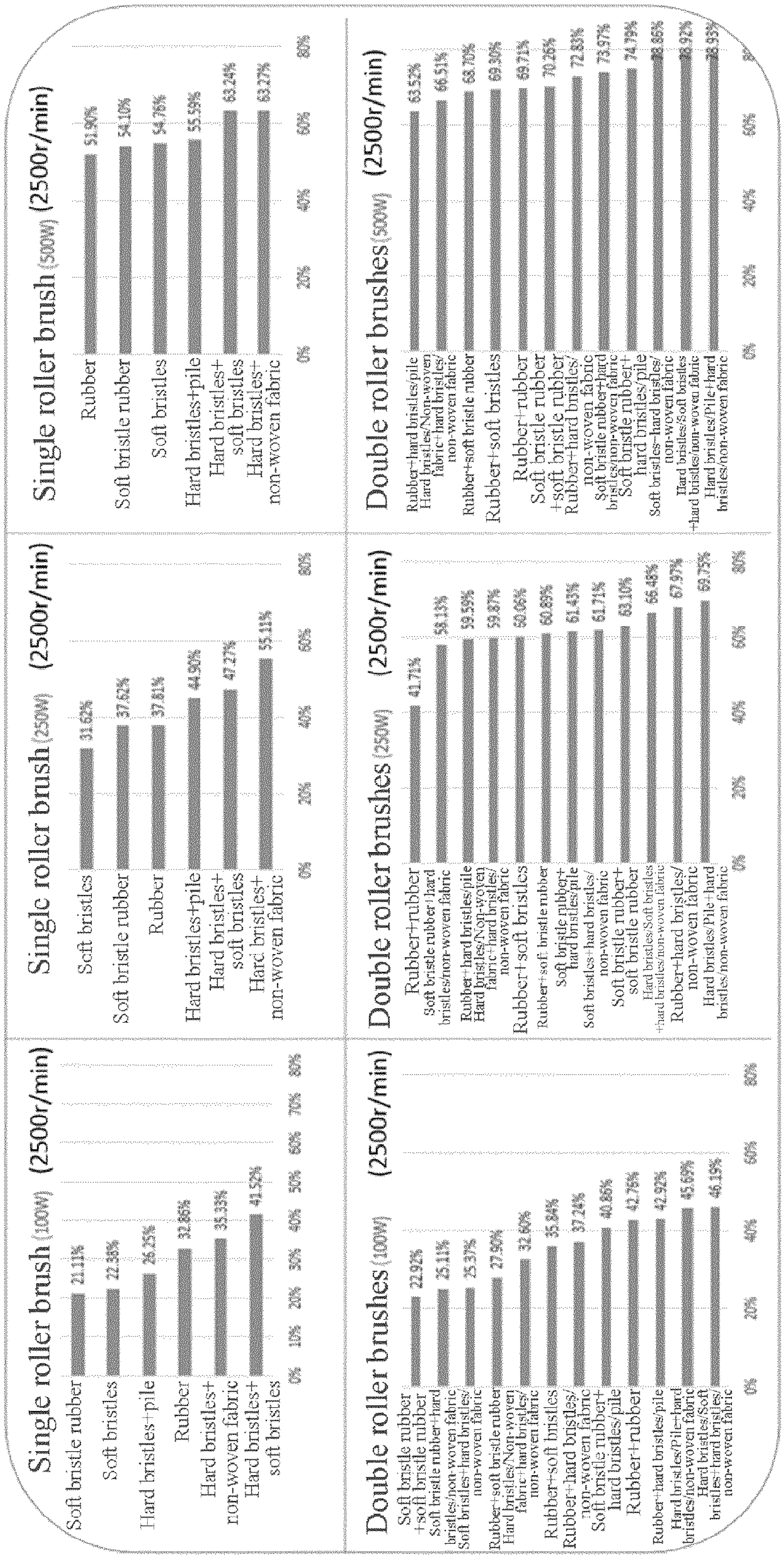
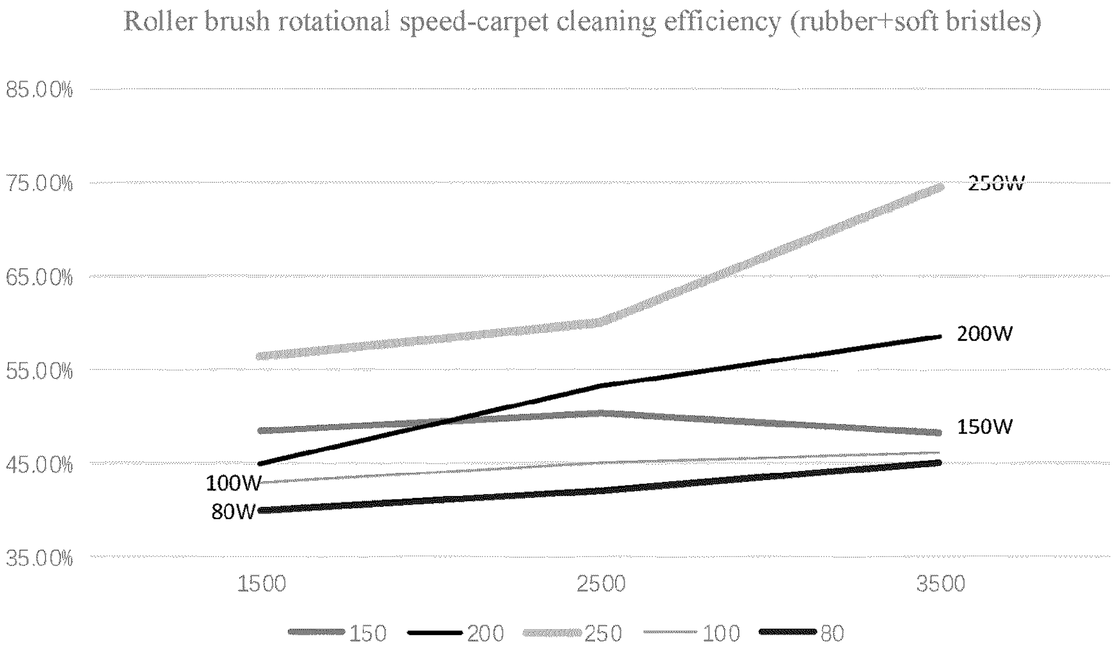

Fan power-carpet cleaning efficiency
Double roller brushes
Single roller brush
80%
70%
60%
50%
40%
30%
20%
10%
0%
25%
37%
43%
54%
68%
69%
70%
71%
72%
73%
18%
20%
30%
30%
37%
41%
39%
42%
49%
57%
80 100 120 140 160 180 200 220 240 260 280 300 320 340 360 380 400 420 440 460 480 500

FIG. 8



Single roller brush (100W) (2500r/min)
Soft bristle rubber 21.11%
Soft bristles 22.38%
Hard bristles+pile 26.25%
Rubber 32.86%
Hard bristles+ non-woven fabric 35.33%
Hard bristles+ soft bristles 41.52%
0% 10% 20% 30% 40% 50% 60% 70% 80%
Single roller brush (250W) (2500r/min)
Soft bristles 31.62%
Soft bristle rubber 37.62%
Rubber 37.81%
Hard bristles+pile 44.90%
Hard bristles+ soft bristles 47.27%
Hard bristles+ non-woven fabric 55.11%
0% 20% 40% 60% 80%
Single roller brush (500W) (2500r/min)
Rubber 51.90%
Soft bristle rubber 54.10%
Soft bristles 54.76%
Hard bristles+pile 55.59%
Hard bristles+ soft bristles 63.24%
Hard bristles+ non-woven fabric 63.27%
0% 20% 40% 60% 80%
Double roller brushes (100W) (2500r/min)
Soft bristle rubber +soft bristle rubber 22.92%
Soft bristle rubber+hard bristles/non-woven fabric 25.11%
Soft bristles+hard bristles/ non-woven fabric 25.37%
Rubber+soft bristle rubber 27.90%
Hard bristles/Non-woven fabric+hard bristles/ non-woven fabric 32.60%
Rubber+soft bristles 35.84%
Rubber+hard bristles/ non-woven fabric 37.24%
Soft bristle rubber+ hard bristles/pile 40.86%
Rubber+rubber 42.76%
Rubber+hard bristles/pile 42.92%
Hard bristles/Pile+hard bristles/non-woven fabric 45.69%
Hard bristles/Soft bristles+hard bristles/ non-woven fabric 46.19%
0% 20% 40% 60% 80%
Double roller brushes (250W) (2500r/min)
Rubber+rubber 41.71%
Soft bristle rubber+hard bristles/non-woven fabric 58.13%
Rubber+hard bristles/pile 59.59%
Hard bristles/Non-woven fabric+hard bristles/ non-woven fabric 59.87%
Rubber+soft bristles 60.06%
Rubber+soft bristle rubber 60.89%
Soft bristle rubber+ hard bristles/pile 61.43%
Soft bristles+hard bristles/ non-woven fabric 61.71%
Soft bristle rubber+ soft bristle rubber 63.10%
Hard bristles/Soft bristles +hard bristles/non-woven fabric 66.48%
Rubber+hard bristles/ non-woven fabric 67.97%
Hard bristles/Pile+hard bristles/non-woven fabric 69.73%
0% 20% 40% 60% 80%
Double roller brushes (500W) (2500r/min)
Rubber+hard bristles/pile 63.52%
Hard bristles/Non-woven fabric+hard bristles/ non-woven fabric 66.51%
Rubber+soft bristle rubber 68.70%
Rubber+soft bristles 69.30%
Rubber+rubber 69.71%
Soft bristle rubber +soft bristle rubber 70.26%
Rubber+hard bristles/ non-woven fabric 72.83%
Soft bristle rubber+hard bristles/non-woven fabric 73.97%
Soft bristle rubber+ hard bristles/pile 74.79%
Soft bristles+hard bristles/ non-woven fabric 78.86%
Hard bristles/Soft bristles +hard bristles/non-woven fabric 78.92%
Hard bristles/Pile+hard bristles/non-woven fabric 78.93%
0% 20% 40% 60% 80%

FIG. 9



Roller brush rotational speed-carpet cleaning efficiency (rubber+soft bristles)
85.00%
75.00%
65.00%
55.00%
45.00%
35.00%
1500
2500
3500
250W
200W
150W
100W
80W
150
200
250
100
80

FIG. 10a

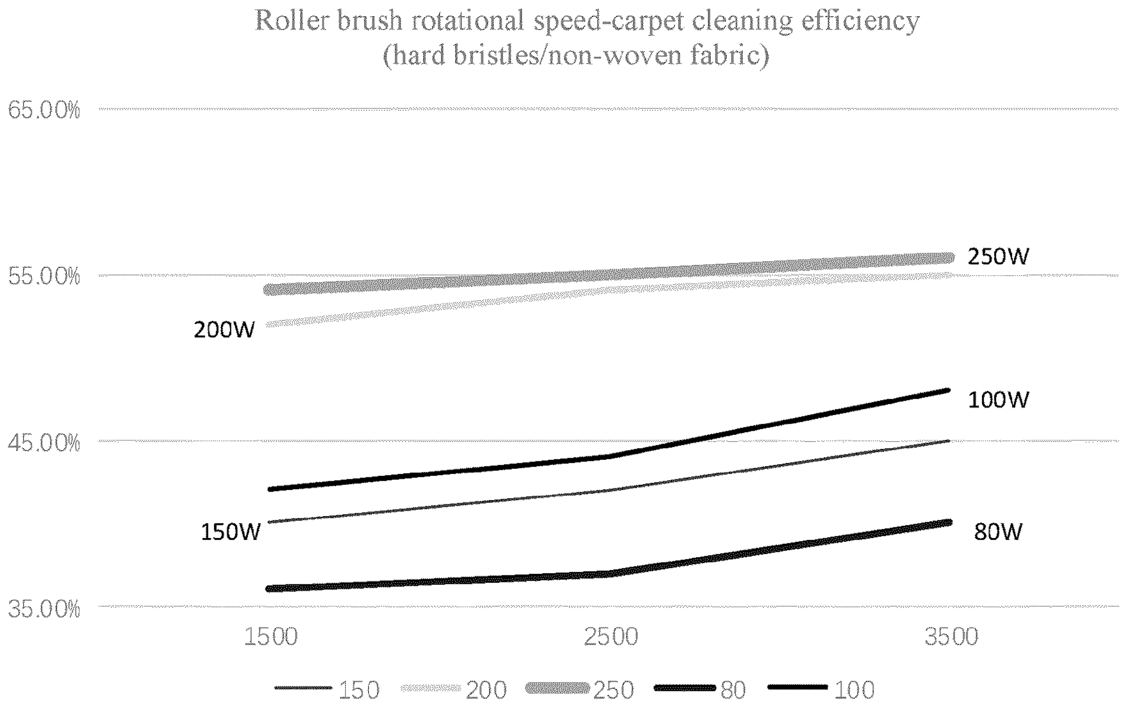


FIG. 10b

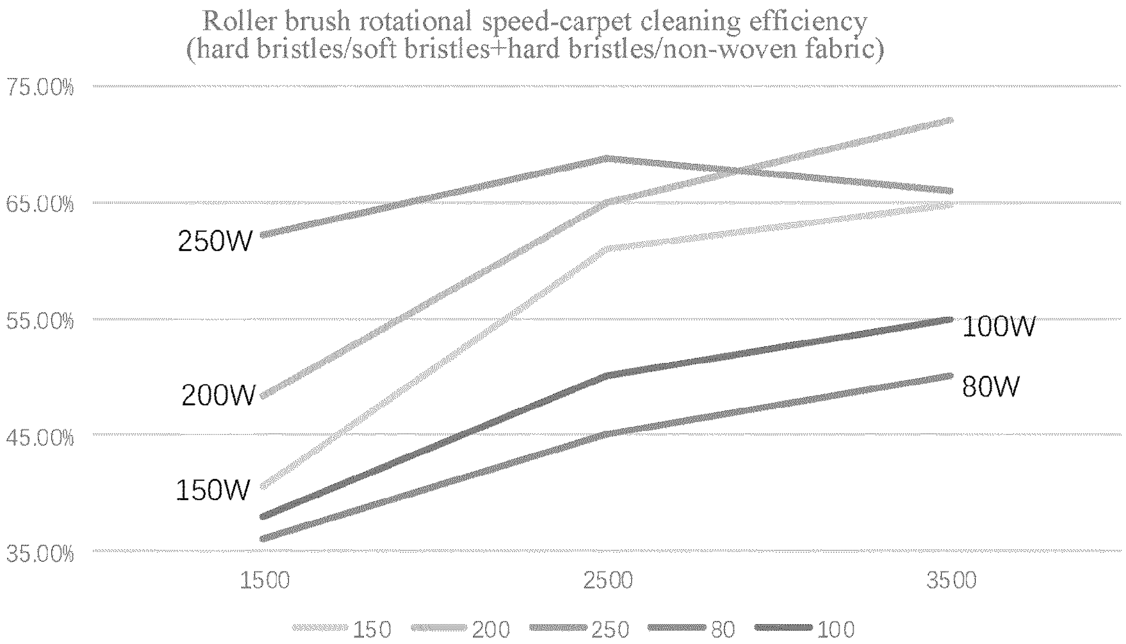


FIG. 10c

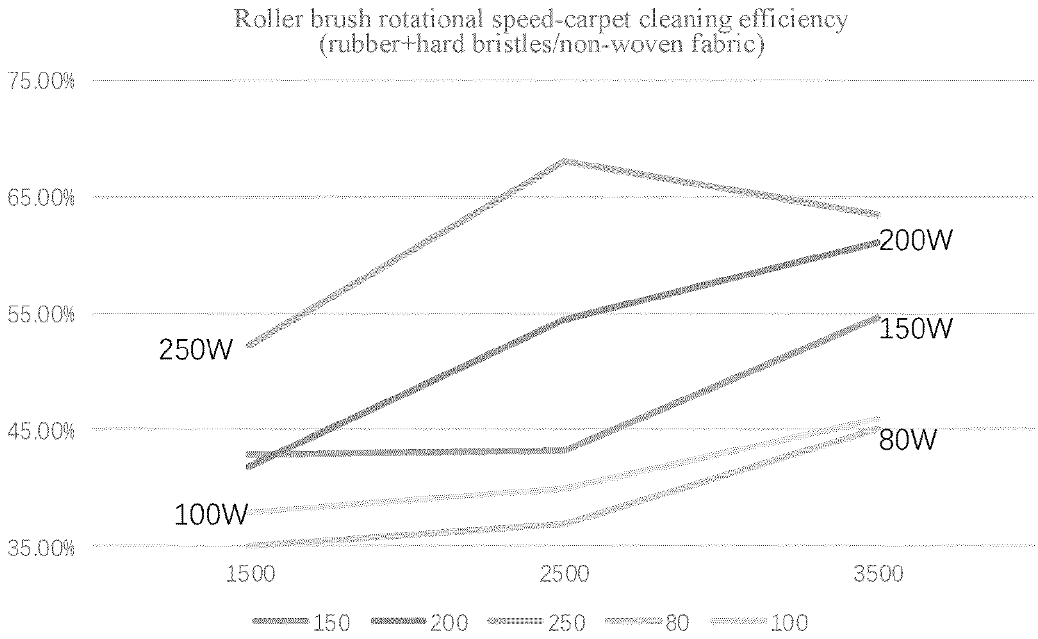


FIG. 10d

Single roller brush (150 w, 1500 r/min)	Hair cleaning rate (150 w, 30 CM)	Hair entanglement rate (150 w, 30 CM)
Rubber	28%	0%
Soft bristle rubber	100%	100%
Soft bristles	100%	83%
Hard bristles/Soft bristles	100%	98%
Hard bristles/Pile	100%	75%
Hard bristles/Non-woven fabric	100%	50%

Double roller brushes (150 w, 1500 r/min)	Hair cleaning rate (150 w, 30 CM)	Hair entanglement rate (150 w, 30 CM)
Rubber+rubber	70. 00%	0%
Rubber+soft bristles	100. 00%	25%
Rubber+hard bristles/pile	100. 00%	88%
Soft bristles+hard bristles/non-woven fabric	100. 00%	75%
Soft bristles/Hard bristles+rubber	100. 00%	70%
Soft bristles/Rubber+rubber	100. 00%	75%
Soft bristles/Rubber+soft bristles/rubber	100. 00%	90%
Soft bristles/Rubber+pile/hard bristles	100. 00%	85%
Rubber+hard bristles/non-woven fabric	100. 00%	48%
Hard bristles/Non-woven fabric+soft bristles/hard bristles	100. 00%	60%

FIG. 11

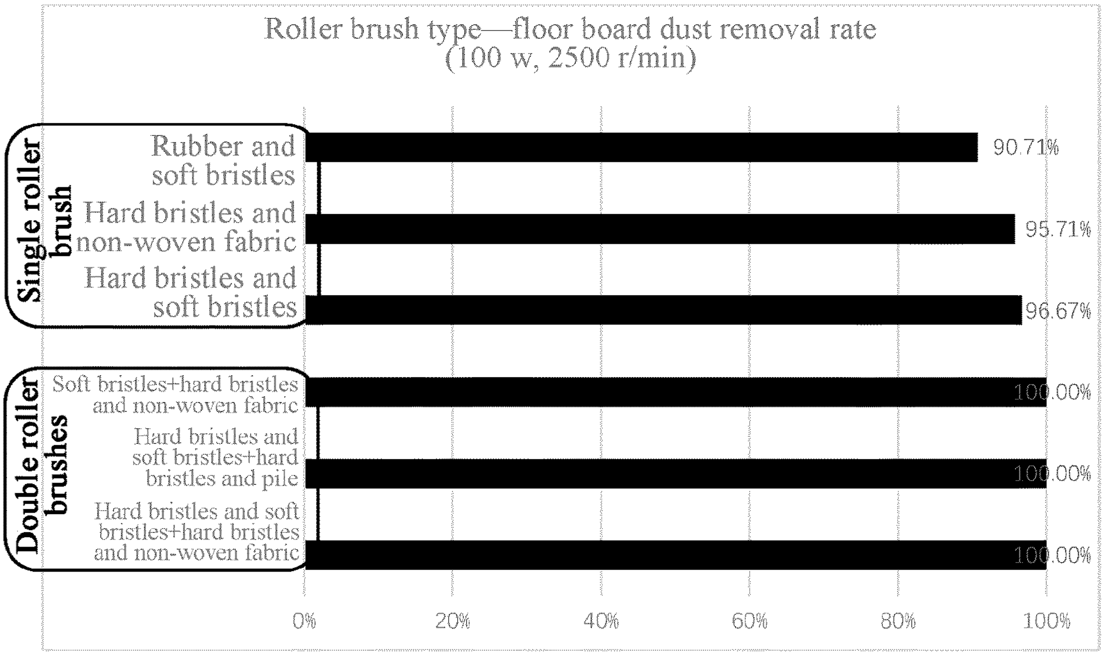

Roller brush type—floor board dust removal rate
(100 w, 2500 r/min)
Single roller brush
Rubber and soft bristles
Hard bristles and non-woven fabric
Hard bristles and soft bristles
Double roller brushes
Soft bristles+hard bristles and non-woven fabric
Hard bristles and soft bristles+hard bristles and pile
Hard bristles and soft bristles+hard bristles and non-woven fabric
90.71%
95.71%
96.67%
100.00%
100.00%
100.00%
0%
20%
40%
60%
80%
100%

FIG. 12

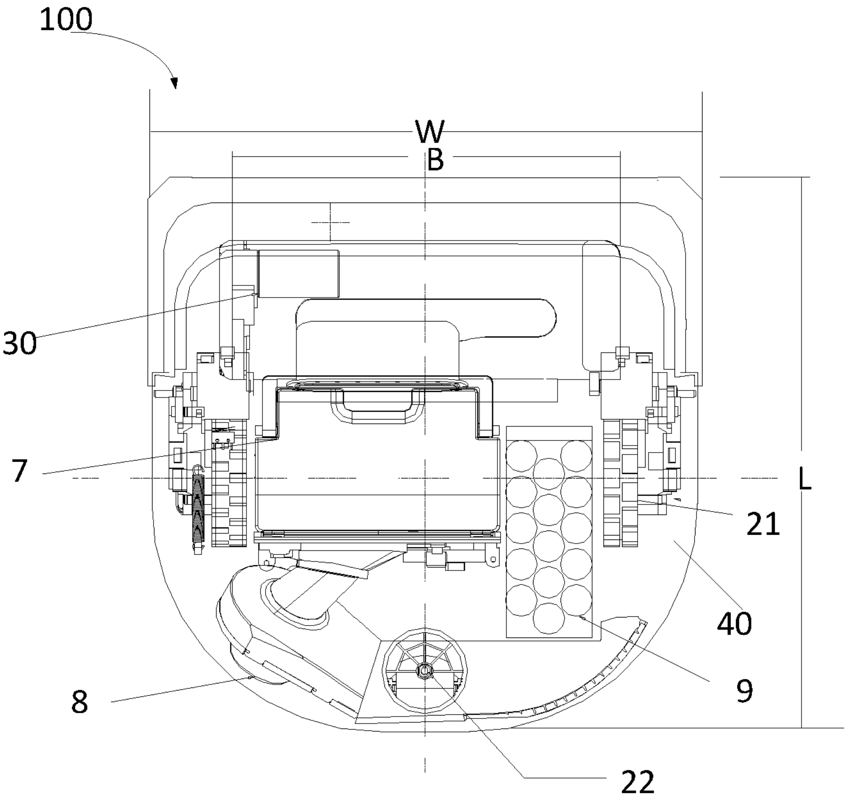

100
W
B
L
30
7
21
40
9
8
22

FIG. 13

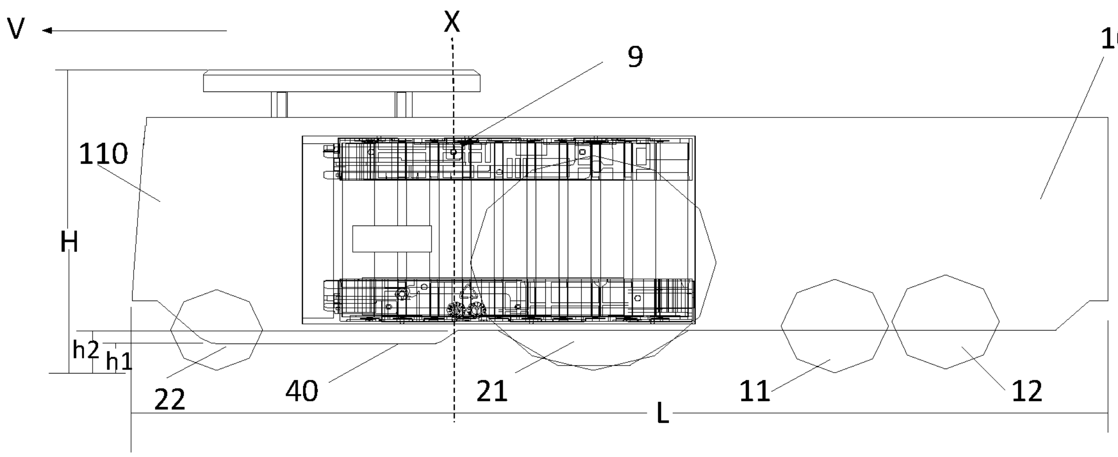


FIG. 14

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2022/115335

A. CLASSIFICATION OF SUBJECT MATTER

A47L 9/28(2006.01)i; A47L 11/24(2006.01)i; A47L 11/40(2006.01)i; A47L 9/04(2006.01)i; A47L 5/00(2006.01)i; A47L 11/18(2006.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A47L

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

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

CNPAT, EPODOC, WPI, CNKI: 宝时得, 张士松, 清洁, 清扫, 扫地, 机器人, 扫地机, 滚刷, 滚动刷, 刷辊, 拍打, 第二, 双, 两个, 一对, 吸尘, 抽吸, 真空, 风机, 马达, 集尘, 功率, 功耗, 瓦, "w", 高度, 效率, 效能, 能耗, 清洁效果, 地毯, 能量, clean, wash+, suct+, vacuum, fan, motor, brush, rotat+, roller, double, second, power, energy, effect+, efficiency, carpet

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 101273860 A (SAMSUNG ELECTRONICS CO., LTD.) 01 October 2008 (2008-10-01) description, page 5, line 2 to page 8, line 14, and figures 1-5	44, 54-62, 71-78
Y	CN 101273860 A (SAMSUNG ELECTRONICS CO., LTD.) 01 October 2008 (2008-10-01) description, page 5, line 2 to page 8, line 14, and figures 1-5	1-43, 45-53, 63-70
Y	CN 211582928 U (GUANGDONG GALANZ ENTERPRISES CO., LTD.) 29 September 2020 (2020-09-29) description, paragraphs 35-46, and figures 1-8	1-43, 45-53, 63-70
Y	CN 103491838 A (IROBOT CORPORATION) 01 January 2014 (2014-01-01) description, paragraphs 94-120, and figures 1-7	1-43, 45-53, 63-70
Y	CN 211212972 U (XIAOGOU ELECTRICAL APPLIANCE INTERNET TECHNOLOGY BEIJING CO., LTD.) 11 August 2020 (2020-08-11) description, paragraphs [0025]-[0037]	1, 2, 4, 45, 46, 63, 64
Y	US 2016235270 A1 (IROBOT CORP.) 18 August 2016 (2016-08-18) description, paragraphs 32-46, and figures 1A-2B	1-43, 45-53, 63-70

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"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)
"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
"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
"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
"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
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
02 November 2022	**29 November 2022**

Name and mailing address of the ISA/CN	Authorized officer
China National Intellectual Property Administration (ISA/CN) **No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088, China**	
Facsimile No. **(86-10)62019451**	Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2022/115335

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2004325020 A (SHARP K. K.) 18 November 2004 (2004-11-18) description, paragraphs [0072]-[0075]	1, 2, 4, 45, 46, 63, 64
A	CN 112022024 A (JIANGSU MIDEA CLEAN ELECTRIC APPLIANCE CO., LTD. et al.) 04 December 2020 (2020-12-04) entire document	1-78
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