

****Title of Invention****

A Cat Litter Box and Smart Litter Replenishing Method and Equipment

****Abstract****

The present invention relates to the technical field of cat litter boxes, and specifically relates to a cat litter box and a smart litter replenishing method and equipment. The cat litter box comprises a base and a cat litter box body with an opening, wherein the cat litter box body is rotatably mounted on the base. The cat litter box body is provided therein with a cat litter placement area, as well as a litter collection cabin and a feces collection cabin detachably installed within the cat litter box body. The litter collection cabin is provided with a filter assembly, which divides the litter collection cabin into a filtering chamber and a litter storage chamber. A one-way door is provided between the filtering chamber and the feces collection cabin, used to restrict the excrement in the feces collection cabin from flowing back into the filtering chamber. By setting up independent litter collection and feces collection cabins, the present invention not only enables the separation of cat litter and excrement through the rotation of the cat litter box, but also prevents the excrement from contaminating the cat litter box body during rotation. Furthermore, this detachable design makes it convenient for users to quickly remove the litter collection cabin and the feces collection cabin from the cat litter box body for cleaning.

****Claims****

1. A cat litter box, characterized in that it comprises a base (1) and a cat litter box body (2) with an opening, the cat litter box body (2) being rotatably mounted on the base (1); the cat litter box body (2) is provided therein with a cat litter placement area (21), as well as a litter collection cabin (22) and a feces collection cabin (23) detachably installed within the cat litter box body; the cat litter placement area (21) communicates with the litter collection cabin (22); the litter collection cabin (22) is provided with a filter assembly (221), and the filter assembly (221) divides the litter collection cabin (22) into a filtering chamber (222) and a litter storage chamber (223); a one-way door (231) is provided between the filtering chamber (222) and the feces collection cabin (23), and the one-way door (231) is used to divide the filtering chamber (222) and the feces collection cabin (23) into two independent compartments, and to restrict the excrement in the feces collection cabin (23) from flowing back to the filtering chamber (222);

The cat litter and excrement in the cat litter placement area (21) enter the filtering chamber (222) under the rotation of the cat litter box body (2), and the filter assembly (221) separates the cat litter from the excrement; the separated cat litter enters the litter storage chamber (223), and the separated excrement enters the feces collection cabin (23) through the one-way door (231); and when the cat litter box body (2) rotates back to an initial position, the filtered cat litter in the litter storage chamber (223) falls into the cat litter placement area (21) under the influence of gravity.

2. The cat litter box according to claim 1, characterized in that the filter assembly (221) is equipped with a retractable limiting baffle (226), the limiting baffle (226) is installed on one side of the filter assembly (221), and the filtering area of the filter assembly (221) can be adjusted by adjusting the length of the limiting baffle (226) on the filter assembly (221).

3. The cat litter box according to claim 1, characterized in that the cat litter box body (2) is a square cabin structure with a receiving cavity; two opposite outer side walls of the cat litter box body (2) are provided with a frustum (24), and the diameter of the frustum (24) is smaller than the width of the cat litter box body (2); the base (1) comprises a bottom plate (11) and a side plate (12) fixed to one side of the bottom plate (11), and the bottom plate (11) is provided with at least two sets of lifting assemblies, the two sets of lifting assemblies being symmetrically arranged along the length direction of the cat litter box body (2); each set of lifting assemblies comprises at least one first driving assembly (111) and at least two support rollers (112); the two support rollers (112) are symmetrically arranged along the width direction of the cat litter box body (2); each support roller (112) is arranged at the bottom of the frustum (24) and abuts against the outer side wall of the cat litter box body (2), and the side wall of the support roller (112) is externally tangent to the outer side wall of the frustum (24), so that the support rollers (112) on the two sets of lifting assemblies can clamp the cat litter box body (2) in the length direction; the first driving assembly (111) drives the support rollers (112) to move up and down to realize raising or lowering the cat litter box body (2);

The side of the frustum (24) facing the side plate (12) is provided with a second driving assembly (121), and the second driving assembly (121) is clutchably connected to the cat litter box body (2); when the first driving assembly (111) drives the support rollers (112) to move upward to a highest point, the second driving assembly (121) engages with the cat litter box body (2); when the first driving assembly (111) drives the support rollers (112) to move downward, the second driving assembly (121) disengages from the cat litter box body (2).

4. The cat litter box according to claim 3, characterized in that the second driving assembly (121) comprises a gear ring (122) and a driving gear (123); the gear ring (122) is fixed on an outside of the frustum (24) on the cat litter box body (2) facing the side plate (12) and is arranged concentrically with the frustum (24); the driving gear (123) is mounted on the side plate (12), and the driving gear (123) meshes with teeth of the gear ring (122) when the lifting assembly drives the cat litter box body (2) to move to the highest point, and the rotation of the cat litter box body (2) is realized by the driving gear (123) driving the gear ring (122) to rotate;

And/or, the second driving assembly (121) comprises a motor and a connecting shaft, the connecting shaft is fixed on the frustum (24) of the cat litter box body (2) and is arranged concentrically with the frustum (24), and the motor is fixedly mounted on the side plate (12); an output shaft of the motor is fixedly connected to the connecting shaft when the lifting assembly drives the cat litter box body (2) to move to the highest point, and the rotation of the cat litter box body (2) is realized by the motor driving the connecting shaft to rotate.

5. The cat litter box according to claim 3, characterized in that a cat litter mat (211) is detachably installed in the cat litter placement area (21), and a litter scraper (113) made of flexible material is provided below the cat litter mat (211), the litter scraper being wavy or multi-diamond shaped and used to scrape the bottom of the cat litter mat (211) when the cat litter box body (2) rotates;

And/or, a litter adding device (26) is detachably installed within the cat litter box body (2), the litter adding device (26) is provided with a litter adding port (264) and a litter adding chamber (265) for storing cat litter, and the litter adding port (264) communicates with the litter adding chamber (265) and the cat litter placement area (21) respectively; the litter adding device (26) comprises a second

motor (261) and a semi-circular rotating cup (262), and the second motor (261) drives the rotating cup (262) to rotate to realize blocking the litter adding port (264) or opening the litter adding port (264).

6. The cat litter box according to claim 5, characterized in that the cat litter box further comprises a controller, and the bottom plate (11) is further installed with a gravity sensor and the litter scraper (113); the controller is electrically connected to the second driving assembly (121), the first driving assembly (111), the litter adding device (26), and the gravity sensor respectively, and the gravity sensor is used to sense the weight of the cat litter box body (2); the controller is used to first control the first driving assembly (111) and the support rollers (112) to drive the cat litter box body (2) to move upward after a cat leaves the cat litter box body (2), and to control the second driving assembly (121) to drive the cat litter box body (2) to rotate after the cat litter box body (2) moves to the highest point; the controller controls the litter adding device (26) to realize adding litter to the cat litter placement area (21).

7. A smart litter replenishing method, characterized in that it utilizes the cat litter box according to any one of claims 1 to 6, and the smart litter replenishing method comprises the following steps:

S1: Acquire a weight value inside the cat litter box in real time, and record an initial weight of the cat litter box as a ; define the weights of the cat litter box before and after the cat enters for the n -th time as b_n and c_n respectively;

S2: Calculate a weight of excrement for the cat's n -th entry as d_n , where $d_n = c_n - b_n$, and make the following judgments:

(1) If $d_n > 0$, the cat has excreted during the n -th entry into the cat litter box, and it is recorded by a counter;

(2) If $d_n = 0$, the cat has no excretion during the n -th entry into the cat litter box;

S3: Count an excretion frequency m of the cat, and make a decision:

If $m \geq G$, perform a cat litter adding operation, and an added litter amount is e : $e = f \times D_m$;

Otherwise, no cat litter is added;

Where G is an excretion threshold set by a system; D_m is a total weight of excrement after the m -th excretion, $D_m = d_1 + d_2 + \dots + d_m$; n is the number of times the cat enters the cat litter box, $n \in \mathbb{N}$; f is a litter adding ratio parameter initially set by the system;

S4: Replace a garbage bag containing excrement in the cat litter box according to a preset rule, and measure a weight g of the cat litter box after removing the excrement; then update the litter adding ratio parameter f as follows:

$$f' = f + j / D;$$

$$j = (h - E) / i;$$

Where f' is an updated litter adding ratio parameter; j is a correction parameter; h is a total amount of cat litter consumed after replacing the garbage bag, $h = a - g$; E is a total amount of litter added before replacing the garbage bag, $E = e_1 + e_2 + \dots + e_i$; i is the number of litter additions before replacing the garbage bag, $i \in \mathbb{N}$.

8. The smart litter replenishing method according to claim 7, characterized in that the preset rule comprises: replacing the garbage bag after a usage duration of the garbage bag reaches a

predetermined time;

Or, replacing the garbage bag when a weight of the excrement in the garbage bag reaches a preset value;

And/or, the litter adding ratio parameter f initially set by the system is obtained through the following expression:

$$f = y / x;$$

Where x is a weight of the excrement per unit time, and y is a correspondingly consumed amount of cat litter per unit time.

9. The smart litter replenishing method according to claim 7, characterized in that the litter adding ratio parameter f can also be updated as follows:

$$f' = f + j / (D + \epsilon),$$

Where ϵ is an extremely small value, and its value range is $[1 \times 10^{-6}, 1 \times 10^{-8}]$;

Alternatively, the litter adding ratio parameter f can also be updated as follows:

$$f' = f + \eta \times [j / (D + \epsilon)],$$

Where η is a learning rate, and its value range is $[0, 1]$.

10. A smart litter replenishing equipment, comprising a memory, a processor, and a computer program stored on the memory and executable on the processor, characterized in that when the processor executes the computer program, the smart litter replenishing method according to any one of claims 7 to 9 is implemented, thereby carrying out smart litter replenishment for the cat litter box.

****Description****

****A Cat Litter Box and Smart Litter Replenishing Method and Equipment****

****Technical Field****

[0001] The present invention relates to the technical field of smart cat litter boxes, and specifically relates to a cat litter box and a smart litter replenishing method and equipment.

****Background Technology****

[0002] With the improvement of living standards, more and more people choose to keep cats, and a cat litter box is a necessary supply for raising cats. With the development of the cat-keeping industry, smart cat litter boxes have emerged to free the hands of cat owners. However, traditional smart cat litter boxes have many problems, such as inconvenient cleaning, waste of cat litter, and excrement contaminating the inner walls. These problems not only affect the user experience of the cat litter box but may also affect the cat's health.

[0003] Existing cat litter boxes generally have a circular structure, which easily leads to inconvenient transportation, thereby increasing logistics costs and the handling burden on users. Moreover, the structure of existing cat litter boxes is relatively single, and the entrance is high off the ground, making it inconvenient for short-legged cats (such as Munchkin cats) to enter and exit, thus affecting the comfort and convenience of the cat's use. In addition, the litter adding process

of existing cat litter boxes is relatively random and lacks precise quantitative control, resulting in situations where cat litter is not replenished in time or is excessively replenished causing waste.

****Summary of the Invention****

[0004] In order to solve the technical problems in the prior art that cat litter boxes cannot accurately perform litter addition operations, leading to untimely litter replenishment or excessive litter replenishment causing waste, the present invention provides a cat litter box and a smart litter replenishing method and equipment.

[0005] The present invention is implemented by adopting the following technical solutions: A cat litter box, which comprises a base and a cat litter box body with an opening, the cat litter box body being rotatably mounted on the base. The cat litter box body is provided therein with a cat litter placement area, as well as a litter collection cabin and a feces collection cabin detachably installed within the cat litter box body. The cat litter placement area communicates with the litter collection cabin. The litter collection cabin is provided with a filter assembly, which divides the litter collection cabin into a filtering chamber and a litter storage chamber. A one-way door is provided between the filtering chamber and the feces collection cabin, used to divide the filtering chamber and the feces collection cabin into two independent compartments, and to restrict the excrement in the feces collection cabin from flowing back into the filtering chamber. The cat litter and excrement in the cat litter placement area enter the filtering chamber under the rotation of the cat litter box body, and the filter assembly separates the cat litter from the excrement. The separated cat litter enters the litter storage chamber, and the separated excrement enters the feces collection cabin through the one-way door; and when the cat litter box body rotates back to an initial position, the filtered cat litter in the litter storage chamber falls into the cat litter placement area under the influence of gravity.

[0006] As a further improvement of the present invention, the filter assembly is equipped with a retractable limiting baffle, and the limiting baffle is installed on one side of the filter assembly. By adjusting the length of the limiting baffle on the filter assembly, adjusting the filtering area of the filter assembly is realized.

[0007] As a further improvement of the present invention, the cat litter box body is a square cabin structure with a receiving cavity. Two opposite outer side walls of the cat litter box body are provided with a frustum, and the diameter of the frustum is smaller than the width of the cat litter box body. The base comprises a bottom plate and a side plate fixed to one side of the bottom plate. The bottom plate is provided with at least two sets of lifting assemblies, and the two sets of lifting assemblies are symmetrically arranged along the length direction of the cat litter box body. Each set of lifting assemblies comprises at least one first driving assembly and at least two support rollers. The two support rollers are symmetrically arranged along the width direction of the cat litter box body. Each support roller is arranged at the bottom of the frustum and abuts against the outer side wall of the cat litter box body, and the side wall of the support roller is externally tangent to the outer side wall of the frustum, so that the support rollers on the two sets of lifting assemblies can clamp the cat litter box body in the length direction. The first driving assembly drives the support rollers to move up and down to realize raising or lowering the cat litter box body. The side of the frustum facing the side plate is provided with a second driving assembly, and the second driving assembly is clutchably connected to the cat litter box body; when the first driving assembly drives the support rollers to move upward to a highest point, the second driving assembly engages

with the cat litter box body; when the first driving assembly drives the support rollers to move downward, the second driving assembly disengages from the cat litter box body.

[0008] As a further improvement of the present invention, the second driving assembly comprises a gear ring and a driving gear. The gear ring is fixed on the outside of the frustum on the cat litter box body facing the side plate and is arranged concentrically with the frustum. The driving gear is mounted on the side plate, and the driving gear meshes with the teeth of the gear ring when the lifting assembly drives the cat litter box body to move to the highest point, and the rotation of the cat litter box body is realized by the driving gear driving the gear ring to rotate.

[0009] As a further improvement of the present invention, the second driving assembly comprises a motor and a connecting shaft, the connecting shaft is fixed on the frustum of the cat litter box body and is arranged concentrically with the frustum, and the motor is fixedly mounted on the side plate. The output shaft of the motor is fixedly connected to the connecting shaft when the lifting assembly drives the cat litter box body to move to the highest point, and the rotation of the cat litter box body is realized by the motor driving the connecting shaft to rotate.

[0010] As a further improvement of the present invention, a cat litter mat is detachably installed in the cat litter placement area, and a litter scraper made of flexible material is provided below the cat litter mat, the litter scraper being wavy or multi-diamond shaped and used to scrape the bottom of the cat litter mat when the rotating cabin rotates.

[0011] As a further improvement of the present invention, a litter adding device is detachably installed within the cat litter box body, the litter adding device is provided with a litter adding port and a litter adding chamber for storing cat litter, and the litter adding port communicates with the litter adding chamber and the cat litter placement area respectively; the litter adding device comprises a second motor and a semi-circular rotating cup, and the second motor drives the rotating cup to rotate, thereby realizing blocking the litter adding port or opening the litter adding port.

[0012] As a further improvement of the present invention, the cat litter box further comprises a controller, and the bottom plate is further installed with a gravity sensor and a litter scraper. The controller is electrically connected to the second driving assembly, the first driving assembly, the litter adding device, and the gravity sensor respectively. The gravity sensor is used to sense the weight of the cat litter box body. The controller is used to first control the first driving assembly and the support rollers to drive the cat litter box body to move upward after the cat leaves the cat litter box body, and to control the second driving assembly to drive the cat litter box body to rotate after the cat litter box body moves to the highest point. The controller controls the litter adding device to realize adding litter to the cat litter placement area.

[0013] The present invention also includes a smart litter replenishing method for the above cat litter box, which comprises the following steps:

S1: Acquire a weight value inside the cat litter box in real time, and record an initial weight of the cat litter box as a ; define the weights of the cat litter box before and after the cat enters for the n -th time as b_n and c_n respectively.

[0014] S2: Calculate a weight of excrement for the cat's n -th entry as d_n , where $d_n = c_n - b_n$, and make the following judgments:

(1) If $d_n > 0$, the cat has excreted during the n -th entry into the cat litter box, and it is recorded by a counter;

(2) If $d_n = 0$, the cat has no excretion during the n -th entry into the cat litter box.

[0015] S3: Count an excretion frequency f_m of the cat, and make a decision:

If $f_m \geq G$, perform a cat litter adding operation, and an added litter amount is e : $e = f \times D_m$; otherwise, no cat litter is added.

[0016] Where G is an excretion threshold set by the system; D_m is a total weight of excrement after the m -th excretion, $D_m = d_1 + d_2 + \dots + d_m$; n is the number of times the cat enters the cat litter box, $n \in \mathbb{N}$; f is a litter adding ratio parameter initially set by the system.

[0017] S4: Replace a garbage bag containing excrement in the cat litter box according to a preset rule, and measure a weight g of the cat litter box after removing the excrement; then update the litter adding ratio parameter f as follows:

$$f' = f + j / D;$$

$$j = (h - E) / i;$$

Where f' is an updated litter adding ratio parameter; j is a correction parameter; h is a total amount of cat litter consumed after replacing the garbage bag, $h = a - g$; E is a total amount of litter added before replacing the garbage bag, $E = e_1 + e_2 + \dots + e_i$; i is the number of litter additions before replacing the garbage bag, $i \in \mathbb{N}$.

[0018] As a further improvement of the present invention, the preset rule comprises: replacing the garbage bag after a usage duration of the garbage bag reaches a predetermined time. Or, replacing the garbage bag when a weight of the excrement in the garbage bag reaches a preset value.

[0019] As a further improvement of the present invention, the litter adding ratio parameter f initially set by the system is obtained through the following expression:

$$f = y / x;$$

Where x is a weight of the excrement per unit time, and y is a correspondingly consumed amount of cat litter per unit time.

[0020] As a further improvement of the present invention, the litter adding ratio parameter f can also be updated as follows:

$$f' = f + j / (D + \epsilon),$$

Where ϵ is an extremely small value, and its value range is $[1 \times 10^{-6}, 1 \times 10^{-8}]$.

[0021] As a further improvement of the present invention, the litter adding ratio parameter f can also be updated as follows:

$$f' = f + \eta \times [j / (D + \epsilon)],$$

Where η is a learning rate, and its value range is $[0, 1]$.

[0022] The present invention also comprises a smart litter replenishing equipment, which comprises a memory, a processor, and a computer program stored on the memory and executable on the processor. When the processor executes the computer program, the smart litter replenishing method as described above is implemented, thereby carrying out smart litter replenishment for the cat litter box.

[0023] The technical solutions provided by the present invention have the following beneficial effects:

(1) By setting up independent litter collection and feces collection cabins, the cat litter box provided by the present invention not only enables the separation of cat litter and excrement through the rotation of the cat litter box, but also prevents the excrement from contaminating the cat litter box body during rotation by setting both the litter collection cabin and the feces collection cabin to be

detachably mounted on the cat litter box body. This detachable method also makes it convenient for users to quickly remove the litter collection cabin and the feces collection cabin from the cat litter box body for cleaning.

[0024] (2) The cat litter box provided by the present invention sets up a second driving assembly and a lifting assembly. Through the mutual cooperation of the second driving assembly and the lifting assembly, the cat litter box body can be lowered to the lowest point by the lifting assembly when a cat needs to enter, facilitating the cat's entry into the cat litter box body. It can also, after the cat leaves the cat litter box body, first move the cat litter box body to the highest point along the vertical direction through the lifting assembly, and then drive the cat litter box body to rotate through the second driving assembly, thereby realizing the filtering of cat litter and excrement in the cat litter box body, achieving automated cleaning of cat litter, and reducing the user's cleaning burden.

[0025] (3) The present invention also provides a smart litter replenishing method, which dynamically adjusts the litter adding ratio parameter during the litter adding process according to the cat's excretion behavior, realizing real-time adjustment of the litter adding amount, thereby realizing precise replenishment of cat litter. That is, it prevents both untimely replenishment and excessive replenishment causing cat litter waste, achieving optimization of cat litter usage and management.

****Brief Description of Drawings****

[0026] Figure 1 is a perspective structural view of the cat litter box provided in Embodiment 1 of the present invention.

[0027] Figure 2 is a perspective structural view of the cat litter box provided in Embodiment 1 of the present invention (at this time, the litter collection cabin and the feces collection cabin are in a half-pulled-out state).

[0028] Figure 3 is a top view of the cat litter box provided in Embodiment 1 of the present invention.

[0029] Figure 4 is a schematic view of the internal structure along the A-A section in Figure 3 of the present invention.

[0030] Figure 5 is a schematic structural view of the cat litter box without the litter collection cabin installed in Embodiment 1 of the present invention.

[0031] Figure 6 is a schematic structural view of the cat litter box without the litter collection cabin and the feces collection cabin installed in Embodiment 1 of the present invention.

[0032] Figure 7 is a schematic internal structural view of the cat litter box provided in Embodiment 1 of the present invention.

[0033] Figure 8 is a schematic view when the limiting baffle is installed on the filter screen in Embodiment 1 of the present invention.

[0034] Figure 9 is a schematic view when the cat litter box body is respectively connected to the first driving assembly and the second driving assembly provided in Embodiment 1 of the present invention.

[0035] Figure 10 is an enlarged view at B in Figure 9 of the present invention.

[0036] Figure 11 is a schematic view when the cat litter box body is installed on the base in Embodiment 1 of the present invention (the side plate is not drawn).

[0037] Figure 12 is a schematic structural view of the base under the meshing of the gear ring and the driving gear in the cat litter box provided in Embodiment 1 of the present invention.

[0038] Figure 13 is a schematic structural view when the gear ring is replaced by four large gears in the cat litter box provided in Embodiment 1 of the present invention.

[0039] Figure 14 is a schematic internal structural view of the litter adding device provided in Embodiment 1 of the present invention.

[0040] Figure 15 is a schematic internal structural view of the litter adding device provided in Embodiment 1 of the present invention (neither the second motor nor the rotating cup is drawn).

[0041] Reference numerals in the drawings are: 1. Base; 11. Bottom plate; 111. First driving assembly; 112. Support roller; 113. Litter scraper; 114. Driving motor; 115. Lead screw; 116. Nut; 117. Connecting rod; 118. Fixing rod; 119. Mounting rod; 12. Side plate; 121. Second driving assembly; 122. Gear ring; 123. Driving gear; 124. Sliding slot; 2. Cat litter box body; 21. Cat litter placement area; 211. Cat litter mat; 22. Litter collection cabin; 221. Filter assembly; 222. Filtering chamber; 223. Litter storage chamber; 224. First baffle; 225. Filter screen; 226. Limiting baffle; 23. Feces collection cabin; 231. One-way door; 24. Frustum; 25. Slider; 26. Litter adding device; 261. Second motor; 262. Rotating cup; 263. Second baffle; 264. Litter adding port; 265. Litter adding chamber; 27. First limiting plate; 28. Second limiting plate; 29. Locking member.

****Detailed Description of Embodiments****

[0042] Below, in conjunction with specific embodiments, the present invention will be further described. It should be noted that, under the premise of no conflict, the embodiments or technical features described below can be arbitrarily combined to form new embodiments.

[0043] In the description of the present invention, it should be noted that for terms indicating orientation, such as "center", "transverse", "longitudinal", "length", "width", "thickness", "upper", "lower", "front", "rear", "left", "right", "vertical", "horizontal", "top", "bottom", "inner", "outer", "clockwise", "counterclockwise", the indicated orientation or positional relationship is based on the orientation or positional relationship shown in the accompanying drawings. This is merely for the convenience of describing the present invention and simplifying the description, and does not indicate or imply that the indicated device or element must have a specific orientation, or be constructed and operated in a specific orientation; therefore, it cannot be understood as a limitation on the specific protection scope of the present invention. The terms "first", "second", etc., in the specification and claims of the present invention are used to distinguish similar objects, and are not necessarily used to describe a specific sequence or chronological order. The terms "comprise" and "have" and any variations thereof in the specification and claims of the present invention are intended to cover a non-exclusive inclusion. For example, a process, method, system, product, or device comprising a series of steps or units is not necessarily limited to those steps or units clearly listed, but may include other steps or units not clearly listed or inherent to such process, method, product, or device.

[0044] **Embodiment 1**

This embodiment provides a cat litter box. As shown in Figure 1, it comprises a base 1 and a cat litter box body 2 with an opening. The side of the cat litter box body 2 opposite to the opening is rotatably mounted on the base 1. The cat litter box body 2 is a square cabin structure with a receiving cavity, which can be a rectangular structure, a circular structure, etc. In this embodiment, the shape of the square cabin is preferably a rectangular structure. Compared to a circular cat litter box body, the rectangular structure can increase the bottom area by 30%-50%, thereby providing a larger excretion space, thus improving the cat's comfort during use. At the same time, the

rectangular cat litter box body 2 is also convenient for transportation and loading/unloading, thereby reducing transportation costs. In addition, the square cabin can be made of lightweight, high-strength composite materials, enabling it to have strong compression and wear resistance, thereby ensuring that it is not easily deformed during transportation and use, and improving its service life.

[0045] Referring to Figures 2 to 8, a cat litter placement area 21, a litter collection cabin 22, and a feces collection cabin 23 are provided within the receiving cavity. The litter collection cabin 22 and the feces collection cabin 23 are respectively detachably fixed to the top of the receiving cavity. The detachable design facilitates the disassembly, cleaning, and replacement of the litter collection cabin 22 and the feces collection cabin 23. The cat litter placement area 21 is used for placing cat litter. When a cat needs to excrete, it will enter the receiving cavity through the opening and defecate in the cat litter placement area 21. The cat litter placement area 21 communicates with the litter collection cabin 22. The litter collection cabin 22 is provided with a filter assembly 221, and the filter assembly 221 is used to divide the litter collection cabin 22 into a filtering chamber 222 and a litter storage chamber 223. The filtering chamber 222 communicates with the feces collection cabin 23, and a one-way door 231 is provided between the filtering chamber 222 and the feces collection cabin 23. The one-way door 231 is used to divide the filtering chamber 222 and the feces collection cabin 23 into two independent compartments, and to restrict the excrement in the feces collection cabin 23 from flowing back to the filtering chamber 222.

[0046] In this embodiment, referring to Figure 2, Figure 5, and Figure 6, both the litter collection cabin 22 and the feces collection cabin 23 are independent compartments, and they are both detachably installed within the cat litter box body 2. By setting both the litter collection cabin 22 and the feces collection cabin 23 as independent compartments in this embodiment, the cat's excrement is not likely to contaminate the inner wall of the cat litter box body 2 during the rotation process. At the same time, when cleaning is needed, the litter collection cabin 22 and the feces collection cabin 23 can be quickly removed from the cat litter box body 2 for cleaning, making the entire operation simple and convenient.

[0047] In this embodiment, the litter collection cabin 22 and the feces collection cabin 23 can be installed in the cat litter box body 2 by pulling and sliding. A first limiting plate 27 is provided inside the cat litter box body 2. A first sliding cavity is enclosed between the first limiting plate 27 and the cat litter box body 2. The structure of the first sliding cavity is identical to the structure of the litter collection cabin 22, facilitating the sliding installation of the litter collection cabin 22 into the first sliding cavity. A locking member 29 is provided on the first limiting plate 27. In this embodiment, as shown in Figure 5 and Figure 6, the locking member 29 can be a push-button snap. A locking slot is provided at the bottom of the litter collection cabin 22. When the litter collection cabin 22 is completely installed in the first sliding cavity, by pressing the locking member 29, the locking member 29 can snap into the locking slot, thereby realizing the fixation of the litter collection cabin 22.

[0048] A second limiting plate 28 is provided inside the cat litter box body 2. A second sliding cavity is enclosed between the second limiting plate 28 and the cat litter box body 2. The structure of the second sliding cavity is identical to the structure of the feces collection cabin 23, facilitating the sliding installation of the feces collection cabin 23 into the second sliding cavity. A locking member 29 is provided on the second limiting plate 28. As shown in Figure 5 and Figure 6, the locking member 29 can be a push-button snap. A locking slot is provided at the bottom of the feces

collection cabin 23. When the feces collection cabin is completely installed in the second sliding cavity, by pressing the locking member 29, the locking member 29 can snap into the locking slot, thereby realizing the fixation of the feces collection cabin 23.

[0049] In the actual usage process, a cat will enter the cat litter box body 2 through the opening and defecate in the cat litter placement area 21. When the cat finishes defecating and leaves the cat litter box body 2, the cat litter box body 2 is rotated. The cat litter and excrement in the cat litter placement area 21 will enter the filtering chamber 222, and under the action of the filter assembly 221, the cat litter and the excrement adhered with cat litter are filtered. The cat litter will enter the litter storage chamber 223 through the filter assembly 221, and the excrement adhered with cat litter will enter the feces collection cabin 23 through the one-way door 231 under the rotation of the cat litter box body 2. The feces collection cabin 23 is used to uniformly collect the filtered excrement. And when the cat litter box body 2 rotates back to the initial position, the filtered cat litter in the litter storage chamber 223 will fall back to the cat litter placement area 21 under the influence of gravity, thereby realizing the reuse of this part of the cat litter and improving its utilization efficiency.

[0050] Referring to Figure 8, the filter assembly 221 is equipped with a retractable limiting baffle 226, and the limiting baffle 226 is installed on one side of the filter assembly 221. In this embodiment, the limiting baffle can actually be installed on the filter screen and located on the side of the filter screen 225 close to the back plate of the cat litter box body 2. By adjusting the length of the limiting baffle 226 on the filter screen 225, adjusting the filtering area of the filter screen 225 is realized. During the rotational separation process of the cat litter box body 2, the limiting baffle 226 can act as a barrier to effectively prevent all cat litter from directly entering the litter storage chamber 223, and guide a portion of the cat litter to enter the feces collection cabin 23. The cat litter entering the feces collection cabin 23 can naturally cover the surface of the excrement, forming a physical odor isolation layer, effectively suppressing the diffusion of odors, and improving the overall hygiene environment.

[0051] To enhance adaptability and regulation capability, the limiting baffle 226 adopts a retractable structure. Users can flexibly adjust the extension length of the limiting baffle 226 on the filter screen 225 according to actual needs, such as cat litter type, cat excretion habits, or odor control requirements. When the limiting baffle 226 is lengthened, it can cover more of the filter screen 225, reducing the effective filtering area of the filter screen 225, and the limiting baffle 226 will also guide a portion of the cat litter into the feces collection cabin 23, allowing more cat litter to enter the feces collection cabin 23 along with the excrement. The cat litter entering the feces collection cabin 23 can better wrap the excrement and enhance the odor isolation effect. When the length of the limiting baffle 226 is shortened, the effective filtering area of the filter screen 225 increases. Most of the cat litter will directly enter the litter storage chamber 223 through the filter screen 225, and only a small amount of cat litter will adhere to the excrement and enter the feces collection cabin 23, thereby reducing the amount of cat litter directly entering the feces collection cabin 23, maximally saving cat litter, and achieving basic odor isolation. From this, it can be seen that by setting the retractable limiting baffle 226 in this solution, it can not only prevent cat litter waste, extend the litter adding cycle, and reduce maintenance costs, but also dynamically optimize the amount of cat litter entering the feces collection cabin 23 according to cat habits, cat litter types, seasons, and spatial environments, achieving the best balance between economy and hygiene.

[0052] In this embodiment, referring to Figure 4 and Figure 7, the cross-section of the litter collection cabin 22 can be an inverted L-shaped structure. The filter assembly 221 comprises a first baffle 224 and a filter screen 225. One end of the first baffle 224 is fixed on the side wall connecting the litter collection cabin 22 and the feces collection cabin 23 and is located above the one-way door 231. The filter screen 225 is rotatably mounted on the side of the first baffle 224 away from the side fixed to the side wall of the litter collection cabin 22. When cat litter is not being filtered, the end of the filter screen 225 away from the first baffle 224 abuts against the inner side wall of the cat litter box body 2, thereby dividing the litter collection cabin 22 into an independent filtering chamber 222 and litter storage chamber 223 under the action of the filter assembly 221, and the filtering chamber 222 is located below the litter storage chamber 223 and communicates with the cat litter placement area 21. The filter screen 225 can be an elastic filter screen 225, so that after filtering the cat litter and when the cat litter box body 2 rotates back to the initial position, the cat litter in the litter storage chamber 223 will fall back into the cat litter placement area 21 under the influence of gravity.

[0053] A passage is provided on the common side wall between the feces collection cabin 23 and the litter collection cabin 22. The upper end of the one-way door 231 is fixed to this side wall, and the one-way door 231 is set to tilt downward. When there is no external force, the lower end of the one-way door 231 also abuts against the side of this side wall close to the litter collection cabin 22, thereby realizing the sealing of the passage by the one-way door 231, making the feces collection cabin 23 and the litter collection cabin 22 two independent compartments. When the cat litter box body 2 rotates, the filtered excrement will move along the filtering chamber 222 to the passage, and the rotation provides a pushing force to the excrement, enabling the excrement to "push open" the one-way door 231 and enter the feces collection cabin 23, thereby achieving the purpose of collecting excrement through the feces collection cabin 23. In this embodiment, by setting the one-way door 231, the filtered excrement can enter the feces collection cabin 23, and the excrement in the feces collection cabin 23 will not flow back to the litter collection cabin 22 during the rotation process, achieving effective separation of cat litter and excrement.

[0054] In this embodiment, the cat litter box body 2 can be a square cabin structure, and the four corners are all rounded. Compared with traditional circular cabin bodies, the bottom area of the square cabin is increased by 30-50%, and it adopts lightweight high-strength composite materials. It not only increases the bottom area but also reduces transportation costs, and has strong compression and wear resistance, ensuring it is not easily deformed during long-term use. Referring to Figure 7, the two opposite outer side walls of the cat litter box body 2 are provided with a frustum 24, and the diameter of the frustum 24 is smaller than the width of the cat litter box body 2. The base 1 comprises a bottom plate 11 and a side plate 12 fixed to one side of the bottom plate 11. The bottom plate 11 is provided with at least two sets of lifting assemblies, and the two sets of lifting assemblies are symmetrically arranged along the length direction of the cat litter box body 2. Each set of lifting assemblies comprises at least one first driving assembly 111 and at least two support rollers 112. The first driving assembly 111 is mounted on the bottom plate 11, and the first driving assembly 111 is connected to the support rollers 112. The first driving assembly 111 can drive the support rollers 112 to move up and down along the vertical direction. Each support roller 112 is arranged at the bottom of the frustum 24 and abuts against the outer side wall of the cat litter box body 2, and the side wall of the support roller 112 is externally tangent to the outer side wall of the frustum 24, so that the support rollers 112 on the two sets of lifting

assemblies can clamp the cat litter box body 2 in the length direction of the cat litter box body 2. In this embodiment, by making the support rollers 112 externally tangent to the outer side wall of the frustum 24, the support rollers 112 will not interfere with the rotation of the cat litter box body 2 when the cat litter box body 2 rotates. The two support rollers 112 located on both sides of the cat litter box body 2 can also clamp the cat litter box body 2 in the length direction to ensure the stability of the cat litter box body 2 during rotation.

[0055] It can be understood that, to further improve the fluency of the rotation of the cat litter box body 2, sliding rollers can be installed on the other four side walls of the cat litter box body 2 without the frustum 24, to improve the fluency of the rotation of the cat litter box body 2.

[0056] The feces collection cabin 23 can be a rectangular parallelepiped structure. It is provided with a card slot and a garbage bag fixing sleeve at the passage, and the sleeve snaps into the card slot. In the actual application process, the opening of the garbage bag can be sleeved on the sleeve, and the garbage bag is fixed by snapping the sleeve into the card slot, so that the opening of the garbage bag always faces the passage. Thus, the excrement filtered by the filtering chamber 222 can entirely enter the garbage bag through the passage, realizing effective collection of the excrement. In this embodiment, by setting the card slot and the garbage bag fixing sleeve, the stability of the garbage bag placement can be improved, ensuring that the excrement filtered by the filtering chamber 222 can all enter the garbage bag, avoiding contamination of the feces collection cabin 23.

[0057] Referring to Figures 9 to 12, the side of the frustum 24 facing the side plate 12 is provided with a second driving assembly 121, and the second driving assembly 121 is clutchably connected to the cat litter box body 2. When the first driving assembly 111 drives the support rollers 112 to move upward to the highest point, the second driving assembly 121 engages with the cat litter box body 2; when the first driving assembly 111 drives the support rollers 112 to move downward, the second driving assembly 121 disengages from the cat litter box body 2. In the actual design process, when the cat litter box body 2 moves to the highest point under the action of the first driving assembly 111 and the support rollers 112, the base 1 will not interfere with the rotation of the cat litter box body 2.

[0058] The cat litter box further comprises a controller. The controller is electrically connected to the second driving assembly 121 and the first driving assembly 111 respectively. The controller is used to first control the first driving assembly 111 and the support rollers 112 to drive the cat litter box body 2 to move upward after the cat leaves the cat litter box body 2, and to control the second driving assembly 121 to drive the cat litter box body 2 to rotate after the cat litter box body 2 moves to the highest point. Through the controller, the operation of automatically cleaning the cat litter inside the cat litter box body 2 can be realized.

[0059] In actual application, it can be implemented through the following operations: When the cat litter box body 2 completes the separation of cat litter and excrement, the controller will control the first driving assembly 111 so that the first driving assembly 111 drives the support rollers 112 to move downward. A plurality of support rollers 112 then move the cat litter box body 2 down to the lowest point. Through this setting, the distance between the cat litter box body 2 and the ground is relatively low. This enables some short-legged cats to quickly enter the cat litter box body 2, improving the cat's comfort in use. After the system senses that the cat has left the cat litter box body 2, the controller will start the first driving assembly 111. The first driving assembly 111 will drive the support rollers 112 to move upward. Under the action of the plurality of support rollers

112, the cat litter box body 2 will move upward to the highest point. At this time, the second driving assembly 121 engages with the cat litter box body 2. Then, the controller controls the second driving assembly 121 to drive the cat litter box body 2 to rotate counterclockwise. The cat litter and excrement in the cat litter placement area 21 will enter the filtering chamber 222 under the rotation, and under the filtration of the filtering chamber 222, the cat litter flows to the litter storage chamber 223, and the filtered excrement will enter the feces collection cabin 23 through the one-way door 231, thereby realizing the separation of cat litter and excrement. And when the cat litter box body 2 rotates to the initial position, the cat litter in the litter storage chamber 223 will fall back into the cat litter placement area 21. Thus, one rotation of the cat litter box body 2 completes one cleaning of the excrement in the cat litter. During actual use, the number of rotations of the cat litter box body 2 can be controlled according to actual conditions (such as the amount of excrement).

[0060] The first driving assembly 111 can be a ball screw device. Referring to Figures 9 to 11, it comprises a driving motor 114, a lead screw 115, two nuts 116, two connecting rods 117, and two fixing rods 118. The two nuts 116, two connecting rods 117, and two fixing rods 118 constitute two sets of connecting members. Each set of connecting members can be connected to one support roller 112. Below is a description of the connection relationship between each set of connecting members and the support roller 112. The fixing rod 118 is fixedly mounted on the bottom plate 11. One end of the support roller 112 is fixed with a mounting rod 119. The middle of the mounting rod 119 is rotatably mounted on the fixing rod 118. The end of the mounting rod 119 away from the support roller 112 is hinged to one end of the connecting rod 117. The other end of the connecting rod 117 is fixed to the nut 116. The driving motor 114 is connected to the lead screw, and both ends of the lead screw 115 are respectively fixed to the bottom plate 11 through bearings. The driving motor 114 can drive the lead screw to rotate, and the nut 116 is mounted on the lead screw. Through the rotation of the lead screw, the nut 116 is driven to move along the axial direction of the lead screw, so that the nut 116 can drive the mounting rod 119 through the connecting rod 117 to rotate around the hinge point with the fixing rod 118, thereby realizing driving the support roller 112 to rotate. By adjusting the position of the support roller 112 in the vertical direction through the rotation of the support roller 112, raising or lowering the cat litter box body 2 through the support roller 112 is realized. Through the two sets of connecting members, it is possible to realize the adjustment of the vertical positions of the two support rollers 112 by sharing the same driving source, thereby realizing raising or lowering the cat litter box body 2 in the vertical direction through the support rollers 112.

[0061] In this embodiment, the first driving assembly 111 can also be a driving cylinder, which can be connected to the support roller 112 through a rod body, and the vertical height of the cat litter box body 2 is adjusted by the driving cylinder driving the support roller 112 to move along the vertical direction.

[0062] The second driving assembly 121 may comprise a gear ring 122 and a driving gear 123. The gear ring 122 can be a structure with inner teeth or outer teeth. The gear ring 122 is fixedly mounted on the outside of the frustum 24 on the cat litter box body 2 facing the side plate 12 and is arranged concentrically with the center of the circle. The driving gear 123 is mounted on the side plate 12. In the actual application process, when the first driving assembly 111 moves upward to the highest point via the support rollers 112, the teeth on the gear ring 122 exactly mesh with the driving gear 123. Then, by starting the driving gear 123 to rotate, under the mutual cooperation of

the driving gear 123 and the gear ring 122, it realizes driving the cat litter box body 2 to rotate.

[0063] In this embodiment, the driving gear 123 can be a plum blossom-shaped petal gear.

[0064] It can be understood that the gear ring 122 in this embodiment can also be replaced by a structure of four large gears meshing in pairs. Please refer to Figure 13 for the specific structure. When the cat litter box body 2 moves to the highest point, the driving gear 123 is located in the middle of the two large gears set below and meshes with the two large gears below respectively.

[0065] In this embodiment, the second driving assembly 121 can also be a first motor and a connecting shaft. The connecting shaft is fixed on the frustum 24 of the cat litter box body 2 and is arranged concentrically with the frustum 24; the first motor is fixedly mounted on the side plate 12. When the first driving assembly 111 moves upward to the highest point via the support rollers 112, the output shaft of the motor exactly fixedly connects with the connecting shaft. Then, by starting the first motor to rotate, under the mutual cooperation of the first motor and the connecting shaft, it realizes driving the cat litter box body 2 to rotate. It can be understood that the output shaft of the first motor and the connecting shaft can be connected by magnetic attraction, and the magnetic force between the output shaft of the first motor and the connecting shaft is much greater than the centrifugal force generated by the rotation of the cat litter box body 2, thereby ensuring the stability of the rotation of the cat litter box body 2.

[0066] Referring to Figure 11 and Figure 12, a cylindrical slider 25 is also fixedly mounted on the side wall of the cat litter box body 2 provided with the gear ring 122; a sliding slot 124 matching the slider 25 is provided along the vertical direction on the side plate 12. The slider 25 is slidably mounted in the sliding slot 124, and by the slider 25 moving along the vertical direction in the sliding slot 124, the stability of the cat litter box body 2 moving in the vertical direction is improved.

[0067] A litter adding device 26 is also detachably installed within the cat litter box body 2. Specifically, referring to Figure 14 and Figure 15, in this embodiment, the upper end of the litter adding device 26 can be slidably mounted below the feces collection cabin 23 through a slide rail. The litter adding device 26 is provided with a litter adding port 264 and a litter adding chamber 265 for storing cat litter, and the litter adding port 264 respectively communicates with the litter adding chamber 265 and the cat litter placement area 21; an adjusting device for controlling the litter adding amount is provided in the litter adding chamber 265, and the sand output amount of the litter adding port 264 is adjusted through the adjusting device. The controller is electrically connected to the litter adding device 26, and through the controller, the operation of controlling the litter adding device 26 to add litter to the cat litter placement area 21 can be realized.

[0068] In this embodiment, the specific structure of the litter adding device 26 can be as follows: Referring to Figure 14 and Figure 15, it comprises a second motor 261, a semi-circular rotating cup 262, and four vertically arranged second baffles 263. The four second baffles 263 extend upward along the bottom of the litter adding chamber 265 and enclose a sand output passage. The sand output passage communicates with the litter adding port 264, and the size of the sand output passage is the same as the size of the litter adding port 264. The diameter of the semi-circular rotating cup 262 is the same as the width of the sand output passage. The semi-circular rotating cup 262 is rotatably mounted on the second baffle 263 through a rotating shaft, and when the semi-circular rotating cup 262 is in a horizontal state with the opening facing up or down, it exactly blocks the sand output passage, making a partition between the litter adding chamber 265 and the litter adding port 264. The motor is connected to the rotating shaft of the semi-circular rotating cup 262. During actual use, the operation of adding litter to the cat litter placement area 21 is

realized by the motor driving the rotating cup 262 to rotate.

[0069] Further, an annular leak-proof rubber is provided on the contact part between the cylindrical surface of the rotating cup 262 and the litter adding passage. By providing the leak-proof rubber, the sealing performance of the rotating cup 262 blocking the litter adding passage can be improved.

[0070] The cat litter placement area 21 is provided with a through hole, and a cat litter mat 211 is detachably installed at the through hole. The cat litter is all placed on the cat litter mat 211. By setting the detachable cat litter mat 211, it is convenient for subsequent disassembly and cleaning of the cat litter mat 211. The cat litter mat 211 can be made of flexible and waterproof fabric.

[0071] In this embodiment, the cat litter mat 211 can be fixedly mounted at the through hole by uniformly providing a plurality of clasps around the through hole.

[0072] It can be understood that the bottom plate 11 is also installed with a gravity sensor and a litter scraper 113. The controller is electrically connected to the gravity sensor. The gravity sensor is used to sense the weight of the cat litter box body 2. The litter scraper 113 can be a flexible litter scraper 113. It can be wavy or multi-diamond shaped. When the cat litter box body 2 is not rotating, the bottom of the cat litter mat 211 is laid on the flexible litter scraper 113, forming a wavy or multi-diamond structure. When the cat litter box body 2 rotates, the cat litter mat 211 will be scraped by the litter scraper 113, thereby preventing cat litter or feces from remaining or adhering to the cat litter mat 211, ensuring that the cat mat is always kept clean, and reducing the cleaning frequency of the cat litter mat 211.

[0073] The litter scraper 113 can be made of flexible materials such as silicone or rubber, so that it does not damage the cat litter mat 211 during the scraping process, extending the service life of the cat litter mat 211. Moreover, the flexible material has good wear resistance and anti-aging properties, and still maintains good elasticity after long-term use.

[0074] ****Embodiment 2****

Based on the cat litter box provided in Embodiment 1, this embodiment 2 provides a smart litter replenishing method, which comprises the following steps:

S1: Obtain a weight value inside the cat litter box in real time through the gravity sensor, and record an initial weight of the cat litter box as a ; define the weight of the cat litter box before the cat enters for the n -th time as b_n , and the weight of the cat litter box after the cat enters for the n -th time and leaves as c_n .

[0075] S2: Calculate a weight of excrement for the cat's n -th entry as d_n , where $d_n = c_n - b_n$, and make the following judgments:

(1) If $d_n > 0$, the cat has excreted during the n -th entry into the cat litter box, and it is recorded by a counter.

[0076] (2) If $d_n = 0$, the cat has no excretion during the n -th entry into the cat litter box.

[0077] S3: Count an excretion frequency m of the cat, and make a decision:

If $m \geq G$, perform a cat litter adding operation, and an added litter amount is e : $e = f \times D_m$.

[0078] Otherwise, no cat litter is added.

[0079] Where G is an excretion threshold set by the system; D_m is a total weight of excrement after the m -th excretion, $D_m = d_1 + d_2 + \dots + d_m$; n is the number of times the cat enters the cat litter box, $n \in \mathbb{N}$; f is a litter adding ratio parameter initially set by the system.

[0080] Wherein, in step S2, by recording the cat excretion frequency through the counter, it is possible to perform a litter adding operation to the cat litter placement area when the excretion frequency reaches the preset threshold of the system, so that the cat litter in the cat litter placement area will not be too little.

[0081] S4: Replace a garbage bag containing excrement in the cat litter box according to a preset rule, and measure a weight g of the cat litter box after removing the excrement; then update the litter adding ratio parameter f as follows:

$$f' = f + j / D;$$

$$j = (h - E) / i;$$

Where f' is an updated litter adding ratio parameter; j is a correction parameter; h is a total amount of cat litter consumed after replacing the garbage bag, $h = a - g$; E is a total amount of litter added before replacing the garbage bag, $E = e_1 + e_2 + \dots + e_i$; i is the number of litter additions before replacing the garbage bag, $i \in \mathbb{N}$.

[0082] And in subsequent litter adding operations, the updated litter adding ratio parameter f' can be used for the litter adding operation.

[0083] In this embodiment, through the above operations, the litter adding amount can be accurately adjusted according to the cat's excretion behavior, realizing dynamic calibration and adjustment of litter addition, thereby achieving optimization of cat litter usage and management. The above smart litter replenishing control method can not only realize timely replenishment of cat litter, but also avoid the situation of wasting cat litter due to excessive litter addition through dynamic monitoring and adjusting the litter adding amount.

[0084] Wherein, during the calculation process of the system, a minimum value ϵ can also be set to avoid the situation where D is 0. At this time, $f' = f + j / (D + \epsilon)$. Through this setting, the situation where f' is infinite when D is zero can be avoided. The range of the minimum value ϵ can be $1 \times 10^{-6} \leq \epsilon \leq 1 \times 10^{-8}$.

[0085] In order to prevent f' from changing too much each time due to data fluctuation, the system can also introduce a learning rate η (value between 0 and 1) to control the update magnitude: $f' = f + \eta \times [j / (D + \epsilon)]$.

[0086] The preset rules include: replacing the garbage bag after a usage duration of the garbage bag reaches a predetermined time;

Or, replacing it when a weight of the excrement in the garbage bag reaches a preset value.

[0087] The litter adding ratio parameter f initially set by the system is obtained through the following expression:

$$f = y / x;$$

Where x is a weight of the excrement per unit time, and y is a correspondingly consumed amount of cat litter per unit time.

[0088] **Embodiment 3**

Based on Embodiment 1 and Embodiment 2, this embodiment provides a smart litter replenishing equipment, which comprises a memory, a processor, and a computer program stored on the memory and executable on the processor. When the processor executes the computer program, the smart litter replenishing method as in Embodiment 2 is implemented, thereby carrying out smart litter replenishment for the cat litter box.

[0089] The smart litter replenishing equipment provided in this embodiment is essentially a computer device. The computer device can be a smartphone, tablet computer, notebook computer,

desktop computer, rack server, blade server, tower server, or cabinet server (including a standalone server, or a server cluster composed of multiple servers), etc., capable of executing programs.

[0090] The computer device of this embodiment at least includes, but is not limited to: a memory and a processor communicatively connected to each other through a system bus. In this embodiment, the memory (i.e., a readable storage medium) includes flash memory, hard disk, multimedia card, card-type memory (e.g., SD or DX memory, etc.), random access memory (RAM), static random access memory (SRAM), read-only memory (ROM), electrically erasable programmable read-only memory (EEPROM), programmable read-only memory (PROM), magnetic memory, magnetic disk, optical disk, etc. In some embodiments, the memory may be an internal storage unit of the computer device, for example, a hard disk or memory of the computer device. In other embodiments, the memory may also be an external storage device of the computer device, for example, a plug-in hard disk equipped on the computer device, a Smart Media Card (SMC), a Secure Digital (SD) card, a Flash Card, etc. Of course, the memory can also include both an internal storage unit of the computer device and its external storage device. In this embodiment, the memory is generally used to store an operating system and various application software, etc. installed on the computer device. In addition, the memory can also be used to temporarily store various data that have been output or will be output.

[0091] The processor in some embodiments may be a Central Processing Unit (CPU), a controller, a microcontroller, a microprocessor, or other data processing chips. The processor is generally used to control the overall operation of the computer device.

[0092] The basic principles, main features, and advantages of the present invention have been described above. Those skilled in the art should understand that the present invention is not limited by the above embodiments. The above embodiments and descriptions merely illustrate the principles of the present invention. Without departing from the spirit and scope of the present invention, there will be various changes and improvements to the present invention, all of which fall within the claimed protection scope of the present invention. The protection scope claimed by the present invention is defined by the appended claims and their equivalents.

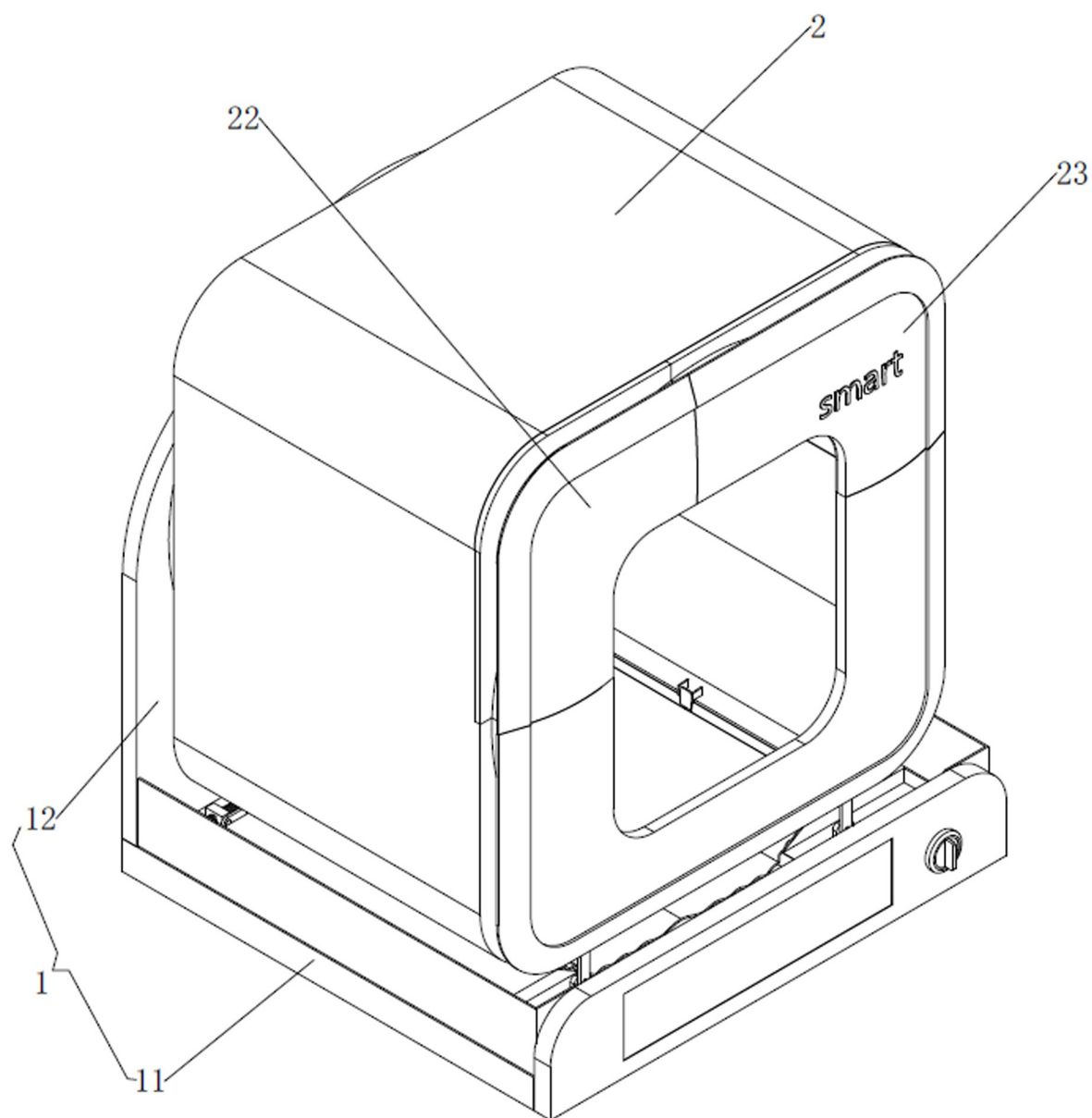


图1

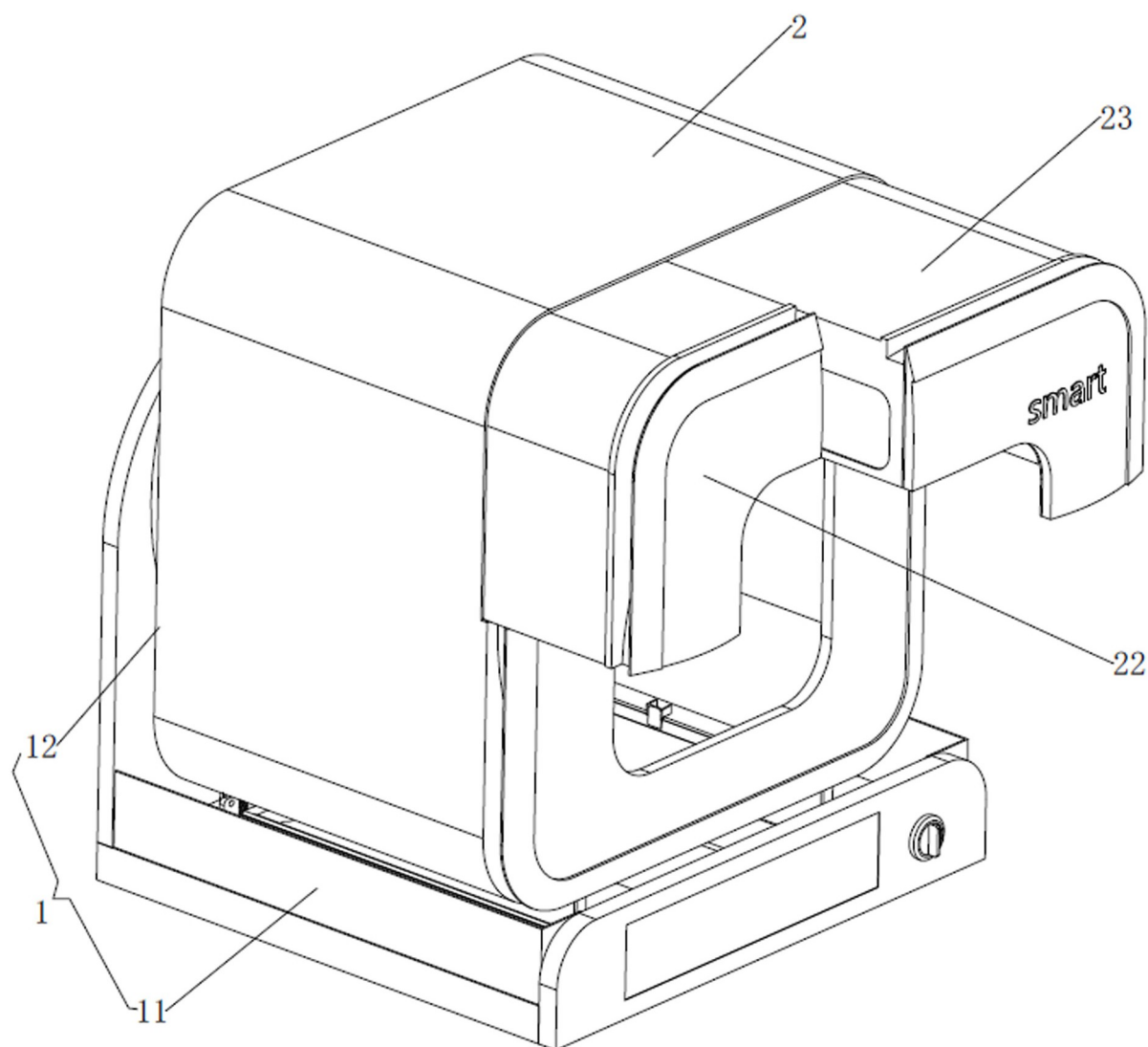


图2

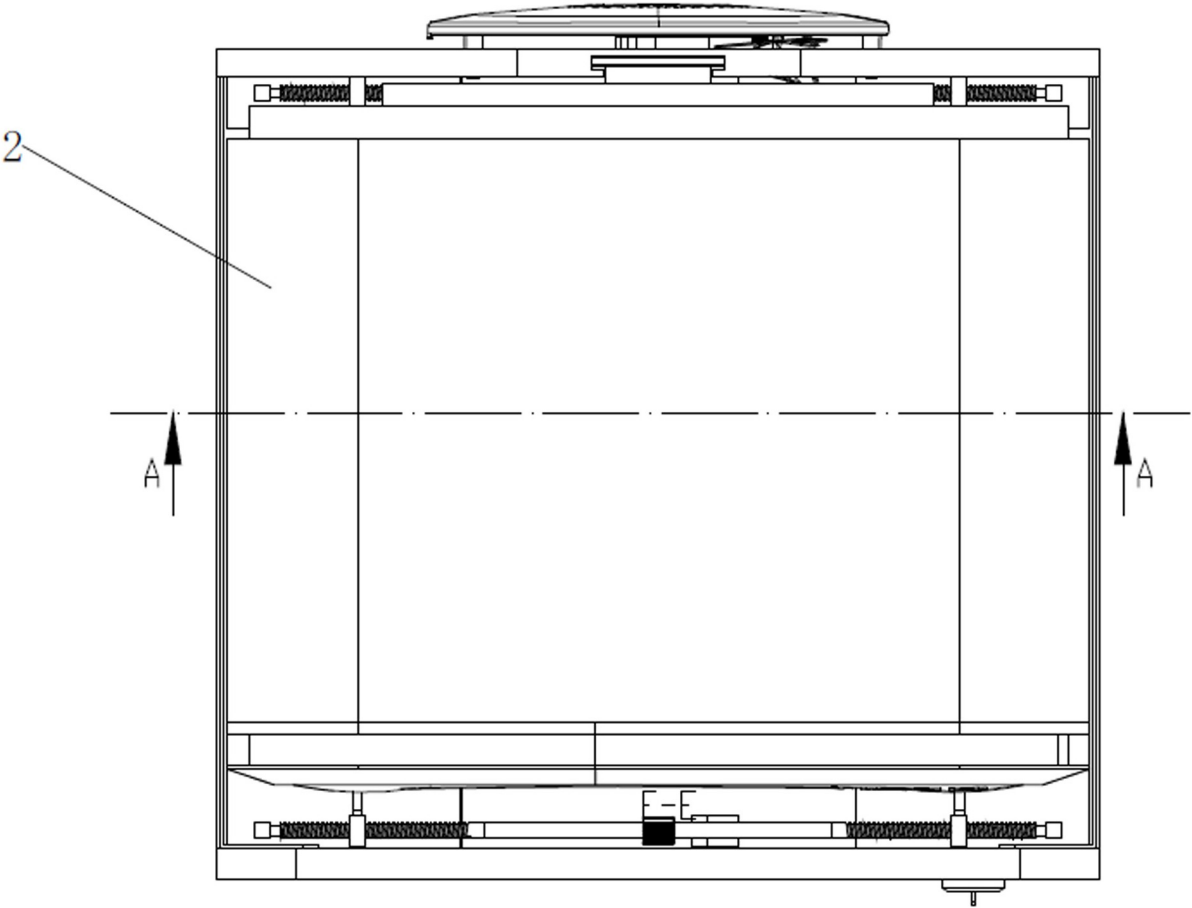


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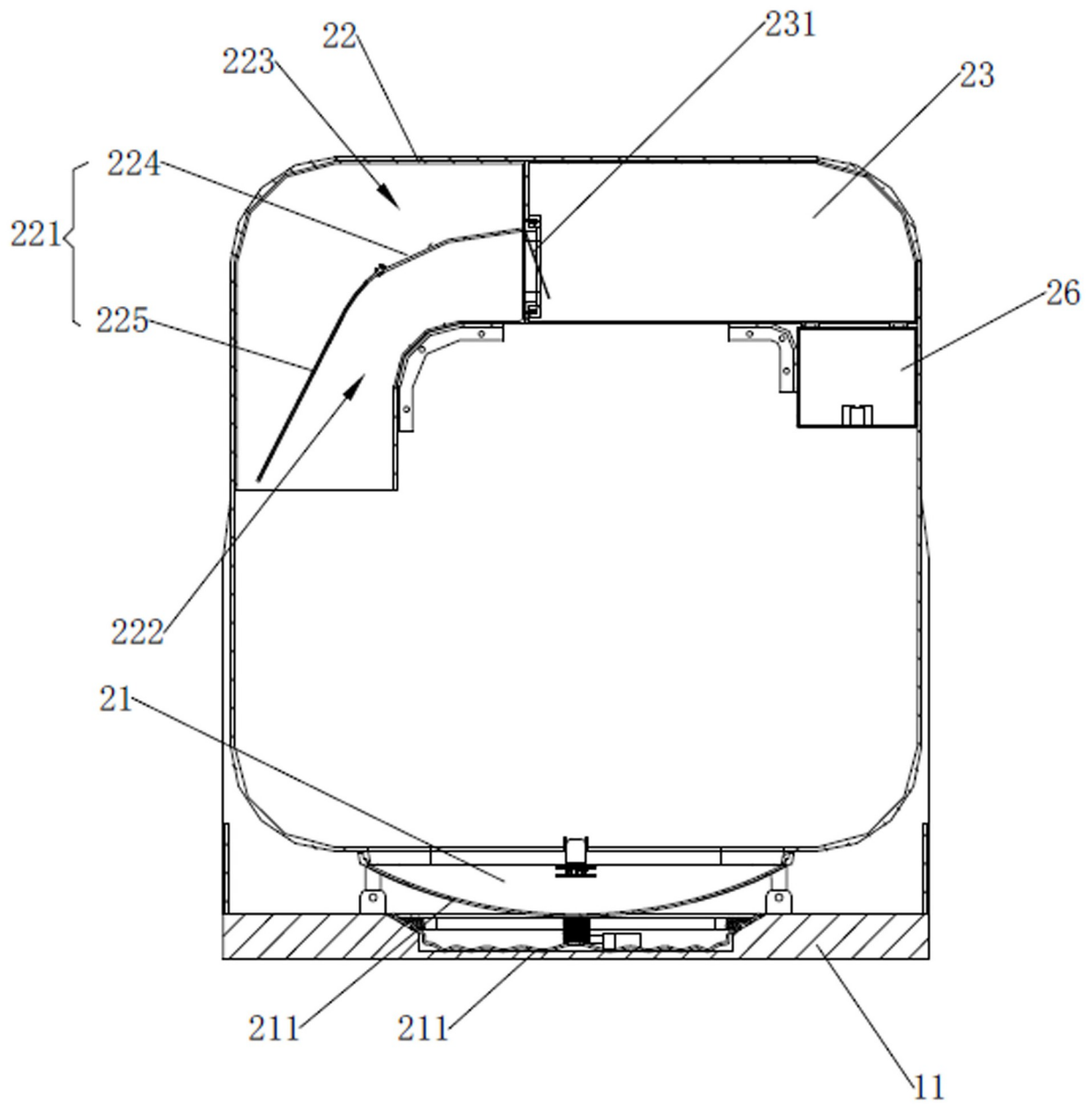


图4

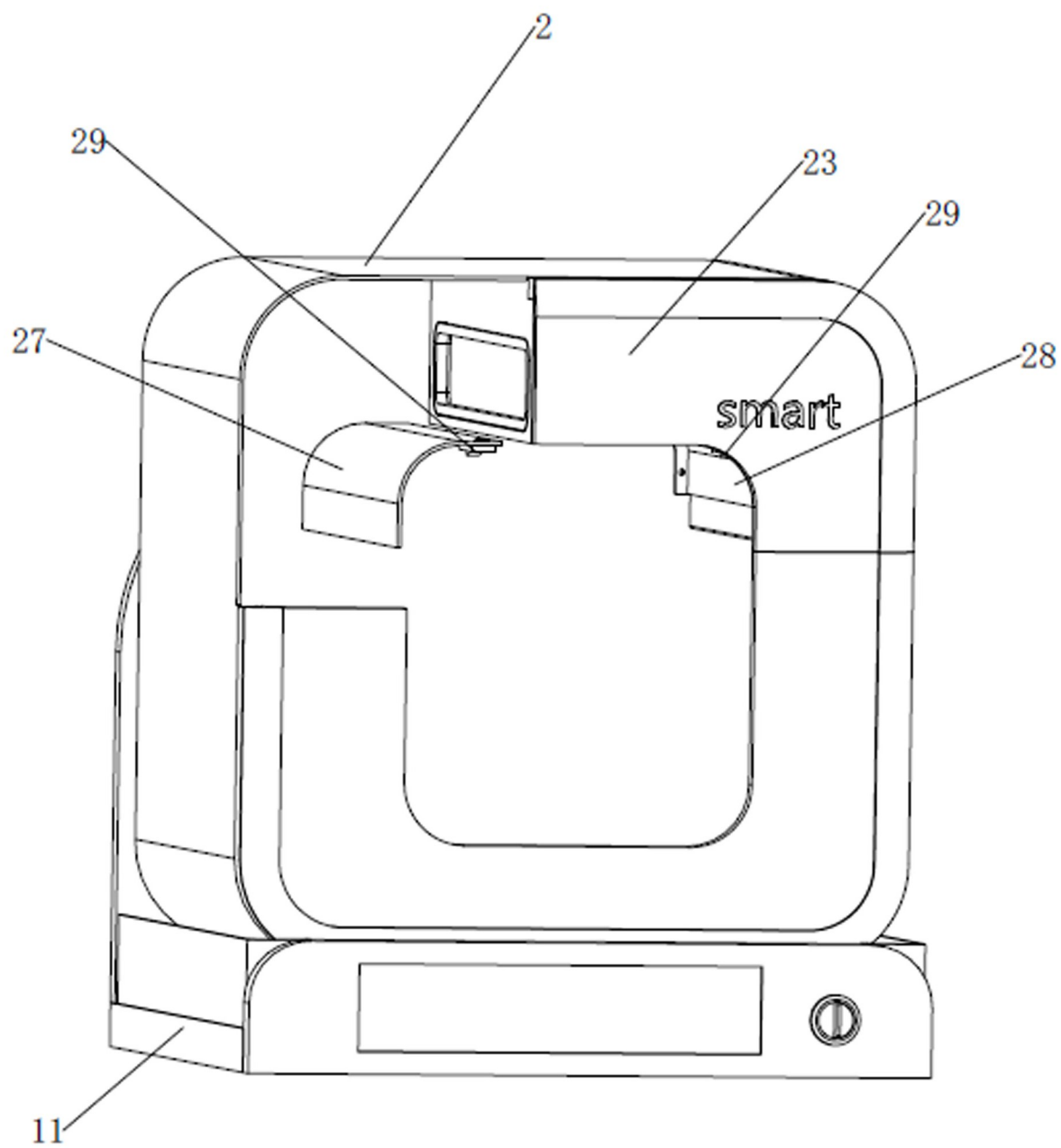


图5

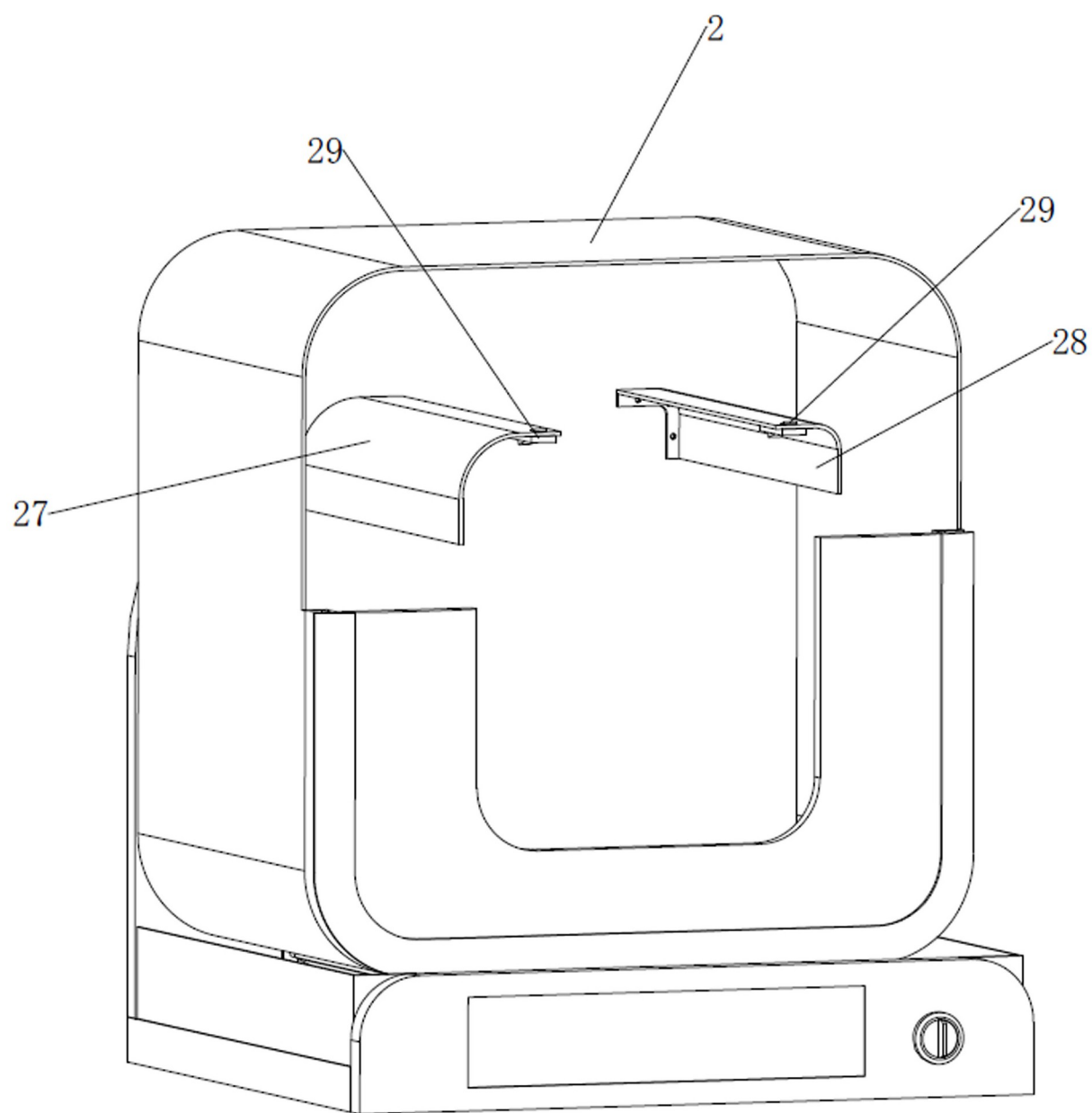


图6

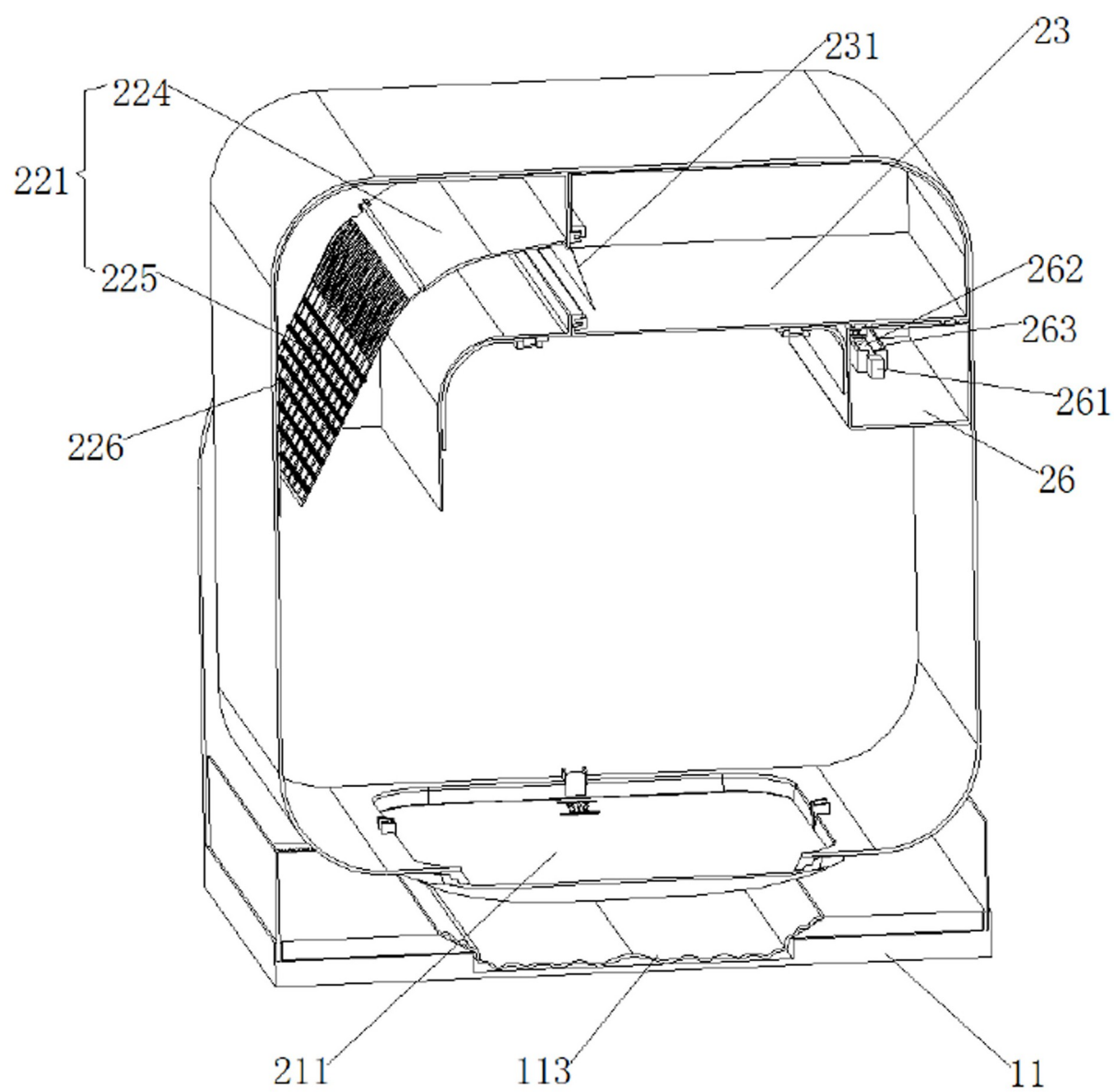


图7

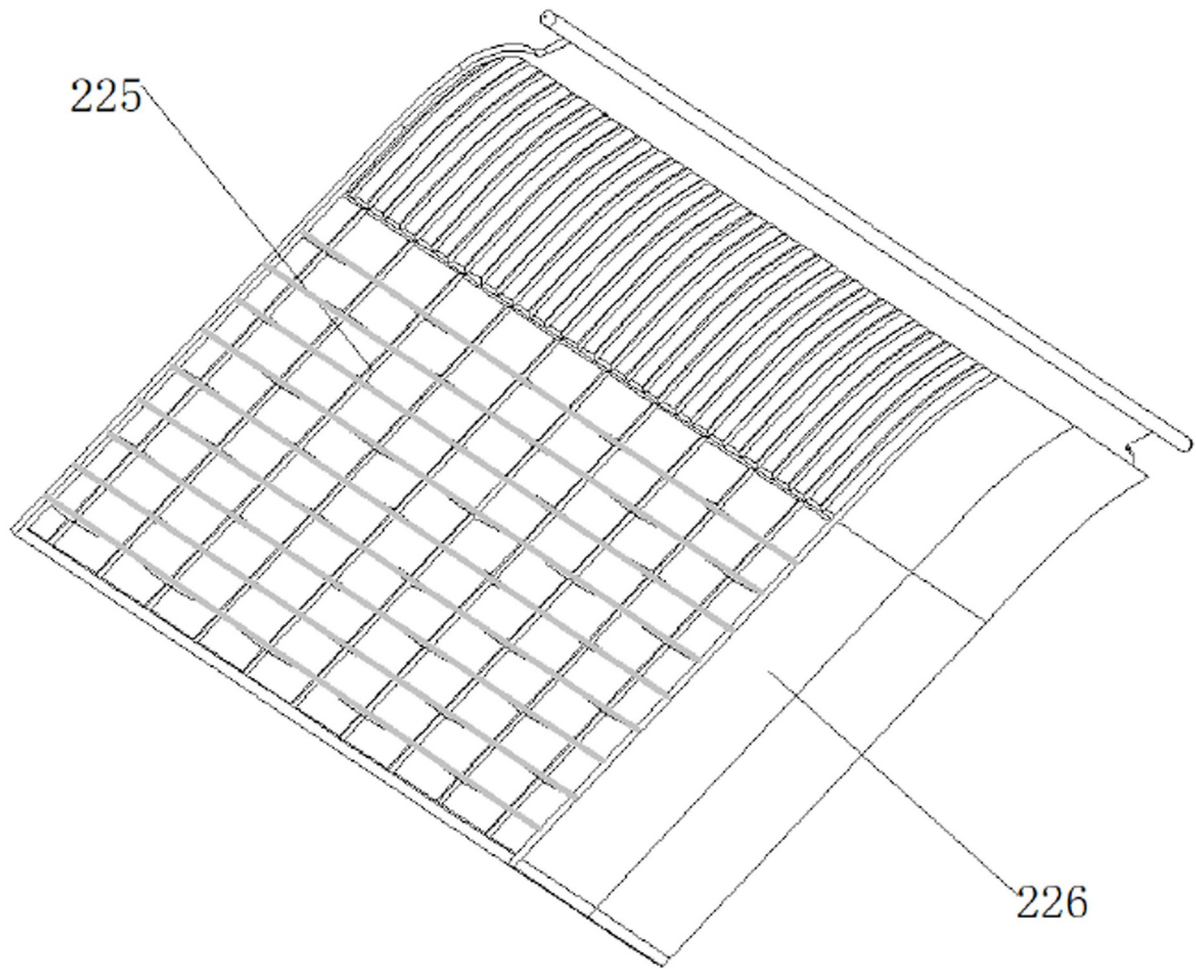


图8

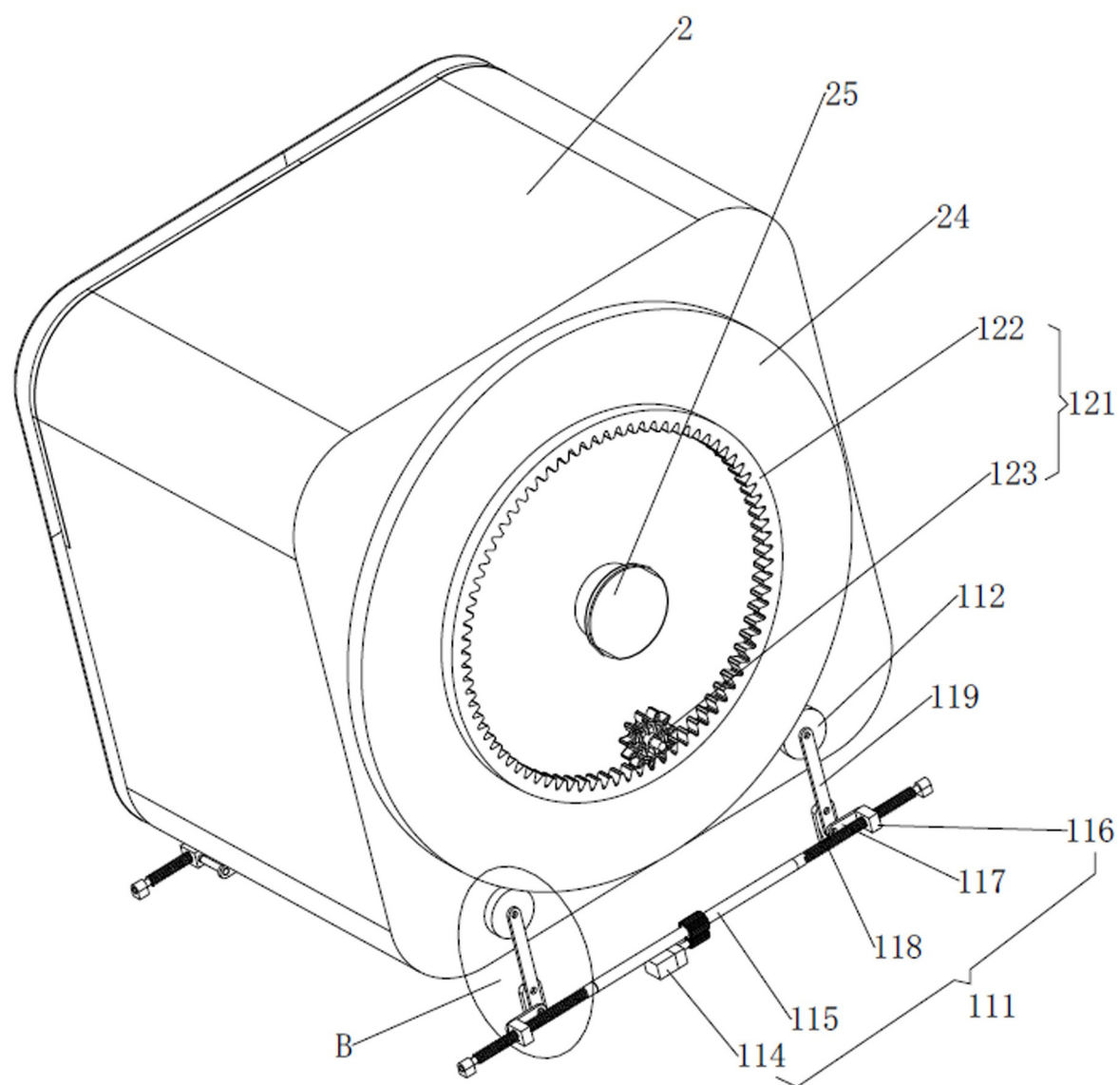


图9

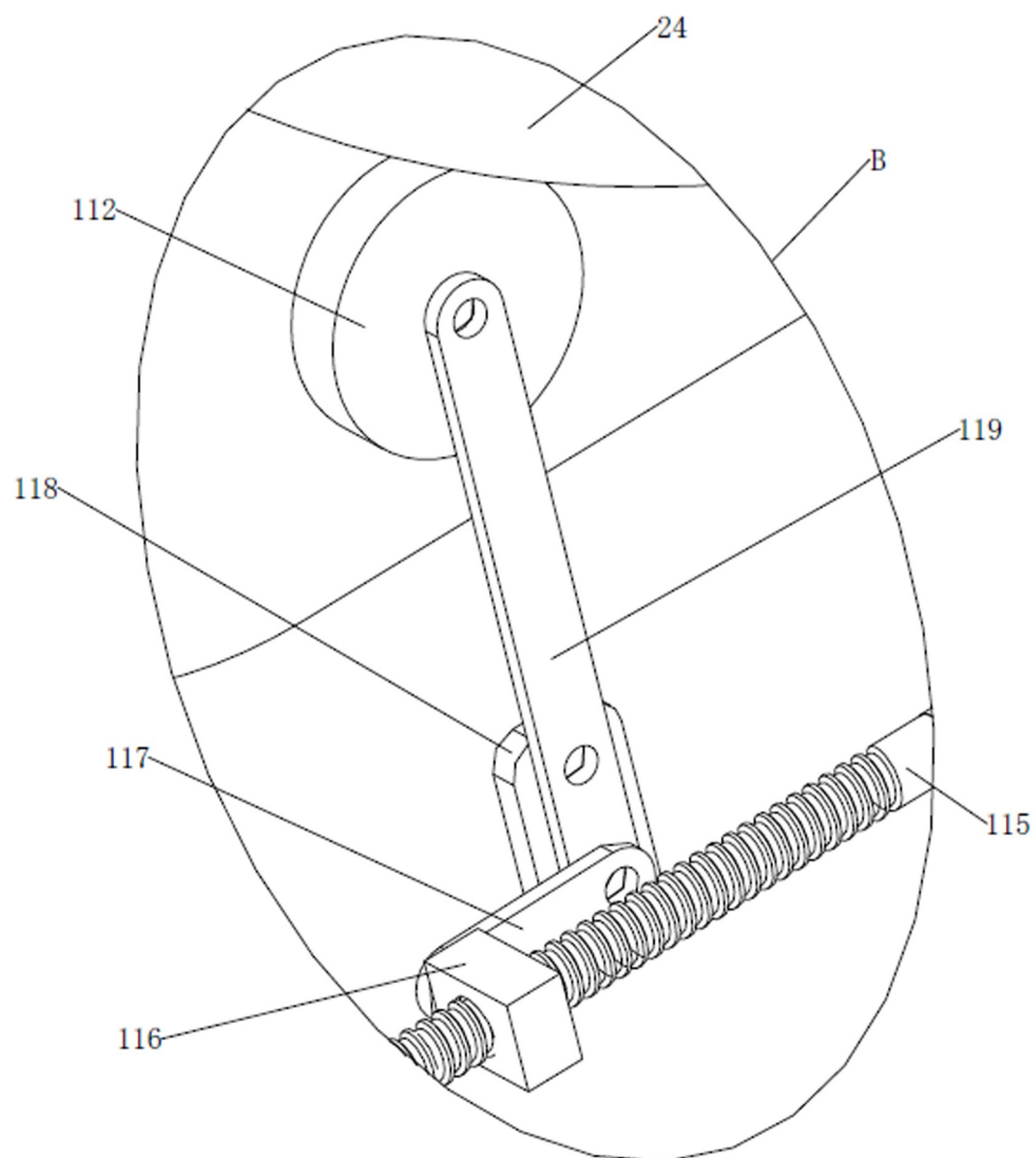


图10

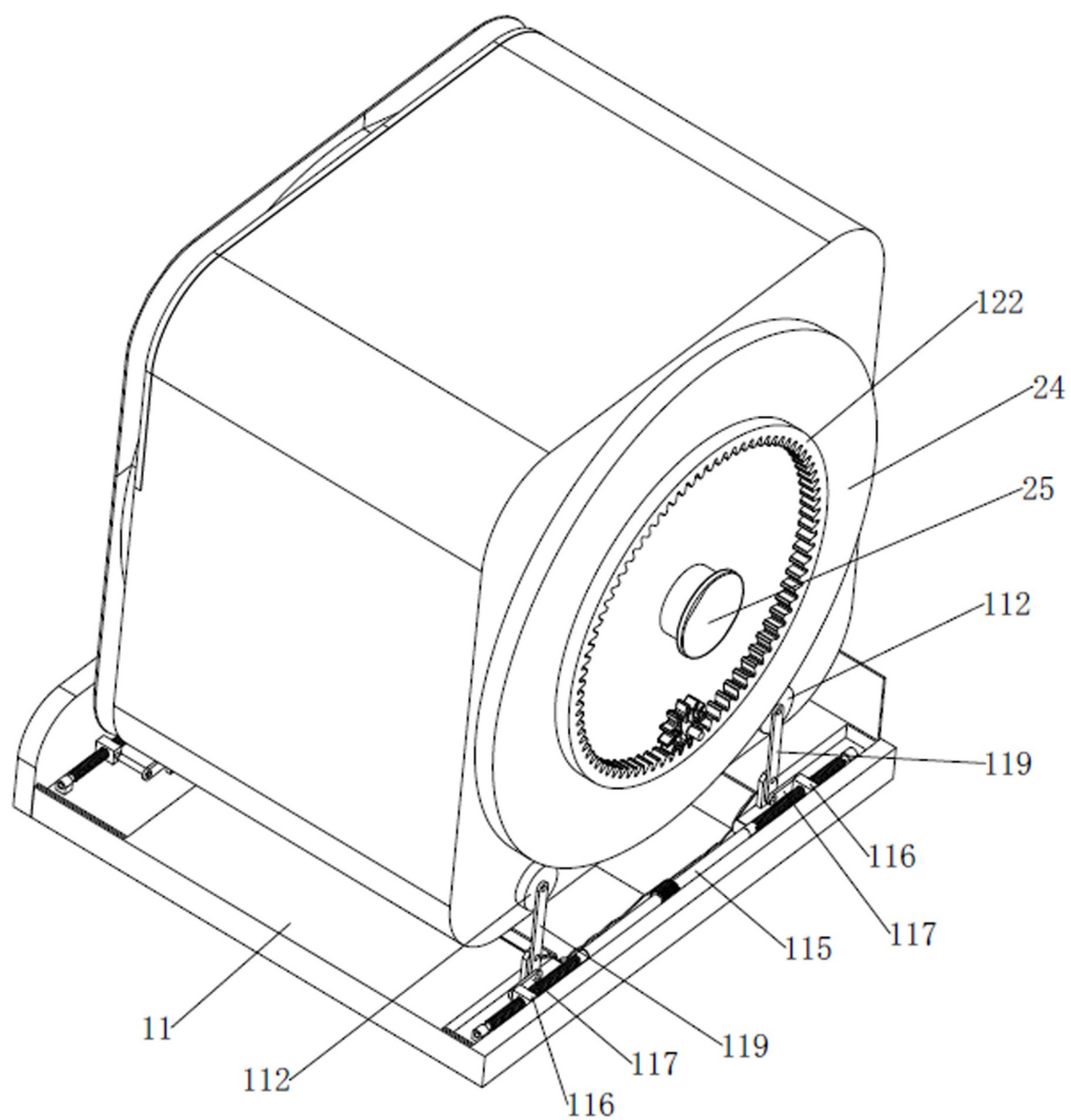


图11

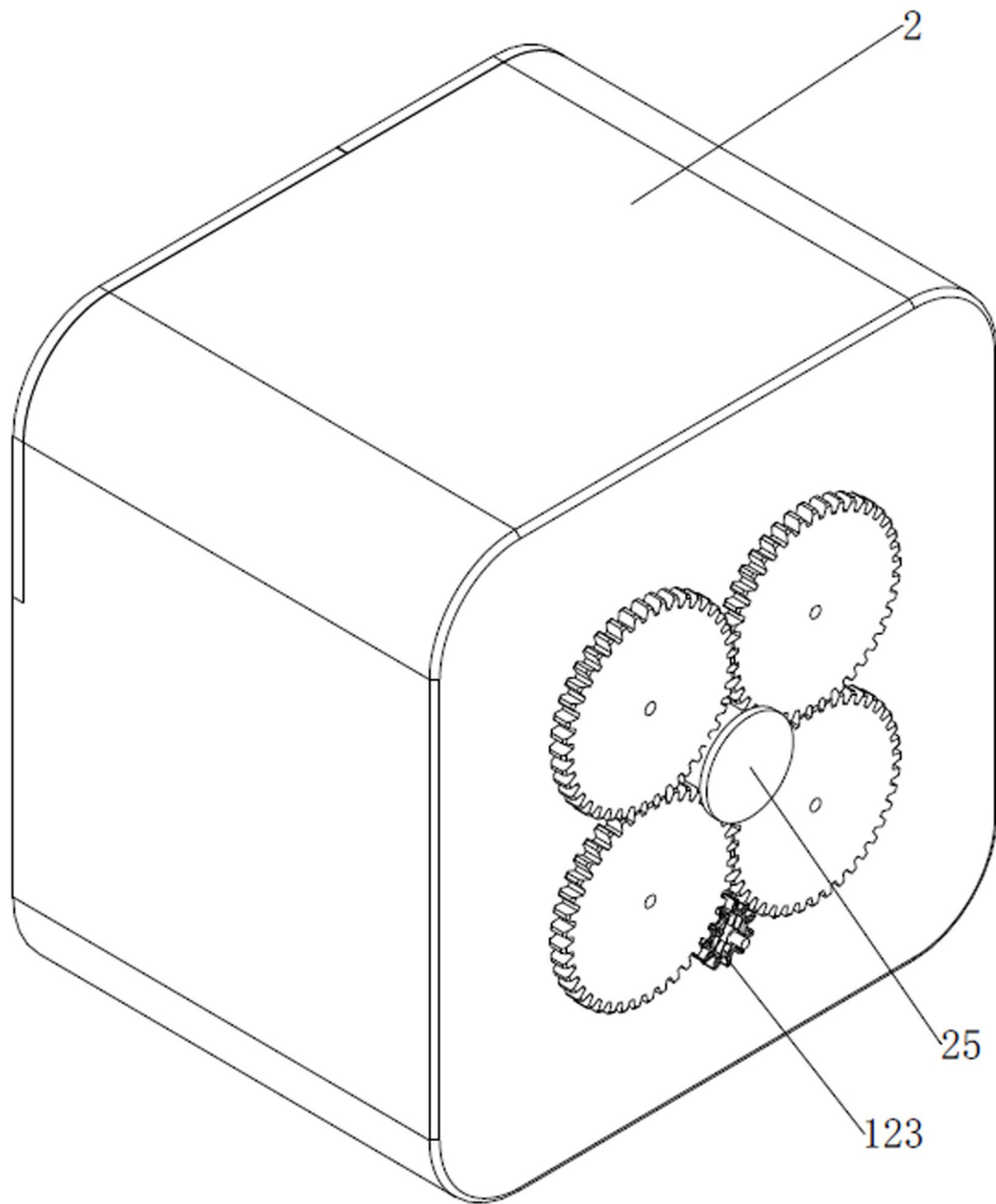


图13

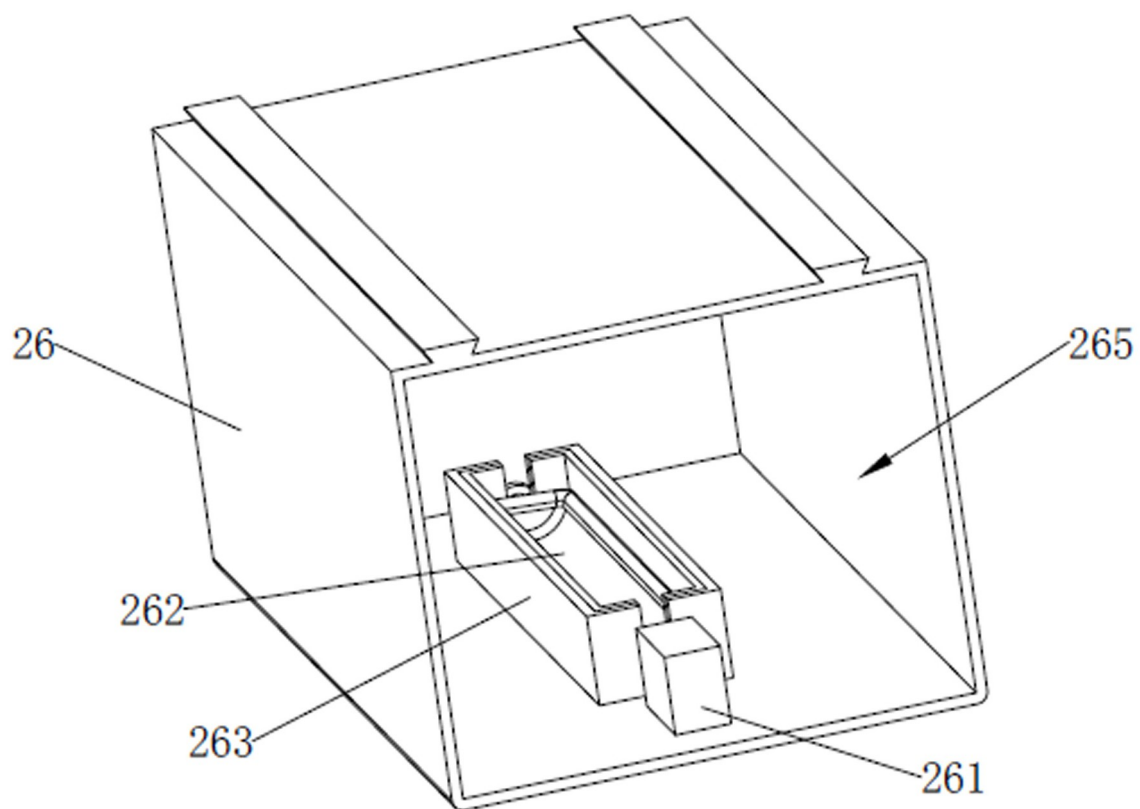


图14

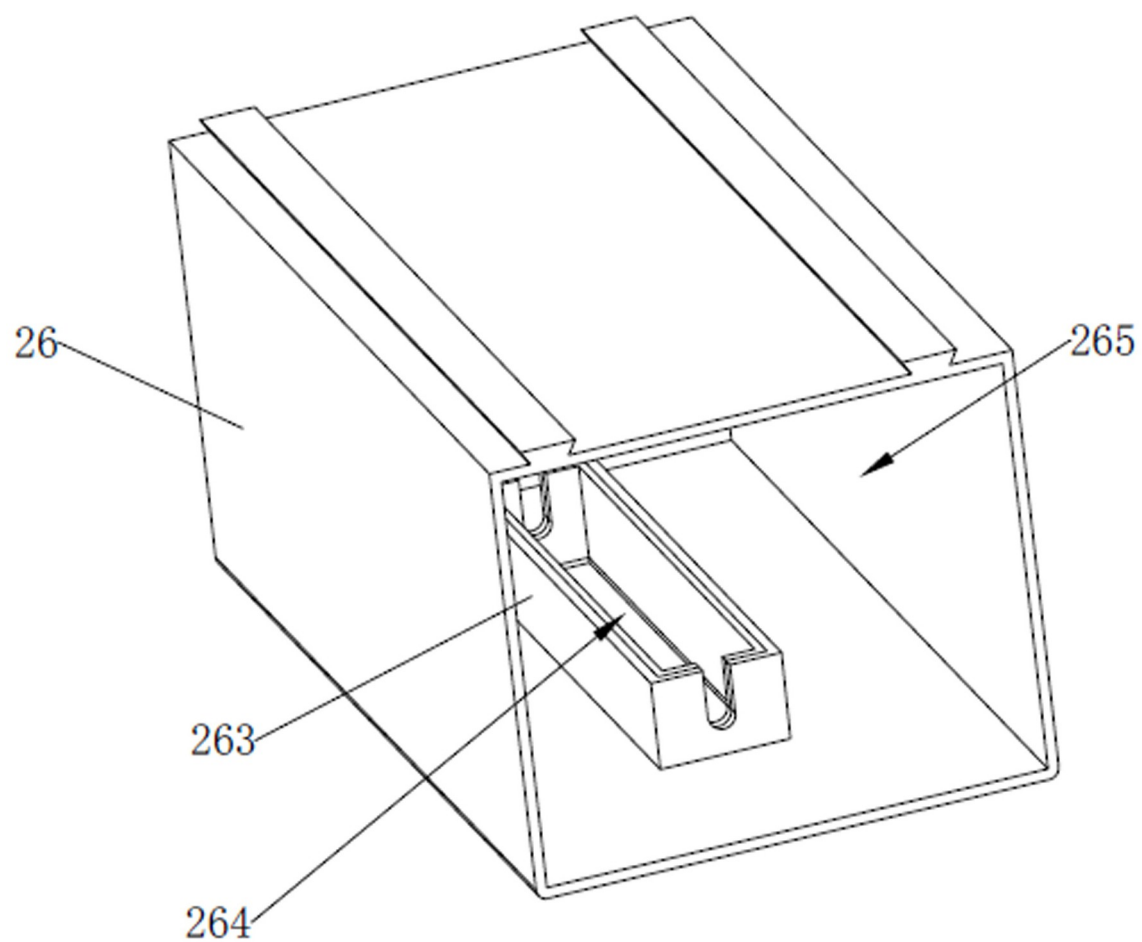


图15