

SORTING DEVICE AND INTELLIGENT REVERSE VENDING MACHINE

TECHNICAL FIELD

[0001] The invention relates to the field of container recycling equipment, and more specifically, to a sorting device and an intelligent reverse vending machine.

BACKGROUND

[0002] A reverse vending machine is a device special for recycling waste containers. It automatically recognizes container materials (such as cans, plastic bottles, glass bottles, and shallow plastic trays) through an internal recognition chamber, and sorts fed containers into different recycling bins through a sorting device.

[0003] However, the sorting device of the existing intelligent reverse vending machine has the shortcomings of complex structure and inconvenient disassembly and assembly. In addition, the recognition chamber is directly connected to the recycling bin, a compactor is provided inside the machine, debris are produced when the compactor compacts and crushes cans, and the debris may splash out from the recognition chamber to injure users, resulting in potential safety hazards.

SUMMARY

[0004] To solve the above technical problems in the prior art, the invention provides the following technical solution:

[0005] A sorting device includes a device housing arranged at a discharge port of a recognition chamber and a sorting plate rotatably connected above a recycling bin, the device housing is provided with an infeed port in communication with the recognition chamber, and an access door covering the infeed port is rotatably connected to the infeed port; a driving member for driving the access door to rotate and an angle control assembly for controlling the rotation angle of the access door are provided on the device housing, and the access door protrudes towards the sorting plate with a pull lever; the pull lever drives the sorting plate to rotate when the access door rotates to one side to open; and a tension spring for driving the sorting plate to reset is further connected to the sorting plate.

[0006] The invention is further configured as follows: the driving member includes a driving motor mounted on the device housing, and the driving motor is connected to the

access door by a spline, so that the driving motor drives the access door to rotate.

[0007] The invention is further configured as follows: the angle control assembly includes a first proximity sensor, a second proximity sensor, and a third proximity sensor arranged on the device housing; a sensing rod protrudes from the connection between the access door and a gear set; the sensing rod approaches the second proximity sensor when the access door closes the infeed port; and the sensing rod approaches the first proximity sensor or the third proximity sensor respectively when the access door is opened to the left or right side.

[0008] The invention is further configured as follows: the device housing is provided with a sliding hole open along the rotation path of the access door, a guide rail parallel to the sliding hole is provided on the outer wall of the device housing, a pulley protruding to the outer side of the sliding hole is provided on the access door, and the pulley slides on the guide rail when the access door rotates.

[0009] The invention is further configured as follows: dampers are provided at two ends of the guide rail, and the pulley abuts against the dampers when the access door rotates to open.

[0010] The invention is further configured as follows: a bracket is vertically arranged above the recycling bin, the sorting plate is rotatably connected to the bracket by hinges, one end of the tension spring is fixed to the sorting plate, and the other end of the tension spring is fixed to the bracket.

[0011] The invention is further configured as follows: a first recycling bin and a second recycling bin are provided on two sides of the sorting plate respectively; the sorting plate guides a container into the first recycling bin when the tension spring is in an initial state; and the sorting plate guides the container into the second recycling bin when the access door drives the sorting plate to rotate through the pull lever.

[0012] The invention is further configured as follows: the device housing is provided with a guide plate at the bottom of the infeed port, and the guide plate is inclined downward towards the inner side of the device housing.

[0013] In addition, the invention further provides an intelligent reverse vending machine, including the sorting device described above.

[0014] Compared with existing technologies, the invention has at least the following advantages:

[0015] 1. The angle control assembly controls the movement position of the access door and drives the sorting plate to rotate, thereby achieving precise classification. On the one

hand, the access door plays a protecting role. After sorting is completed, the access door closes, which can prevent debris from splashing to injure users during compaction and crushing. On the other hand, the access door can prevent some improper operations by users. The sorting device has a simple structure, low cost, and easy disassembly and assembly.

- 5 **[0016]** 2. The device housing is provided with the sliding hole, and the pulley protruding to the outer side of the sliding hole is provided on the access door and slides on the guide rail to clamp the access door, thereby improving the stability and guiding the rotation trajectory of the access door.

10 **BRIEF DESCRIPTION OF THE DRAWINGS**

[0017] FIG. 1 is an overall schematic diagram of a first embodiment;

[0018] FIG. 2 is a schematic diagram from the perspective of the inner side of a device housing;

[0019] FIG. 3 is a schematic diagram of a sorting plate;

- 15 **[0020]** FIG. 4 is a schematic diagram of an access door;

[0021] FIG. 5 is a schematic diagram from the perspective of the outer side of the device housing; and

[0022] FIG. 6 is a schematic diagram of a second embodiment.

[0023] Description of reference numerals:

- 20 **[0024]** 1. Device housing; 2. Access door; 3. Pull lever; 4. Sorting plate; 5. Driving motor; 6. Angle control assembly; 601. First proximity sensor; 602. Second proximity sensor; 603. Third proximity sensor; 604. Sensing rod; 7. Sliding hole; 8. Guide rail; 9. Pulley; 10. Damper; 11. Bracket; 12. Hinge; 13. Tension spring; 14. Infeed port; 15. Guide plate; 16. Slider; 17. Bottle feeding port; 18. Recognition chamber; 19. Compactor; 20. Intelligent reverse vending machine.
- 25

DETAILED DESCRIPTION

- [0025]** In order to make the objectives, technical solutions, and advantages of the embodiments of the invention clearer, the following will clearly and completely describe the technical solutions in the embodiments of the invention in conjunction with the accompanying drawings therein. Obviously, the described embodiments are some of the embodiments of the invention, not all of them. Generally, the components of the embodiments of the invention described and illustrated in the accompanying drawings can be
- 30

arranged and designed in various different configurations.

[0026] In the description of the invention, it should be further noted that unless otherwise specified and defined, the terms “arranged”, “mounted”, “connected”, and “connection” should be understood in a broad sense, for example, the “connection” may be
5 fixed connection, detachable connection, integral connection, mechanical connection, electrical connection, direct connection, indirect connection by a medium, or internal communication between two elements. Those of ordinary skill in the art can understand the specific meanings of the above terms in the invention according to specific circumstances.

[0027] First embodiment:

[0028] A sorting device, as shown in FIG. 1 to FIG. 3, includes a device housing 1
10 arranged at a discharge port of a recognition chamber 18 and a sorting plate 4 rotatably connected above a recycling bin. The device housing 1 is provided with an infeed port 14 in communication with the recognition chamber 18, and an access door 2 covering the infeed port 14 is rotatably connected to the infeed port 14. A driving member for driving the access
15 door 2 to rotate and an angle control assembly 6 for controlling the rotation angle of the access door 2 are provided on the device housing 1.

[0029] The driving member includes a driving motor 5 mounted on the device housing 1, the driving motor 5 is a direct current motor, and the driving motor 5 is equipped with a worm gear reducer. An output shaft of the driving motor 5 is connected to the access
20 door 2 by a spline, and the spline cooperates with a slot to achieve transmission. The access door 2 is parallel to the device housing 1, and a rotation axis of the access door 2 is perpendicular to the device housing 1. A connecting rod protrudes from the top of the access door 2, and the connecting rod is connected to the reducer. When the connecting rod is in a vertical state, the access door 2 closes to completely cover the infeed port 14. When the
25 driving motor 5 drives the connecting rod to rotate to left and right sides, the access door 2 opens the infeed port 14. A container conveyed from the recognition chamber 18 enters the sorting device through the infeed port 14.

[0030] The angle control assembly 6 includes a first proximity sensor 601, a second proximity sensor 602, and a third proximity sensor 603 mounted on the device housing 1. A
30 sensing rod 604 protrudes from the connection between the access door 2 and a gear set,

namely, the top of the connecting rod, and the sensing rod 604 rotates synchronously with the connecting rod. When the access door 2 closes the infeed port 14, the sensing rod 604 approaches and contacts the second proximity sensor 602. When the access door 2 rotates to the left or right side to open, the sensing rod 604 approaches the first proximity sensor 601 or the third proximity sensor 603, to control the driving motor 5 to stop rotating.

[0031] In other embodiments, the angle control assembly 6 may alternatively be configured as other types of sensors or include other numbers of sensors, which are selectively mounted according to the types of containers actually to be detected and actual needs. In this embodiment, three sensors, specifically proximity sensors, are used.

[0032] The access door 2 protrudes towards the sorting plate 4 with a pull lever 3. When the access door 2 rotates to one side to open, the pull lever 3 drives the sorting plate 4 to rotate. A tension spring 13 for driving the sorting plate 4 to reset is further connected to the sorting plate 4. When the access door 2 rotates back to the closed state, the tension spring 13 drives the sorting plate 4 to rotate back to its initial state.

[0033] A bracket 11 is vertically fixed to the inner wall of an intelligent reverse vending machine 20 and located above the recycling bin, the sorting plate 4 is rotatably connected to the bracket 11 by hinges 12, a rotation axis of the sorting plate 4 is vertically arranged, one end of the tension spring 13 is fixed to the top of the sorting plate 4, and the other end of the tension spring 13 is fixed to the top of the bracket 11.

[0034] In this embodiment, a first recycling bin and a second recycling bin are provided on two sides of the sorting plate 4 respectively. When the tension spring 13 is in an initial state, the angle of the sorting plate 4 remains in its initial state. After a container enters the sorting device, the container is guided into the first recycling bin by the sorting plate 4. When the access door 2 drives the sorting plate 4 to rotate through the pull lever 3, the sorting plate 4 overcomes the tension of the tension spring 13 and rotates, and guides the container into the second recycling bin on the other side.

[0035] In this embodiment, when the pull lever 3 is close to the right side of the access door 2 and the sorting plate 4 is in the initial state, the pull lever 3 is located on the right side of the sorting plate 4. When the access door 2 rotates from the second proximity sensor 602 to the third proximity sensor 603 (to the right), the pull lever 3 does not contact

the sorting plate 4, and the sorting plate 4 remains stationary. When the access door 2 rotates from the second proximity sensor 602 to the first proximity sensor 601 (to the left), the pull lever 3 drives the sorting plate 4 to rotate.

[0036] The device housing 1 is provided with a guide plate 15 at the bottom of the infeed port 14, and the guide plate 15 is inclined downward towards the inner side of the device housing 1. When the container enters from the infeed port 14, the container slides forward along the guide plate 15, passes through the sorting plate 4, and then falls into the recycling bin.

[0037] As shown in FIG. 4 and FIG. 5, the device housing 1 is provided with a sliding hole 7 open along the rotation path of the access door 2, a guide rail 8 parallel to the sliding hole 7 is provided on the outer wall of the device housing 1 (the side of the device housing 1 facing the recognition chamber 18 is the outer side, and the access door 2 is arranged on the inner side), the guide rail 8 is attached to the lower edge of the sliding hole 7, and a pulley 9 protruding to the outer side of the sliding hole 7 is provided on the access door 2. When the access door 2 rotates, the pulley 9 slides on the guide rail 8. A slider 16 is further provided on the access door 2, and the slider 16 is attached to the inner side of the device housing 1. The pulley 9 cooperates with the slider 16 to provide a clamping effect, making the access door 2 more stable. Meanwhile, the guide rail 8 guides the rotation trajectory of the access door 2.

[0038] Dampers 10 are provided at two ends of the guide rail 8. When the access door 2 rotates to open, the pulley 9 moves to abut against the dampers 10, so as to absorb impact force when the access door 2 rotates.

[0039] The working process of the invention is as follows:

[0040] It is assumed that the first recycling bin collects cans and the second recycling bin collects plastic bottles. After a container is recognized in the recognition chamber 18, the conveying mechanism inside the recognition chamber 18 feeds the container into the sorting device from the infeed port 14. If the container is recognized as a can, the access door 2 rotates counterclockwise by 60 degrees, the sensing rod 604 turns from the position of the second proximity sensor 602 (initial position) to the position of the third proximity sensor 603, the pull lever 3 is not in contact with the sorting plate 4, the sorting plate 4 remains in its initial state, then the can is transported into the first recycling bin, and after the sorting is

completed, the access door 2 rotates back to the position of the second proximity sensor 602.

[0041] Similarly, if the container is recognized as a plastic bottle, the access door 2 rotates clockwise by 60 degrees from the position of the second proximity sensor 602 to the position of the first proximity sensor 601, the pull lever 3 drives the sorting plate 4 to rotate, the plastic bottle is transported into the second recycling bin, and after the sorting is completed, the access door 2 rotates back to the position of the second proximity sensor 602, and the sorting guide plate is pulled back to its initial position under the action of the tension spring 13.

[0042] Second embodiment:

[0043] An intelligent reverse vending machine, as shown in FIG. 6, includes a recognition chamber 18 and the sorting device of the above embodiment. The sorting device is arranged at a rear end of the recognition chamber 18, a bottle feeding port 17 is provided at a front end of the recognition chamber 18, a recycling bin is provided below the sorting device, and a compactor 19 is provided inside the recycling bin.

[0044] The above descriptions are merely preferred embodiments of the invention and are not intended to limit the invention. Any modifications, equivalent substitutions, improvements, etc. made within the design concept of the invention should be included within the scope of protection of the invention.

WHAT IS CLAIMED IS:

1. A sorting device, comprising a device housing arranged at a discharge port of a recognition chamber and a sorting plate rotatably connected above a recycling bin, wherein the device housing is provided with an infeed port in communication with the recognition chamber, and an access door covering the infeed port is rotatably connected to the infeed port; a driving member for driving the access door to rotate and an angle control assembly for controlling the rotation angle of the access door are provided on the device housing, and the access door protrudes towards the sorting plate with a pull lever; the pull lever drives the sorting plate to rotate when the access door rotates to one side to open; and a tension spring for driving the sorting plate to reset is further connected to the sorting plate.

2. The sorting device according to claim 1, wherein the driving member comprises a driving motor mounted on the device housing, and the driving motor is connected to the access door by a spline, so that the driving motor drives the access door to rotate.

3. The sorting device according to claim 2, wherein the angle control assembly comprises a first proximity sensor, a second proximity sensor, and a third proximity sensor arranged on the device housing; a sensing rod protrudes from the connection between the access door and a gear set; the sensing rod approaches the second proximity sensor when the access door closes the infeed port; and the sensing rod approaches the first proximity sensor or the third proximity sensor respectively when the access door is opened to the left or right side,.

4. The sorting device according to claim 1, wherein the device housing is provided with a sliding hole open along the rotation path of the access door, a guide rail parallel to the sliding hole is provided on the outer wall of the device housing, a pulley protruding to the outer side of the sliding hole is provided on the access door, and the pulley slides on the guide rail when the access door rotates.

5. The sorting device according to claim 4, wherein dampers are provided at two ends of the guide rail, and the pulley abuts against the dampers when the access door rotates to open.

6. The sorting device according to claim 1, wherein a bracket is vertically arranged
5 above the recycling bin, the sorting plate is rotatably connected to the bracket by hinges, one end of the tension spring is fixed to the sorting plate, and the other end of the tension spring is fixed to the bracket.

7. The sorting device according to claim 6, wherein a first recycling bin and a second
10 recycling bin are provided on two sides of the sorting plate respectively; the sorting plate guides a container into the first recycling bin when the tension spring is in an initial state; and the sorting plate guides the container into the second recycling bin when the access door drives the sorting plate to rotate through the pull lever.

15 8. The sorting device according to claim 1, wherein the device housing is provided with a guide plate at the bottom of the infeed port, and the guide plate is inclined downward towards the inner side of the device housing.

9. An intelligent reverse vending machine, comprising the sorting device according to
20 any of claims 1 to 8.