COLLECTION DEVICE FOR SAFELY HANDLING NUCLEAR MEDICINE WASTE

Field of the Invention

The invention belongs to the technical field of waste bins, and specifically relates to a collection device for safely handling nuclear medicine waste.

Background to the Invention

Radioactive waste, due to its content of radionuclides, poses potential hazards to human health and the environment, and therefore strict treatment measures must be adopted. Radioactive waste generated in nuclear medicine departments can be divided by its physical state into solid waste, liquid waste and airborne waste, collectively referred to as the "three types of radioactive waste". These wastes may contain different kinds and half-lives of radionuclides, which need to be classified and treated according to their properties. Therefore, there is an urgent need for a collection device capable of safely and efficiently handling nuclear medicine waste, so as to meet the pressing requirements of the nuclear medicine industry for waste treatment, safeguard the health and safety of practitioners, reduce potential environmental hazards, and promote the sustainable development of nuclear medicine.

Patent publication number CN116101659B discloses a collection device for safely handling nuclear medicine waste, comprising: a collection barrel, an inner barrel body arranged inside the collection barrel, and a leakage-prevention mechanism connected with the inner barrel body; a limiting mechanism connected with the leakage-prevention mechanism; a restricting mechanism connected with the inner barrel body; and a distributing mechanism connected with the inner barrel body. In use, when the barrel cover is lifted, radionuclide waste can be inserted into a baffle, causing the baffle to be compressed, which further compresses an arc-shaped plate, allowing the radionuclide waste to enter a sealed space. At the same time, the rebound of the arc-shaped plate accelerates the restoration of the baffle to its original position, thereby closing the sealed space and reducing the leakage of internal radionuclide radiation. If solid radionuclide waste and liquid radionuclide waste

need to be classified, diversion holes can be opened at the bottom of the waste bag, so that liquid radionuclide waste passes through the openings on a perforated plate into the bottom of the inner barrel body for collection.

However, in the above technical solution, when medical staff insert radionuclide waste into the baffle, the baffle is forced open to form an opening, causing the radionuclide waste inside the sealed space to be exposed, thereby leading to the leakage of volatilised gas from the radionuclide waste, which increases the harm of the radionuclide waste within the sealed space to medical staff. Moreover, the above technical solution requires diversion holes to be opened at the bottom of the waste bag in order to achieve solid-liquid separation of the radionuclide waste. If used for a long time and waste accumulates in large quantities, the liquid radionuclide waste located above cannot smoothly pass through the perforated plate into the bottom end of the inner barrel body, resulting in poor solid-liquid separation of the radionuclide waste.

Statement of Invention

The purpose of the invention is to overcome the problems of existing nuclear medicine waste collection devices, in which nuclear medicine waste is exposed, causing significant harm to medical staff, and the effect of solid-liquid separation and collection is poor.

To achieve the above purpose, the technical concept adopted by the invention is as follows: a collection device for safely handling nuclear medicine waste is provided, comprising a barrel body, a delivery cover, a protective cover, a driving mechanism, and a solid-liquid separation mechanism located below the protective cover; during use, when medical staff open the delivery cover, the driving mechanism drives the protective cover to close, preventing exposure of nuclear medicine waste, and after delivery, when the delivery cover closes, the protective cover opens, allowing the nuclear medicine waste to enter the solid-liquid separation mechanism, where it is subsequently classified and collected. In this way, through the design of the delivery cover and the protective cover, exposure of nuclear medicine waste inside the collection device can be prevented, and each delivery of nuclear medicine waste can undergo solid-liquid separation, avoiding liquid nuclear medicine waste remaining on solid nuclear medicine waste, thereby achieving good classification

and collection results.

Based on the above technical concept, the technical solution adopted by the invention is as follows:

A collection device for safely handling nuclear medicine waste, comprising: a double-layer barrel body, the double-layer barrel body comprising an outer barrel and an inner barrel, the double-layer barrel body comprising: an outer barrel; an inner barrel, arranged inside the outer barrel; a delivery cover, slidably arranged at the top of the outer barrel; a partition plate, transversely arranged inside the outer barrel, the bottom of the partition plate being in communicating connection with the top of the inner barrel; an inverted-trapezoidal guide barrel, located above the partition plate; a protective cover, arranged at the bottom opening of the inverted-trapezoidal guide barrel and rotatably connected with the side wall of the bottom opening; a solid-liquid separation mechanism, located inside the inner barrel and connected with the inner wall of the inner barrel; two driving mechanisms, both embedded in accommodating cavities of the side wall of the outer barrel, each driving mechanism being respectively connected with the delivery cover, the protective cover and the solid-liquid separation mechanism; a double-port collection box, located below the solid-liquid separation mechanism and slidably connected with the barrel body.

In the above technical solution, as a preferred option, the solid-liquid separation mechanism comprises: an inclined guide plate, connected with the bottom surface of the partition plate; two arc-shaped sliding grooves, respectively arranged on two opposite inner side walls of the inner barrel; a filter screen, located between the two driving mechanisms, both ends of one side of the filter screen being respectively connected with each driving mechanism, and both ends of the other side of the filter screen being respectively provided with sliders, each slider being slidably connected with the arc-shaped sliding groove on the same side.

As a further limitation of the above technical solution, the driving mechanism comprises: a rack, arranged at the side edge of the bottom surface of the delivery cover; a first transmission shaft, one end of which is rotatably connected with the side wall of the outer barrel, the other end being provided with a first transmission gear, the first transmission

gear being in meshing connection with the rack; a second transmission shaft, located below the first transmission shaft, connected with the first transmission shaft through a first synchronous belt, and, after passing through the side wall of the outer barrel via a second synchronous belt, rotatably connected with a mounting rod provided at the end of the protective cover; a third transmission shaft, connected with the second transmission shaft through a third synchronous belt, one end of the third transmission shaft being provided with a second transmission gear, the second transmission gear, after passing through the outer barrel and the inner barrel, being rotatably connected with a third transmission gear provided at the end of the filter screen.

As a further limitation of the above technical solution, a cleaning mechanism for disinfecting the protective cover is provided on the partition plate.

As a further limitation of the above technical solution, the cleaning mechanism comprises: a contact switch, arranged on the opening side wall of the outer barrel; a loop-shaped spray pipe, arranged above the inverted-trapezoidal guide barrel and connected with the inner side wall of the outer barrel; a water tank, arranged below the inverted-trapezoidal guide barrel and in communication with the loop-shaped spray pipe; an electric push rod, the fixed end of which is connected with the inner wall of the outer barrel, the movable end of the electric push rod being connected with a piston arranged inside the water tank.

As a further limitation of the above technical solution, an alarm mechanism for reminding that the collection of nuclear medicine waste is full is embedded at the bottom of the outer barrel.

As a further limitation of the above technical solution, the alarm mechanism comprises: an alarm unit, arranged on the side wall of the outer barrel; two limiting arc strips, respectively arranged on both sides of the double-port collection box, each being in contact with the bottom surface of the double-port collection box; each limiting arc strip being connected with the bottom surface inside a groove on the side wall of the outer barrel through a first pressing spring; a second pressing spring, arranged between the two limiting arc strips, one end of the second pressing spring being connected with the inner side wall of the outer barrel, the other end being provided with a pressing rod, the pressing rod being arranged in

parallel with the limiting arc strips; a rotating rod, one end of which is connected with the bottom surface of the double-port collection box, the other end being located between the alarm unit and the pressing rod, the middle part of the rotating rod being connected with the side wall of the barrel body through a rotating shaft.

As a further limitation of the above technical solution, a supporting spring is arranged below the rotating rod.

As a further limitation of the above technical solution, a sealing ring is arranged at the side edge of the delivery cover.

Beneficial Effects

1. Through the combined design of the delivery cover, protective cover, solid-liquid separation mechanism and driving mechanism, when nuclear medicine waste needs to be delivered, medical staff open the delivery cover while the driving mechanism closes the protective cover. In this way, the nuclear medicine waste stored inside the barrel body is isolated by the protective cover, preventing exposure of the nuclear medicine waste, thereby effectively safeguarding the respiratory health of operators and the safety of the working environment, preventing potential cross-contamination, avoiding the risk of radioactive pollution to surrounding areas, and meeting the strict requirements of nuclear medicine waste treatment for sealing and safety. After the delivery cover is closed, the driving mechanism drives the protective cover to turn downwards, so that the nuclear medicine waste on the protective cover enters the solid-liquid separation mechanism for classified collection.

2. Through the combined design of the inverted-trapezoidal guide barrel, loop-shaped spray pipe, piston, water tank and electric push rod, when the protective cover is closed, the electric push rod is triggered to press the piston to force water in the water tank into the loop-shaped spray pipe, and the water is then sprayed from the loop-shaped spray pipe onto the surfaces of the inverted-trapezoidal guide barrel and the protective cover. This can promptly remove residual small amounts of waste and contaminants, maintain cleanliness and hygiene inside the device, reduce the possibility of bacterial growth and accumulation of radioactive residues, lower the risk of secondary pollution, while also extending the

service life of the device, reducing the need for frequent maintenance, and improving the convenience and reliability of use.

3. The solid-liquid separation mechanism provided by the invention can perform solid-liquid separation on each delivery of nuclear medicine waste, avoiding liquid nuclear medicine waste remaining on solid nuclear medicine waste, and achieving good classification and collection results.

4. Through the combined design of the double-port collection box and the alarm mechanism, when the nuclear medicine waste inside the double-port collection box is full, the double-port collection box moves downward under the gravity of the nuclear medicine waste, thereby compressing the limiting arc strips in the alarm mechanism, which in turn causes the rotating rod to rotate and contact the alarm unit, thereby triggering the alarm unit to give an alarm, reminding medical staff to replace the waste bag in the double-port collection box. This avoids safety accidents such as leakage and overflow caused by excessive accumulation of waste, ensures the orderly progress of waste treatment work, and improves the safety and stability of the entire nuclear medicine waste management system.

5. The double-layer sleeve provided by the invention can isolate the nuclear medicine waste from the driving mechanism, preventing nuclear medicine waste from leaking from the inner wall of the double-layer sleeve.

6. The outer end of the double-port collection box provided by the invention is equipped with a shielding plate, so that during the process of the double-port collection box descending when the nuclear medicine waste inside is full, the shielding plate can cover the upper space of the double-port collection box, preventing nuclear medicine waste from leaking during the descent of the double-port collection box.

Brief Description of the Drawings

In order to more clearly illustrate the technical solutions of the embodiments of the invention or of the prior art, the drawings required for the description of the embodiments or the prior art will be briefly introduced below. It is obvious that the drawings described below

are merely some embodiments of the invention, and for those of ordinary skill in the art, other drawings can also be obtained on the basis of these drawings without creative effort.

Figure 1 is a structural schematic diagram of a collection device for safely handling nuclear medicine waste provided by an embodiment of the invention;

Figure 2 is a structural schematic diagram of the driving mechanism;

Figure 3 is an enlarged view of portion A in Figure 2;

Figure 4 is an enlarged view of portion B in Figure 2;

Figure 5 is a usage state diagram of the device shown in Figure 2;

Figure 6 is an enlarged view of portion C in Figure 5;

Figure 7 is an enlarged view of portion D in Figure 5;

Figure 8 is a sectional view at the position of the first transmission shaft in the device shown in Figure 1;

Figure 9 is an enlarged view of portion E in Figure 8;

Figure 10 is a structural schematic diagram of the alarm mechanism;

Figure 11 is a usage state diagram of the device shown in Figure 10;

Figure 12 is a sectional view at the position of the second transmission shaft in the device shown in Figure 1;

Figure 13 is a usage state diagram of the device shown in Figure 12;

Figure 14 is a structural schematic diagram of the cleaning mechanism;

Figure 15 is an enlarged view of portion F in Figure 14;

Figure 16 is a structural schematic diagram of the device shown in Figure 1 in an unused state.

In the drawings: 1 - Delivery cover, 2 - Protective cover, 21 - Mounting rod, 3 - Solid-liquid separation mechanism, 31 - Inclined guide plate, 32 - Arc-shaped sliding groove, 33 - Filter screen, 34 - Slider;

4 - Driving mechanism, 41 - Rack, 42 - First transmission shaft, 42a - First transmission gear, 43 - Second transmission shaft, 43a - First synchronous belt, 43b - Second synchronous belt, 44 - Third transmission shaft, 44a - Third synchronous belt, 44b - Second transmission gear, 44c - Third transmission gear;

5 - Double-port collection box, 51 - Shielding plate, 6 - Double-layer barrel body, 61 - Outer barrel, 62 - Inner barrel, 63 - Partition plate;

7 - Cleaning mechanism, 71 - Contact switch, 72 - Loop-shaped spray pipe, 73 - Water tank, 73a - Piston, 74 - Electric push rod;

8 - Alarm mechanism, 81 - Alarm unit, 82 - Limiting arc strip, 83 - First pressing spring, 84 - Second pressing spring, 85 - Pressing rod, 86 - Rotating rod, 86a - First rotating part, 86b - Second rotating part, 87 - Supporting spring;

9 - Inverted-trapezoidal guide barrel.

Detailed Description

In order to make the objectives, technical solutions and advantages of the embodiments of the invention clearer, the technical solutions in the embodiments of the invention will be clearly and completely described below with reference to the accompanying drawings of the embodiments of the invention.

In the description of the invention, it should be understood that the terms "upper", "lower", "front", "rear", "left", "right", "top", "bottom", "inner", "outer" and the like indicating orientation or positional relationships are based on the orientation or positional relationships shown in the drawings, and are merely for the purpose of facilitating the description of the invention and simplifying the description, rather than indicating or implying that the device or element referred to must have a specific orientation, be constructed and operated in a specific orientation, and therefore should not be understood as limiting the invention.

In addition, features defined as "first" and "second" may explicitly or implicitly include one or more of such features.

In the description of the invention, unless otherwise specified, the meaning of "plurality" is two or more.

In the description of the invention, it should be noted that unless otherwise expressly specified and defined, the terms "mounted", "connected" and "coupled" should be understood in a broad sense, for example, they may be fixed connections, detachable connections, or integrally connected; they may be mechanical connections or electrical connections; they may be directly connected, or indirectly connected through an intermediate medium, or they may be communication between the interiors of two elements. For those of ordinary skill in the art, the specific meanings of the above terms in the invention can be understood according to specific circumstances.

Embodiment 1

An embodiment of the invention provides a collection device for safely handling nuclear medicine waste, as shown in Figures 1-16, comprising a delivery cover 1, a protective cover 2, a solid-liquid separation mechanism 3, a driving mechanism 4, a double-port collection box 5, a cleaning mechanism 7, an alarm mechanism 8, an inverted-trapezoidal guide barrel 9 and a double-layer sleeve 6.

As shown in Figures 1 and 8, the double-layer sleeve 6 is a square structure with an opening, and the double-layer sleeve 6 comprises an outer barrel 61 and an inner barrel 62 located inside the outer barrel 61, wherein the inner barrel 62 is a cylindrical structure with upper and lower ends in communication.

An opening is provided at the top of the outer barrel 61, the delivery cover 1 is located at the opening of the outer barrel 61 and is slidably connected with the outer barrel 61; a handle is provided on the delivery cover 1 so that medical staff can pull the delivery cover 1 open or closed.

A horizontally arranged partition plate 63 is provided inside the double-layer sleeve 6, the inner barrel 62 is located below the partition plate 63, and the inner barrel 62 is integrally connected with the partition plate 63; a square tube is provided on the top surface of the partition plate 63, the square tube being in communication with the inner barrel 62.

The inverted-trapezoidal guide barrel 9 is located inside the outer barrel 61 and above the partition plate 63; the side of the inverted-trapezoidal guide barrel 9 is fixedly connected with the inner side wall of the outer barrel 61. Specifically, a square opening is provided on the bottom surface of the inverted-trapezoidal guide barrel 9, the square opening being in communication with the square tube on the partition plate 63.

The protective cover 2 is located at the square opening on the bottom surface of the inverted-trapezoidal guide barrel 9, and the inverted-trapezoidal guide barrel 9 is rotatably connected with the protective cover 2 through the mounting rod 21. In this way, the protective cover 2 can close or open the square tube opening on the partition plate 63. That is, when the protective cover 2 is in a horizontal state to close the square tube opening on the partition plate 63, when medical staff throw nuclear medicine waste onto the inverted-trapezoidal guide barrel 9, the nuclear medicine waste slides onto the upper side of the protective cover 2 under the guiding action of the inclined surface of the inverted-trapezoidal guide barrel 9. When the protective cover 2 turns downwards to open the square tube on the partition plate 63, the nuclear medicine waste located on the protective cover 2 falls below the partition plate 63, so that the solid-liquid separation mechanism 3 located below the partition plate 63 can classify the nuclear medicine waste.

As shown in Figure 14, the double-port collection box 5 is arranged below the solid-liquid separation mechanism 3 so as to collect the classified nuclear medicine waste. Specifically, the double-port collection box 5 is a frame-shaped structure with an opening, and a vertical partition plate is arranged inside the opening, the vertical partition plate dividing the internal space of the double-port collection box 5 into a solid collection chamber and a liquid collection chamber.

As shown in Figure 8, the solid-liquid separation mechanism 3 is located inside the inner barrel 62; the solid-liquid separation mechanism 3 comprises an inclined guide plate 31, arc-shaped sliding grooves 32 and a filter screen 33.

Specifically, the upper end of the inclined guide plate 31 is fixedly connected with the bottom surface of the partition plate 63.

The arc-shaped sliding grooves 32 are arranged on two opposite inner side surfaces of the

inner barrel 62.

Sliders 34 are symmetrically arranged at both end portions of one side of the filter screen 33; the sliders 34 are fixedly connected with the filter screen 33, and each slider 34 is limitedly arranged in the arc-shaped sliding groove 32 on the same side; the other side of the filter screen 33 is rotatably connected with the inner side wall of the inner barrel 62 through a rotating shaft, and both end portions of the rotating shaft are respectively connected with the driving mechanism 4 on the same side.

In practical application, the number of driving mechanisms 4 is two, and each driving mechanism 4 is embedded in an accommodating cavity of the side wall of the double-layer sleeve 6, and is connected with the delivery cover 1, the protective cover 2 and the solid-liquid separation mechanism 3.

The two driving mechanisms 4 have the same structure, and each driving mechanism 4 is respectively connected with the delivery cover 1, the protective cover 2 and the filter screen 33, that is, the two driving mechanisms 4 are respectively arranged on both sides of the delivery cover 1, the protective cover 2 and the filter screen 33.

Specifically, as shown in Figure 2, each driving mechanism 4 comprises: a rack 41, a first transmission shaft 42, a second transmission shaft 43 and a third transmission shaft 44.

The rack 41 is arranged on the bottom surface of the delivery cover 1 and located at the side edge of the delivery cover 1;

The first transmission shaft 42 is embedded in an accommodating cavity of the inner side wall of the double-layer sleeve 6, one end of the first transmission shaft 42 being provided with a first transmission gear 42a, the first transmission gear 42a being in meshing connection with the rack 41, and the other end being rotatably connected with the inner side wall of the double-layer sleeve 6;

The second transmission shaft 43 is located below the first transmission shaft 42; the second transmission shaft 43 is connected with the first transmission shaft 42 through a first synchronous belt 43a, and after passing through the outer barrel 61 via a second synchronous belt 43b, is connected with the mounting rod 21;

The third transmission shaft 44 is located below the second transmission shaft 43; the third transmission shaft 44 is connected with the second transmission shaft 43 through a third synchronous belt 44a, and one end of the third transmission shaft 44 close to the outer side is provided with a second transmission gear 44b. After passing through the side walls of the outer barrel 61 and the inner barrel 62, the second transmission gear 44b is in meshing connection with a third transmission gear 44c provided at the end of the rotating shaft of the filter screen 33.

It should be noted that the inner side surfaces of the first synchronous belt 43a, the second synchronous belt 43b and the third synchronous belt 44a are all provided with grooves engaged with the transmission gears.

The working principle of the driving mechanism 4 provided in the embodiment of the invention is as follows:

After medical staff pull open the delivery cover 1, the rack 41 on the bottom surface of the delivery cover 1 engages with the first transmission gear 42a, thereby driving the first transmission shaft 42 to rotate. The first transmission shaft 42 drives the second transmission shaft 43 to rotate through the first synchronous belt 43a, and then the second transmission shaft 43 drives the mounting rod 21 to rotate upwards through the second synchronous belt 43b, so that the protective cover 2 is in a horizontal state to close the square tube opening on the partition plate 63, preventing nuclear medicine waste in the double-port collection box 5 from leaking. At the same time, the second transmission shaft 43 drives the third transmission shaft 44 to rotate through the third synchronous belt 44a, and then the second transmission gear 44b at the end of the third transmission shaft 44 drives the third transmission gear 44c to rotate, so that the movable end of the filter screen 33 rotates downwards, allowing the solid nuclear medicine waste retained on the filter screen 33 from the previous delivery to slide into the solid collection chamber of the double-port collection box 5.

After medical staff place nuclear medicine waste onto the protective cover 2 and then close the delivery cover 1, the first transmission gear 42a rotates in the reverse direction under the drive of the rack 41, thereby driving the first transmission shaft 42 to rotate in the

reverse direction. The first transmission shaft 42 drives the second transmission shaft 43 to rotate in the reverse direction through the first synchronous belt 43a, and then the second transmission shaft 43 drives the mounting rod 21 to rotate downwards through the second synchronous belt 43b, so that the protective cover 2 returns to its initial position in a vertical state, allowing the nuclear medicine waste on the protective cover 2 to fall into the square tube on the partition plate 63 and then enter the inner barrel 62.

At the same time, the second transmission shaft 43 drives the third transmission shaft 44 to rotate in the reverse direction through the third synchronous belt 44a, and then the second transmission gear 44b at the end of the third transmission shaft 44 drives the third transmission gear 44c to rotate in the reverse direction, so that the movable end of the filter screen 33 rotates upwards, thereby performing solid-liquid separation on the nuclear medicine waste falling into the inner barrel 62. That is, liquid nuclear medicine waste passes through the filter screen 33 into the liquid collection chamber of the double-port collection box 5, while solid nuclear medicine waste remains on the filter screen 33. In this way, when medical staff next open the delivery cover 1, the filter screen 33 turns downwards under the action of the driving mechanism 4, so that the solid nuclear medicine waste retained on the filter screen 33 slides into the solid collection chamber of the double-port collection box 5.

As shown in Figures 8, 14 and 15, the cleaning mechanism 7 comprises a contact switch 71, a loop-shaped spray pipe 72, a water tank 73 and an electric push rod 74; wherein the contact switch 71 is electrically connected with the electric push rod 74, and the contact switch 71 is arranged on the opening side surface of the outer barrel 61.

The water tank 73 is arranged on the partition plate 63, the water tank 73 being a square structure with an opening on its side surface, and a piston 73a is arranged inside the opening of the water tank 73. The outer side surface of the piston 73a is fixedly connected with the movable end of the electric push rod 74, and the fixed end of the electric push rod 74 is fixedly connected with the inner side wall of the outer barrel 61. Specifically, the water tank 73 is provided with a water outlet, the water outlet being in communication with the loop-shaped spray pipe 72 through a water pipe.

The loop-shaped spray pipe 72 is arranged above the inverted-trapezoidal guide barrel 9 and is fixedly connected with the inner side wall of the outer barrel 61, wherein a plurality of water outlets arranged at equal intervals are provided on the loop-shaped spray pipe 72.

The working principle of the cleaning mechanism 7 provided in the embodiment of the invention is as follows:

When medical staff pull the delivery cover 1 so that the opening of the outer barrel 61 is closed, the side surface of the delivery cover 1 presses the contact switch 71, thereby triggering the movable end of the electric push rod 74 to extend, thus pressing the piston 73a, causing the piston 73a to move into the interior of the water tank 73, and further causing the water in the water tank 73 to be sprayed through the loop-shaped spray pipe 72 onto the surface of the inverted-trapezoidal guide barrel 9, thereby realising cleaning of the surface of the inverted-trapezoidal guide barrel 9, maintaining cleanliness and hygiene inside the device, reducing the possibility of bacterial growth and accumulation of radioactive residues, and lowering the risk of secondary pollution.

In actual use, by adjusting the movable end of the electric push rod 74, namely the extension speed and time of the push rod of the electric push rod 74, the washing duration and the water output can be regulated.

In order to reduce the number of times medical staff need to check whether the nuclear medicine waste in the double-port collection box 5 has been fully collected, as shown in Figures 9, 10, 11 and 14, the alarm mechanism 8 comprises an alarm unit 81, limiting arc strips 82, first pressing springs 83, a second pressing spring 84, a pressing rod 85, a rotating rod 86 and a supporting spring 87; wherein the number of limiting arc strips 82 and first pressing springs 83 is two.

In actual use, two grooves are respectively provided at the lower ends of the two opposite inner side walls of the outer barrel 61, the bottom surface inside each groove being connected with one first pressing spring 83, and the end of each first pressing spring 83 away from the bottom surface inside the groove being connected with one limiting arc strip 82. In this way, a part of each limiting arc strip 82 is located inside the groove, and another part is located outside the groove, and the portion of the limiting arc strip 82 located outside

the groove is in contact with the bottom surface of the double-port collection box 5.

The pressing rod 85 is horizontally arranged below the double-port collection box 5 and located between the two limiting arc strips 82; wherein one end of the pressing rod 85 is connected with the second pressing spring 84, and the end of the second pressing spring 84 away from the pressing rod 85 is fixedly connected with the inner side wall of the double-layer sleeve 6.

Correspondingly, a through hole is provided below the side wall of the double-layer sleeve 6, and the alarm unit 81 is embedded in the through hole.

The rotating rod 86 comprises a first rotating part 86a and a second rotating part 86b.

The first rotating part 86a is an L-shaped structure arranged vertically, the upper end of the first rotating part 86a abutting against the bottom surface of the double-port collection box 5, and the lower end of the first rotating part 86a being rotatably connected with the second rotating part 86b; specifically, the lower side of the first rotating part 86a is connected with the supporting spring 87, the lower end of the supporting spring 87 being fixedly arranged on the inner bottom surface of the outer barrel 61.

The second rotating part 86b is a rod-shaped structure, the end of the second rotating part 86b away from the first rotating part 86a being located between the alarm unit 81 and the movable end of the pressing rod 85, and the middle portion of the second rotating part 86b being rotatably connected with the inner side wall of the outer barrel 61 through a rotating shaft.

In the initial state, the supporting spring 87 is in its natural state, providing supporting force to the first rotating part 86a, so that the first rotating part 86a is in a horizontal state. The end of the second rotating part 86b away from the first rotating part 86a is located between the alarm unit 81 and the movable end of the pressing rod 85, and the rotating rod 86 abuts against the movable end of the pressing rod 85. At this time, the rotating rod 86 presses the second pressing spring 84 through the pressing rod 85, and the second pressing spring 84 is in a compressed state.

In this way, when the nuclear medicine waste collected inside the double-port collection

box 5 is full, the double-port collection box 5, under the action of the gravity of the nuclear medicine waste, presses down the limiting arc strips 82 located on both sides thereof, until the double-port collection box 5 completely presses the limiting arc strips 82 into the grooves of the inner side wall of the outer barrel 61, at which time the first pressing springs 83 are compressed.

When the double-port collection box 5 moves downwards, it simultaneously presses the end of the first rotating part 86a away from the second rotating part 86b, causing the end of the first rotating part 86a close to the second rotating part 86b to tilt upwards and disengage from between the alarm unit 81 and the movable end of the pressing rod 85. As a result, the second pressing spring 84 is no longer compressed by the rotating rod 86 and returns to its natural state, thereby causing the pressing rod 85 connected with the second pressing spring 84 to move forward to contact the alarm unit 81, thus triggering the alarm unit 81 to give an alarm, reminding medical staff to replace the waste bag inside the double-port collection box 5.

After replacing the waste bag, medical staff can lift the double-port collection box 5 upwards, thereby restoring the double-port collection box 5 to its initial position. At this time, the limiting arc strips 82 are no longer pressed by the side walls of the double-port collection box 5 and return to their initial positions, so that the double-port collection box 5 is limitedly positioned above the two limiting arc strips 82.

It should be noted that the alarm unit 81 provided in the embodiment of the invention is prior art, and the embodiment of the invention does not make improvements thereto. For example, the alarm unit 81 may be a buzzer.

In practical application, as shown in Figure 14, a shielding plate 51 is further provided at the upper end of the double-port collection box 5, so that during the downward movement of the double-port collection box 5, the shielding plate 51 can cover the gap between the double-port collection box 5 and the outer barrel 61, preventing nuclear medicine waste inside from leaking.

The specific usage process is as follows:

Step 1: Medical staff open the delivery cover 1. At this time, the rack 41 on the bottom

surface of the delivery cover 1 engages with the first transmission gear 42a, thereby driving the first transmission shaft 42 to rotate. The first transmission shaft 42 drives the second transmission shaft 43 to rotate through the first synchronous belt 43a, and then the second transmission shaft 43 drives the mounting rod 21 to rotate upwards through the second synchronous belt 43b, so that the protective cover 2 is in a horizontal state to close the square tube opening on the partition plate 61.

At the same time, the second transmission shaft 43 drives the third transmission shaft 44 to rotate through the third synchronous belt 44a, and then the second transmission gear 44b at the end of the third transmission shaft 44 drives the third transmission gear 44c to rotate, so that the movable end of the filter screen 33 rotates downwards, allowing the nuclear medicine waste retained on the filter screen 33 from the previous delivery to slide into the solid collection chamber of the double-port collection box 5.

Step 2: Medical staff place nuclear medicine waste into the inverted-trapezoidal guide barrel 9, and the nuclear medicine waste then slides along the inclined surface of the inverted-trapezoidal guide barrel 9 onto the upper side of the protective cover 2.

Step 3: Medical staff close the delivery cover 1. At this time, the side surface of the delivery cover 1 presses the contact switch 71, thereby triggering the movable end of the electric push rod 74 to extend, thus pressing the piston 73a, causing the piston 73a to move into the interior of the water tank 73, and further causing the water in the water tank 73 to be sprayed through the loop-shaped spray pipe 72 onto the surface of the inverted-trapezoidal guide barrel 9, thereby realising cleaning of the inverted-trapezoidal guide barrel 9.

At the same time, the first transmission gear 42a rotates in the reverse direction under the drive of the rack 41, thereby driving the first transmission shaft 42 to rotate in the reverse direction. The first transmission shaft 42 drives the second transmission shaft 43 to rotate in the reverse direction through the first synchronous belt 43a, and then the second transmission shaft 43 drives the mounting rod 21 to rotate downwards through the second synchronous belt 43b, so that the protective cover 2 returns to its initial position in a vertical state, allowing the nuclear medicine waste on the protective cover 2 to fall into the square tube on the partition plate 63. Moreover, the second transmission shaft 43 drives the third

transmission shaft 44 to rotate in the reverse direction through the third synchronous belt 44a, and then the second transmission gear 44b at the end of the third transmission shaft 44 drives the third transmission gear 44c to rotate in the reverse direction, so that the movable end of the filter screen 33 rotates upwards, thereby performing solid-liquid separation on the nuclear medicine waste falling into the inner barrel 61. At this time, the liquid nuclear medicine waste drips from the filter screen 33 into the liquid collection chamber of the double-port collection box 5, while the solid nuclear medicine waste remains on the filter screen 33, so that when medical staff next open the delivery cover 1, the filter screen 33 turns downwards under the action of the driving mechanism 4, thereby allowing the solid nuclear medicine waste retained on the filter screen 33 to slide into the solid collection chamber of the double-port collection box 5.

The contents not described in detail in this specification belong to the prior art known to those skilled in the art.