STAGE DEVICE AND SEMICONDUCTOR PROCESS APPARATUS

TECHNICAL FIELD

[0001] The present disclosure relates to the technical field of semiconductor apparatuses, and in particular to a stage device and a semiconductor process apparatus.

BACKGROUND

[0002] In a process of manufacturing semiconductors, a semiconductor process apparatus, especially a vertical heat treatment apparatus, generally employs a front opening unified pod (FOUP) as a container for storing wafers. In order for the wafers to be cleanly transferred from the FOUP into a loading-unloading chamber, or from the loading-unloading chamber into the FOUP, the FOUP is generally driven to move by a stage device, so that an opening of the FOUP is hermetically attached to a transfer port of the loading-unloading chamber.

[0003] There are two processes for the opening of the FOUP to be hermetically attached to the transfer port of the loading-unloading chamber. First, the FOUP is transferred to the stage device, and the stage device drives the FOUP to move in an initial stage, so that the opening of the FOUP is connected to the transfer port of the loading-unloading chamber. Then, the FOUP is finally clamped at the transfer port of the loading-unloading chamber by a sealing-clamping mechanism.

[0004] However, after the stage device drives the FOUP to move in the initial stage, so that the opening of the FOUP is connected to the transfer port of the loading-unloading chamber, the stage device does not move any more. Since the FOUP is fixedly connected to the stage device, after finally clamped by the sealing-clamping mechanism, the FOUP cannot move closer to the loading-unloading chamber under the restriction of the stage device. In consequence, insufficient clamping between the FOUP and the transfer port of the loading-unloading chamber is caused, which is likely to lead to a clamping and sealing failure between the FOUP and the transfer port, and the wafers are damaged by particles diffused into the FOUP.

SUMMARY

[0005] The present disclosure discloses a stage device and a semiconductor process apparatus, so as to solve the problem that when a stage device drives an opening of a front opening unified pod to

be connected to a transfer port of a loading-unloading chamber in the related art, insufficient sealing between the opening of the front opening unified pod and the transfer port of the loading-unloading chamber is likely to be caused.

[0006] To solve the above technical problem, the present disclosure is implemented as follows:

[0007] In a first aspect, the present disclosure discloses a stage device. The stage device is configured to bear and drive a front opening unified pod to move outside a loading-unloading chamber of a semiconductor process apparatus in a first direction, so as to cause an opening of the front opening unified pod to be connected to a transfer port of the loading-unloading chamber, where the stage device includes a stage support, a bearing portion, a driving mechanism, and a buffer mechanism;

[0008] the driving mechanism is arranged on the stage support, and the bearing portion is movably arranged on the stage support in the first direction, and is configured to support the front opening unified pod;

[0009] the driving mechanism is connected to the bearing portion through the buffer mechanism, and configured to drive the bearing portion to move in the first direction through the buffer mechanism; and

[0010] in a case that the driving mechanism drives the bearing portion to move to a connection location in the first direction through the buffer mechanism, the bearing portion continues moving by a preset buffer distance in the first direction under a buffer action of the buffer mechanism.

[0011] In a second aspect, the present disclosure further discloses a semiconductor process apparatus. The disclosed semiconductor process apparatus includes a loading-unloading chamber and the stage device in the first aspect. The stage device is configured to bear and drive a front opening unified pod to move outside the loading-unloading chamber in a first direction, so as to cause an opening of the front opening unified pod to be connected to a transfer port of the loading-unloading chamber.

[0012] The technical solutions employed by the present disclosure can achieve the following technical effects.

[0013] According to the stage device disclosed in embodiments of the present disclosure, the buffer mechanism is arranged, so that the driving mechanism drives the bearing portion to move in the first direction through the buffer mechanism, and the front opening unified pod moves to a location where the opening of the front opening unified pod is connected to the transfer port of

the loading-unloading chamber. The buffer mechanism has the preset buffer distance in the first direction, and the bearing portion continues moving by the preset buffer distance in the first direction under the buffer action of the buffer mechanism. Thus, when the opening of the front opening unified pod is pressed against the transfer port of the loading-unloading chamber through a sealing-clamping mechanism or another mechanism, the opening of the front opening unified pod can move closer to the transfer port of the loading-unloading chamber, good sealing between the opening of the front opening unified pod and the transfer port of the loading-unloading chamber can be achieved, and damage to a wafer caused by external particles diffused into the front opening unified pod can be avoided.

BRIEF DESCRIPTION OF DRAWINGS

[0014] FIG. 1 is a schematic structural diagram of a stage device disclosed in an embodiment of the present disclosure;

[0015] FIG. 2 is a schematic enlarged view of a part of a buffer mechanism disclosed in an embodiment of the present disclosure;

[0016] FIG. 3 is an axial side view of a stage device disclosed in an embodiment of the present disclosure;

[0017] FIG. 4 is a schematic diagram of FIG. 3 with a bearing portion hidden;

[0018] FIG. 5 is a schematic diagram of FIG. 3 in another view; and

[0019] FIG. 6 is a schematic diagram of a stage device bearing a front opening unified pod hermetically connected to a loading-unloading chamber disclosed in an embodiment of the present disclosure.

[0020] Reference numerals:

[0021] 100-stage support, 110-elongated avoiding hole,

[0022] 200-bearing portion,

[0023] 300-driving mechanism, 310-driving body, 320-driving rod,

[0024] 400-buffer mechanism, 410-base, 411-elongated limiting hole, 420-movable member, 430-anti-disengagement pin,

[0025] 510-first slide rail, 520-first slide block

[0026] 610-mounting bracket, 620-transition rod, 630-flexible connector,

[0027] 710-second slide rail, 720-second slide block,

[0028] 810-limiting member, 820-adjustable positioning pin, 830-fixed positioning pin, 840-presence sensor,

[0029] 910-front opening unified pod, 920-loading-unloading chamber, and 930-sealing-clamping mechanism.

DETAILED DESCRIPTION

[0030] To make the objectives, technical solutions, and advantages of the present disclosure clearer, the technical solutions of the present disclosure are clearly and completely described below with reference to particular embodiments of the present disclosure and the corresponding accompanying drawings. Apparently, the embodiments described are merely some embodiments rather than all embodiments of the present disclosure. All other embodiments derived by those of ordinary skill in the art based on the embodiments of the present disclosure without creative efforts fall within the scope of protection of the present disclosure.

[0031] The technical solutions disclosed in the embodiments of the present disclosure are described in detail with reference to the accompanying drawings below.

[0032] With reference to FIG. 1 to FIG. 6, the embodiments of the present disclosure disclose a stage device. The disclosed stage device is configured to bear and drive a front opening unified pod 910 to move outside a loading-unloading chamber 920 of a semiconductor process apparatus in a first direction, so as to cause an opening of the front opening unified pod 910 to be connected to a transfer port of the loading-unloading chamber 920.

[0033] The disclosed stage device includes a stage support 100, a bearing portion 200, a driving mechanism 300, and a buffer mechanism 400. The stage support 100 may be mounted on a chamber wall of the loading-unloading chamber 920. Certainly, the stage support 100 may alternatively be mounted on another component. A mounting location of the stage support 100 is not specifically limited in the embodiments of the present disclosure.

[0034] The driving mechanism 300 is arranged on the stage support 100, and the bearing portion 200 is movably arranged on the stage support 100 in the first direction, and is configured to support the front opening unified pod 910.

[0035] The driving mechanism 300 is connected to the bearing portion 200 through the buffer mechanism 400, and configured to drive the bearing portion 200 to move in the first direction through the buffer mechanism 400.

[0036] In a case that the driving mechanism 300 drives the bearing portion 200 to move to a connection location in the first direction through the buffer mechanism 400, the bearing portion 200 continues moving by a preset buffer distance in the first direction under a buffer action of the buffer mechanism 400.

[0037] In a specific implementation process, first, the front opening unified pod 910 is placed on the bearing portion 200, and the driving mechanism 300 drives the bearing portion 200 to move in the first direction through the buffer mechanism 400, so that the front opening unified pod moves to a location (i.e. the connection location herein) where the opening of the front opening unified pod 910 is connected to the transfer port of the loading-unloading chamber 920. Then, the opening of the front opening unified pod 910 is pressed against the transfer port of the loading-unloading chamber 920 through a sealing-clamping mechanism 930 or another mechanism. In the process, since the buffer mechanism 400 has the preset buffer distance in the first direction, the bearing portion 200 may drive the opening of the front opening unified pod 910 to be further attached to the transfer port of the loading-unloading chamber 920. Thus, good sealing between the opening of the front opening unified pod 910 and the transfer port of the loading-unloading chamber 920 can be achieved.

[0038] According to the stage device disclosed in the embodiments of the present disclosure, the buffer mechanism 400 is arranged, so that the driving mechanism 300 drives the bearing portion 200 to move in the first direction through the buffer mechanism 400, and the front opening unified pod 910 moves to the location where the opening of the front opening unified pod 910 is connected to the transfer port of the loading-unloading chamber 920. The buffer mechanism 400 has the preset buffer distance in the first direction, and the bearing portion 200 may continue moving by the preset buffer distance in the first direction under the buffer action of the buffer mechanism 400. Thus, when the opening of the front opening unified pod 910 is pressed against the transfer port of the loading-unloading chamber 920 through the sealing-clamping mechanism 930 or another mechanism, the opening of the front opening unified pod 910 can move closer to the transfer port of the loading-unloading chamber, good sealing between the opening of the front opening unified pod 910 and the transfer port of the loading-unloading chamber can be achieved, and damage to a wafer caused by external particles diffused into the front opening unified pod 910 can be avoided.

[0039] It should be noted that when the opening of the front opening unified pod 910 is pressed against the transfer port of the loading-unloading chamber through the sealing-clamping

mechanism 930, a distance by which the front opening unified pod 910 needs to move is generally 2 mm. Thus, the preset buffer distance may be greater than 2 mm. For example, the preset buffer distance may be 3 mm, 3.5 mm, etc.

[0040] Specifically, the buffer mechanism 400 may be an elastic member, and the elastic member may be in a stretched state when the driving mechanism 300 drives the bearing portion 200 to move in the first direction through the buffer mechanism 400. In a case that the driving mechanism 300 drives the bearing portion 200 to move to the connection location in the first direction through the buffer mechanism 400, since the elastic member still has a certain elastic stretch deformation amount (i.e. the preset buffer distance), the bearing portion 200 may continue moving by the preset buffer distance in the first direction.

[0041] According to the stage device disclosed in the embodiments of the present disclosure, the buffer mechanism 400 is configured as the elastic member, so that a structure of the buffer mechanism 400 is relatively simple.

[0042] In another implementation, the buffer mechanism 400 may include a base 410 and a movable member 420. The movable member 420 is movably arranged on the base 410 in the first direction. The base 410 may be sequentially provided with a first limiting portion and a second limiting portion in the first direction. The driving mechanism 300 may be connected to the movable member 420, and the bearing portion 200 may be connected to the base 410. In a case that the driving mechanism 300 drives the base 410 to move through limiting contact between the movable member 420 and the second limiting portion, so as to cause the base 410 to drive the bearing portion 200 to move to the connection location in the first direction, the bearing portion 200 may continue moving by the preset buffer distance in the first direction along with the base 410 relative to the movable member 420, where a movement stroke length of the movable member 420 between the first limiting portion and the second limiting portion is the preset buffer distance.

[0043] According to the stage device disclosed in the embodiments of the present disclosure, the buffer mechanism 400 is configured to be of a structure including the base 410 and the movable member 420, so that the base 410 can drive the bearing portion 200 to move more stably, the first limiting portion and the second limiting portion can better limit a movement range of the movable member 420, and disengagement of the movable member 420 caused by unlimited movement can be avoided.

[0044] In a case that the opening of the front opening unified pod 910 is separated from the transfer port of the loading-unloading chamber 920, the bearing portion 200 may first drive the front opening unified pod 910 to move by the preset buffer distance in a second direction, and then drive the base 410 to drive the front opening unified pod 910 to continue moving in the second direction under the action of limiting contact between the movable member 420 and the second limiting portion, so that the opening of the front opening unified pod 910 is separated from the transfer port of the loading-unloading chamber 920, where the second direction is opposite to the first direction.

[0045] In some embodiments, the base 410 may be provided with an elongated limiting hole 411 extending in the first direction. The movable member 420 may be arranged in the elongated limiting hole 411 in a penetrating manner, and is slidable in the elongated limiting hole 411 in the first direction. Two opposite side walls of the elongated limiting hole 411 in the first direction may be the first limiting portion and the second limiting portion respectively.

[0046] According to the stage device disclosed in the embodiments of the present disclosure, the base 410 is provided with the elongated limiting hole 411 extending in the first direction, and the movable member 420 may be arranged in the elongated limiting hole 411 in the penetrating manner, and is slidable in the elongated limiting hole 411 in the first direction. Thus, movement of the movable member 420 is more stable under a limiting action of the elongated limiting hole 411. Moreover, the elongated limiting hole 411 may guide the movement of the movable member 420, so that the movement of the movable member 420 is more accurate.

[0047] To prevent the movable member 420 from escaping out of the elongated limiting hole 411 during the movement, in some embodiments, the buffer mechanism 400 may further include anti-disengagement pins 430. Two ends of the movable member 420 may extend out of the elongated limiting hole 411 to be connected to the anti-disengagement pins 430 respectively. The anti-disengagement pins 430 are configured to be in limiting fit with an opening of the elongated limiting hole 411, so that the movable member 420 can be prevented from escaping out of the elongated limiting hole 411 during the movement.

[0048] For lightweight design of the stage device, in some embodiments, the base 410 may be provided with an inner cavity, and the elongated limiting hole 411 communicates with the inner cavity. The driving mechanism 300 may include a driving body 310 and a driving rod 320. The driving body 310 may be arranged on the stage support 100, a first end of the driving rod 320 may be

connected to the driving body 310, and a second end of the driving rod 320 may extend into the inner cavity to be connected to the movable member 420.

[0049] According to the stage device disclosed in the embodiments of the present disclosure, the base 410 is configured to be of a hollow structure, so that weight reduction of the base 410 is facilitated, and the lightweight design of the stage device is further facilitated.

[0050] To make the driving mechanism 300 drive the base 410 to move more stably through the movable member 420, in some embodiments, the stage device may further include a first slide rail 510 and a first slide block 520. The first slide rail 510 may be arranged on the stage support 100, and may extend in the first direction. The first slide block 520 is slidably arranged on the first slide rail 510, and the base 410 is connected to the first slide block 520.

[0051] According to the stage device disclosed in the embodiments of the present disclosure, the first slide rail 510 and the first slide block 520 are arranged, and the base 410 is connected to the first slide block 520. Thus, the driving mechanism 300 drives the base 410 to move more stably through the movable member 420, and the base drives the bearing portion 200 and the front opening unified pod 910 to move more stably.

[0052] Specifically, the bearing portion 200 may be located above the stage support 100, and the buffer mechanism 400 and the driving mechanism 300 may be located below the stage support 100; and the stage device may further include a mounting bracket 610, and the base 410 is connected to the bearing portion 200 through the mounting bracket 610.

[0053] According to the stage device disclosed in the embodiments of the present disclosure, the bearing portion 200 is arranged above the stage support 100, and the buffer mechanism 400 and the driving mechanism 300 are arranged below the stage support 100, so that excessive occupation of a space on the same side of the stage support 100 is avoided.

[0054] In some embodiments, the stage support 100 may be provided with an elongated avoiding hole 110, and the elongated avoiding hole 110 may extend in the first direction. One end of the mounting bracket 610 may be connected to the base 410, the other end of the mounting bracket 610 may penetrate the elongated avoiding hole 110 to be connected to the bearing portion 200, and the mounting bracket 610 may move in the elongated avoiding hole 110 in the first direction. By forming the elongated avoiding hole 110 in the stage support 100, the elongated avoiding hole 110 can guide the mounting bracket 610. Moreover, a large occupied space caused by the mounting bracket 610 and the stage support 100 that are arranged in parallel can be avoided.

[0055] To avoid the situation that the bearing portion 200 and the base 410 are stuck under binding stress during movement, in some embodiments, the stage device may further include a transition rod 620 and a flexible connector 630. The transition rod 620 is connected to the base 410, and the flexible connector 630 may be connected between the transition rod 620 and the mounting bracket 610. It should be noted that the base 410 is indirectly connected to the mounting bracket 610 through the transition rod 620 and the flexible connector 630.

[0056] According to the stage device disclosed in the embodiments of the present disclosure, the flexible connector 630 is arranged, and the flexible connector 630 is connected between the transition rod 620 and the mounting bracket 610. Through the flexibility characteristics of the flexible connector 630, the binding stress between the bearing portion 200 and the base 410 caused by unparallel movement trajectories can be buffered.

[0057] To make the movement of the bearing portion 200 more stable, in some embodiments, the stage device may further include second slide rails 710 and second slide blocks 720. The second slide rails 710 may extend in the first direction, the second slide blocks 720 are slidably arranged on the second slide rails 710, and the bearing portion 200 may be connected to the second slide blocks 720.

[0058] According to the stage device disclosed in the embodiments of the present disclosure, the second slide rails 710 and the second slide blocks 720 are arranged. The second slide blocks 720 are slidably arranged on the second slide rails 710, and the bearing portion 200 is connected with the second slide blocks 720, so that the movement of the bearing portion 200 is more stable.

[0059] Further, the stage device may include at least two second slide rails 710 and at least two second slide blocks 720. At least two second slide rails 710 may be spaced from each other in a direction perpendicular to the first direction, at least two second slide blocks 720 may match at least two second slide rails 710 in a one-to-one correspondence manner, and the two ends of the bearing portion 200 may be connected to at least two second slide blocks 720 respectively. Thus, stability of the bearing portion 200 during the movement can be further improved.

[0060] To avoid the unlimited movement of the bearing portion 200 in a process that the stage device drives the front opening unified pod 910 to be separated from the transfer port of the loading-unloading chamber 920, in some embodiments, the stage device may further include a limiting member 810. The limiting member 810 may be arranged on the stage support 100, and configured to stop the bearing portion 200 at a preset stop location when the bearing portion

200 drives the front opening unified pod 910 to move in a direction (i.e. the second direction) in which the opening of the front opening unified pod 910 is separated from the transfer port of the loading-unloading chamber 920. When the bearing portion 200 moves to the preset stop location, the opening of the front opening unified pod 910 is separated from the transfer port of the loading-unloading chamber 920. Thus, the unlimited movement of the bearing portion 200 when the bearing portion 200 drives the front opening unified pod 910 to move in the direction in which the opening of the front opening unified pod 910 is separated from the transfer port of the loading-unloading chamber 920 can be avoided.

[0061] Specifically, the limiting member 810 may make direct contact with the bearing portion 200 to stop the bearing portion 200 at the preset stop location. Certainly, in the embodiment that the stage support 100 is provided with the elongated avoiding hole 110 and the base 410 is connected to the bearing portion 200 through the mounting bracket 610, the limiting member 810 may be in limiting contact with the mounting bracket 610, so as to indirectly stop the bearing portion 200 at the preset stop location through the mounting bracket 610.

[0062] When the front opening unified pod 910 is borne by the bearing portion 200, the front opening unified pod 910 is connected to the bearing portion through a positioning pin. To adjust parallelism between the opening of the front opening unified pod 910 and the transfer port of the loading-unloading chamber 920 in a case that the opening of the front opening unified pod 910 is connected to the transfer port of the loading-unloading chamber 920, in some embodiments, the stage device may further include an adjustable positioning pin 820. In a case that the front opening unified pod 910 is borne by the bearing portion 200, the front opening unified pod 910 may be connected to the bearing portion 200 through the adjustable positioning pin 820. The adjustable positioning pin 820 is configured to adjust levelness of the front opening unified pod 910. Further, in a case that the opening of the front opening unified pod 910 is connected to the transfer port of the loading-unloading chamber 920, the parallelism between the opening of the front opening unified pod 910 and the transfer port of the loading-unloading chamber 920 may be adjusted. Thus, better sealing connection between the opening of the front opening unified pod 910 and the transfer port of the loading-unloading chamber 920 is facilitated.

[0063] Further, the stage device may further include a fixed positioning pin 830. In a case that the front opening unified pod 910 is borne by the bearing portion 200, the front opening unified pod 910 may be connected to the bearing portion 200 through the fixed positioning pin 830 and the

adjustable positioning pin 820. Thus, the front opening unified pod 910 is connected to the bearing portion through cooperation of the fixed positioning pin 830 and the adjustable positioning pin 820.

[0064] In some embodiments, the stage device may further include a presence sensor 840. The presence sensor 840 may be configured to detect whether the front opening unified pod 910 is located on the bearing portion 200. In a case of confirming that the front opening unified pod 910 is placed on the bearing portion 200, the bearing portion 200 is driven by the driving mechanism 300 to drive the front opening unified pod 910 to move, and thus intelligent design of the stage device is facilitated.

[0065] To make it convenient for a transfer device (such as a manipulator) to transfer the front opening unified pod 910, in some embodiments, a first hollow zone having an opening may be delimited by the stage support 100, and a second hollow zone having an opening may be delimited by the bearing portion 200. The bearing portion 200 may be stacked above the stage support 100. The first hollow zone may be opposite the second hollow zone, and the opening of the first hollow zone and the opening of the second hollow zone may be oriented in the same direction. The bearing portion 200 may be configured to support an edge of the front opening unified pod 910.

[0066] According to the stage device disclosed in the embodiments of the present disclosure, the stage support 100 and the bearing portion 200 are each configured to be of a structure having the hollow zone, and provided with the opening communicating with the hollow zone, so that the bearing portion 200 supports the edge of the front opening unified pod. Thus, the transfer device enters from the openings, and lifts the front opening unified pod 910 from a bottom of the front opening unified pod, so as to transfer the front opening unified pod 910.

[0067] The present disclosure further discloses a semiconductor process apparatus. The disclosed semiconductor process apparatus includes a loading-unloading chamber 920 and the stage device disclosed in the above embodiments. The stage device is configured to bear and drive a front opening unified pod 910 to move outside the loading-unloading chamber 920 in a first direction, so as to cause an opening of the front opening unified pod 910 to be connected to a transfer port of the loading-unloading chamber 920.

[0068] The semiconductor process apparatus disclosed in the embodiments of the present disclosure is provided with the stage device disclosed in the above embodiments. In a case that the stage device drives the front opening unified pod 910 to cause the front opening unified pod 910 to be connected to the transfer port of the loading-unloading chamber 920, good sealing between the

opening of the front opening unified pod 910 and the transfer port of the loading-unloading chamber 920 can be achieved, and damage to a wafer caused by external particles diffused into the front opening unified pod can be avoided.

[0069] In some embodiments, the semiconductor process apparatus may further include a sealing-clamping mechanism 930. The sealing-clamping mechanism 930 may be arranged on the loading-unloading chamber 920, and configured to press the opening of the front opening unified pod 910 against the transfer port.

[0070] Specifically, in a specific implementation process, first, the front opening unified pod 910 is placed on a bearing portion 200, and a driving mechanism 300 drives the bearing portion 200 to move in a first direction through a buffer mechanism 400, so that the front opening unified pod moves to a location where the opening of the front opening unified pod 910 is connected to the transfer port of the loading-unloading chamber 920. Then, when the opening of the front opening unified pod 910 is pressed against the transfer port of the loading-unloading chamber 920 through the sealing-clamping mechanism 930, since the buffer mechanism 400 has a preset buffer distance in the first direction, the bearing portion 200 may drive the opening of the front opening unified pod 910 to be further attached to the transfer port of the loading-unloading chamber 920. Thus, good sealing between the opening of the front opening unified pod 910 and the transfer port of the loading-unloading chamber 920 can be achieved.

[0071] The above embodiments of the present disclosure emphatically describe differences between the embodiments, and different optimization features between the embodiments can be combined to form more optimal embodiments as long as they are not contradictory, which will not be repeated herein for brevity.

[0072] The embodiments of the present disclosure are described above with reference to the accompanying drawings, but the present disclosure is not limited to the above particular implementations. The above particular implementations are merely illustrative rather than restrictive. Under the inspiration of the present disclosure, those of ordinary skill in the art can still make various variations without departing from the spirit of the present disclosure and the scope of protection of the claims, and such variations fall within the scope of protection of the present disclosure.

Claims

1. A stage device, configured to bear and drive a front opening unified pod to move outside a loading-unloading chamber of a semiconductor process apparatus in a first direction, so as to cause an opening of the front opening unified pod to be connected to a transfer port of the loading-unloading chamber, wherein the stage device comprises a stage support, a bearing portion, a driving mechanism, and a buffer mechanism;

the driving mechanism is arranged on the stage support, and the bearing portion is movably arranged on the stage support in the first direction, and is configured to support the front opening unified pod;

the driving mechanism is connected to the bearing portion through the buffer mechanism, and configured to drive the bearing portion to move in the first direction through the buffer mechanism; and

in a case that the driving mechanism drives the bearing portion to move to a connection location in the first direction through the buffer mechanism, the bearing portion continues moving by a preset buffer distance in the first direction under a buffer action of the buffer mechanism.

2. The stage device according to claim 1, wherein the buffer mechanism comprises a base and a movable member, the movable member is movably arranged on the base in the first direction, the base is sequentially provided with a first limiting portion and a second limiting portion in the first direction, the driving mechanism is connected to the movable member, and the bearing portion is connected to the base; and

in a case that the driving mechanism drives the base to move through limiting contact between the movable member and the second limiting portion, so as to cause the base to drive the bearing portion to move to the connection location in the first direction, the bearing portion continues moving by the preset buffer distance in the first direction along with the base relative to the movable member, wherein a movement stroke length of the movable member between the first limiting portion and the second limiting portion is the preset buffer distance.

3. The stage device according to claim 2, wherein the base is provided with an elongated limiting hole extending in the first direction, the movable member is arranged in the elongated limiting hole in a penetrating manner, and is slidable in the elongated limiting hole in the first direction, and two opposite side walls of the elongated limiting hole in the first direction are the first limiting portion and the second limiting portion respectively.

4. The stage device according to claim 3, wherein the buffer mechanism further comprises anti-disengagement pins, two ends of the movable member extend out of the elongated limiting hole to be connected to the anti-disengagement pins respectively, and the anti-disengagement pins are configured to be in limiting fit with an opening of the elongated limiting hole.

5. The stage device according to claim 3, wherein the base is provided with an inner cavity, and the elongated limiting hole communicates with the inner cavity; and the driving mechanism comprises a driving body and a driving rod, the driving body is arranged on the stage support, a first end of the driving rod is connected to the driving body, and a second end of the driving rod extends into the inner cavity to be connected to the movable member.

6. The stage device according to claim 2, further comprising a first slide rail and a first slide block, wherein the first slide rail is arranged on the stage support, and extends in the first direction, the first slide block is slidably arranged on the first slide rail, and the base is connected to the first slide block.

7. The stage device according to claim 2, wherein the bearing portion is located above the stage support, and the buffer mechanism and the driving mechanism are located below the stage support; and the stage device further comprises a mounting bracket, and the base is connected to the bearing portion through the mounting bracket.

8. The stage device according to claim 7, further comprising a transition rod and a flexible connector, wherein the transition rod is connected to the base, and the flexible connector is connected between the transition rod and the mounting bracket.

9. The stage device according to claim 1, further comprising second slide rails and second slide blocks, wherein the second slide rails extend in the first direction, the second slide blocks are slidably arranged on the second slide rails, and the bearing portion is connected to the second slide blocks.

10. The stage device according to claim 9, comprising at least two of the second slide rails and at least two of the second slide blocks, wherein at least two of the second slide rails are spaced from each other in a direction perpendicular to the first direction, at least two of the second slide blocks match at least two of the second slide rails in a one-to-one correspondence manner, and two ends of the bearing portion are connected to at least two of the second slide blocks respectively.

11. The stage device according to claim 1, further comprising a limiting member, wherein the limiting member is arranged on the stage support, and the limiting member and the bearing portion are sequentially arranged in the first direction; and the limiting member is configured to stop the

bearing portion at a preset stop location when the bearing portion drives the front opening unified pod to move in a direction in which the opening of the front opening unified pod is separated from the transfer port of the loading-unloading chamber, wherein when the bearing portion moves to the preset stop location, the opening of the front opening unified pod is separated from the transfer port of the loading-unloading chamber.

12. The stage device according to claim 1, further comprising an adjustable positioning pin, wherein in a case that the bearing portion bears the front opening unified pod, the front opening unified pod is connected to the bearing portion through the adjustable positioning pin, and the adjustable positioning pin is configured to adjust levelness of the front opening unified pod.

13. The stage device according to claim 12, further comprising a fixed positioning pin, wherein in a case that the bearing portion bears the front opening unified pod, the front opening unified pod is connected to the bearing portion through the fixed positioning pin and the adjustable positioning pin.

14. The stage device according to claim 1, further comprising a presence sensor, wherein the presence sensor is configured to detect whether the front opening unified pod is located at the bearing portion.

15. The stage device according to claim 1, wherein a first hollow zone having an opening is delimited by the stage support, and a second hollow zone having an opening is delimited by the bearing portion; the bearing portion is stacked above the stage support; the first hollow zone is opposite the second hollow zone, and the opening of the first hollow zone and the opening of the second hollow zone are oriented in the same direction; and the bearing portion is configured to support an edge of the front opening unified pod.

16. A semiconductor process apparatus, comprising a loading-unloading chamber, and the stage device according to any one of claims 1 to 15, wherein the stage device is configured to bear and drive a front opening unified pod to move outside the loading-unloading chamber in a first direction, so as to cause an opening of the front opening unified pod to be connected to a transfer port of the loading-unloading chamber.