

UNLOCKING MECHANISM FOR SEMICONDUCTOR PROCESSING APPARATUS, AND SEMICONDUCTOR PROCESSING APPARATUS

5 **Field**

[0001] The present application relates to the technical field of a semiconductor processing apparatus, and in particular to an unlocking mechanism for the semiconductor processing apparatus, and the semiconductor processing apparatus.

10 **Background**

[0002] In the semiconductor processing apparatus, there are very high requirements for core process parameters such as film formation uniformity, film formation quality, metal ion contamination control and particle contamination control. In the wafer manufacturing process, particulate contamination is one of the main reasons that affect the yield of the wafers. Therefore, it is necessary to strictly control particle contamination on the wafers.

[0003] Currently, in order to control the contamination of wafers by particles, wafers are typically stored and transferred within semiconductor production process plants using a front opening unified pod (FOUP) (alternatively referred to as a wafer storage box). The existing front opening unified pod includes a body of the FOUP having an opening on one side and a cover of the FOUP for closing the opening, the cover of the FOUP may be movably connected to the body of the FOUP, and the cover of the FOUP further has a lock body structure, typically, the locking or unlocking of the sealing door via the lock body structure is controlled by movement of the unlocking mechanism to enable the cover of the FOUP to be switched between the closed state and the openable state.

[0004] In particular, the key of the unlocking structure is typically inserted into a key groove of the lock body structure, switching of the cover of the FOUP between the closed state and the openable state is achieved by rotating the key, however, when the key needs to be removed from the key groove, friction is generated by contact between the key and the key groove, and particles generated by the friction can contaminate the wafers and thus affect the production yield of the wafers.

Summary

[0005] The present application discloses a semiconductor processing apparatus which can solve the problem that particles are easy to contaminate the wafers in the process of unlocking.

[0006] In order to solve the above problem, the present application employs the following

technical solutions:

[0007] An embodiment of the present application discloses an unlocking mechanism of a semiconductor processing apparatus for opening or closing a lock body structure on a sealing door of a front opening unified pod, including a key and a driving device, the key being able to move into or out of a key groove of the lock body structure and match the key groove in an inserted manner;

the driving device is connected with the key, which is used to drive the key to rotate from an initial position to a first preset position that can make the sealing door in an openable state when the sealing door is in a closed state, and when the sealing door is in the openable state, the driving device is used for driving the key to rotate from the first preset position to a second preset position that can make the sealing door in the closed state; and

the driving device is further used for driving the key to rotate from the second preset position to the initial position after the driving device drives the key to rotate from the first preset position to the second preset position, and the key does not make contact with the groove at the initial position.

[0008] As another solution, an embodiment of the present application also discloses a semiconductor processing apparatus including a sealing door of a front opening unified pod and an unlocking mechanism, wherein, a lock body structure is arranged on the sealing door, and the unlocking mechanism is used for opening or closing the lock body structure, the unlocking mechanism employs the above-described unlocking mechanism disclosed in the embodiments of the present application.

[0009] The technical solutions adopted in the present application can achieve the following benefits:

In the technical solution of the unlocking mechanism of the semiconductor processing apparatus disclosed in the application, the driving device is connected with the key, which is used to drive the key to rotate from the initial position to the first preset position that can make the sealing door in an openable state when the sealing door is in a closed state; when the sealing door is in the openable state, the driving device is used for driving the key to rotate from the first preset position to the second preset position that can make the sealing door in the closed state, so that the switching between the openable state and the closed state of the sealing door can be realized. At the same time, the driving device is also used for driving the key to rotate from the second preset position to the initial position after driving the key to rotate from the first preset position to the second preset position, and the key does not contact the key groove at the initial position, that is, the driving device first drives the key to rotate to the second preset position to ensure that the sealing door is closed, and then drives the key to rotate from the second preset position to the

initial position, since the key does not contact the key groove at the initial position, when the key is taken out of the key groove, it is not easy to generate friction between the key and the key groove, which can reduce the generation of particulate matters, and further reduce the contamination of wafers by particulate matters, thus improving the production yield of wafers, and finally solving the problem of easy contamination of wafers during the unlocking process.

[0010] The semiconductor processing apparatus disclosed herein, which by employing the above-described unlocking mechanism disclosed in the embodiments of the present application, can reduce the generation of particulate matters, reduce the contamination of wafers by particulate matters, thereby increasing the production yield of wafers, and ultimately solves the problem of easily contamination of wafers during the unlocking process.

Brief Description of the Drawings

[0011] The drawings set forth herein are provided to provide a further understanding of and constitute a part of this application, and illustrative embodiments of the present application and descriptions thereof are provided to explain the present application and do not constitute undue limitations of the present application. In the drawings:

[0012] FIG. 1 is a schematic diagram of the structure of a semiconductor processing apparatus in accordance with an embodiment of the present disclosure;

[0013] FIG. 2 is a schematic diagram of the structure of a front opening unified pod in accordance with an embodiment of the present disclosure;

[0014] FIG. 3 is a schematic diagram of a lock body structure in a locked state in accordance with an embodiment of the present disclosure;

[0015] FIG. 4 is a diagram showing the position relationship of a key and a key groove;

[0016] FIG. 5 is a schematic diagram of a lock body structure in an unlocked state in accordance with an embodiment of the present disclosure;

[0017] FIG. 6 is a partial structural diagram of an unlocking mechanism in accordance with an embodiment of the present disclosure from a perspective;

[0018] FIG. 7 is a partial structural diagram of the unlocking mechanism in accordance with an embodiment of the present disclosure from another perspective;

[0019] FIG. 8 is an enlarged partial view of FIG. 3;

[0020] FIG. 9 is an enlarged partial view of FIG. 5;

[0021] FIG. 10A is a diagram illustrating movement of a driving device in a first travel in accordance with an embodiment of the present disclosure; and

[0022] FIG. 10B shows a diagram illustrating movement of the driving device in a second travel according to an embodiment of the present disclosure.

[0023] Description of reference signs:

100-chamber portion;

200-front opening unified pod, 210-body of FOUP, 220-sealing door, 230-lock body structure, 231-key groove, 232-rotary table, 232a-arc groove, 233-locking rod, 233a-sliding piece;

5 300-unlocking mechanism, 310-key, 311-connector, 320-driving device, 321-telescoping mechanism, 322-first connecting rod, 323-second connecting rod, 330-linkage mechanism, 340-limit part, 341-limit block, 342-stop block.

Detailed Description of the Embodiments

10 **[0024]** In order to make the objectives, technical solutions and advantages of the application clearer, the technical solutions of the application will be described clearly and completely in combination with the specific embodiments of the application and the corresponding drawings. Obviously, the described embodiments are only part of the embodiments of this application, not all of them. Based on the embodiments in the application, all other embodiments obtained by
15 those of ordinary skills in the art without doing creative work belong to the scope of protection in the application.

[0025] The terms "first", "second", etc. in the description and claims of the application are used to distinguish similar objects, not to describe a specific order or sequence. It should be understood that the data so used can be interchanged in appropriate cases, so that the embodiments of the
20 present application can be implemented in an order other than those illustrated or described herein. In addition, the objects distinguished by "first" and "second" are usually of one class, and the number of objects is not limited. For example, the first object can be one or multiple. In addition, in the description and claims, "and/or" represents at least one of the connected objects, and the character "/" generally indicates that the front and back associated objects are in an "or"
25 relationship.

[0026] In combination with the drawings, the technical solutions disclosed by each embodiment of the application will be described in detail through specific embodiments and their application scenarios.

[0027] Please refer to FIG. 1, an embodiment of the present application discloses a
30 semiconductor processing apparatus, the disclosed semiconductor processing apparatus includes a chamber portion 100 and an unlocking mechanism 300, in general, the chamber portion 100 may include a transfer chamber, a process chamber, or the like. A front opening unified pod 200 used by the semiconductor processing apparatus is located outside the chamber portion 100, as shown in FIGS. 2 and 3, the front opening unified pod 200 includes a body of the FOUP 210 and
35 a sealing door 220 movably connected to the body of the FOUP 210, a lock body structure 230 is

arranged on the sealing door 220 for locking or unlocking the sealing door 220 so that it can be in a closed or openable state, the closed state means that the sealing door 220 is in a closed position with the body of the FOUP 210 and the sealing door 220 cannot be opened when locked by the lock body structure 230; the openable state means that the sealing door 220 is in a closed position with the body of the FOUP 210, but the sealing door 220 can be opened. The unlocking mechanism 300 is used for opening or closing the lock body structure 230 described above to enable locking or unlocking of the lock body structure 230 to the sealing door 220.

[0028] In the specific working process, the wafers are initially placed in the front opening unified pod 200. A corresponding manipulator transmits the front opening unified pod 200 to a carrier set at one side of the front of the unlocking mechanism 300 (as shown in FIG. 1 where the front opening unified pod 200 is located), and then the lock body structure 230 is opened through the unlocking mechanism 300, so that the lock body structure 230 unlocks the sealing door 220, and the sealing door 220 can be opened. In this state, the wafers in the front opening unified pod 200 are transferred to a wafer boat in the chamber portion 100 by a manipulator in the chamber portion 100, and then sent to the chamber portion 100 by the wafer boat for processing. After all the wafer processes are completed, the wafers are put back into the front opening unified pod 200 by the manipulator in the chamber portion 100, and then the sealing door 220 is closed, and the lock body structure 230 is closed by the unlocking mechanism 300, so that the lock body structure 230 can lock the sealing door 220 and the process is completed.

[0029] In particular, as shown in FIGS. 3, 6 and 7, the lock body structure 230 is provided with a key groove 231, and the unlocking mechanism 300 includes a key 310 and a driving device 320, the key 310 is able to move into or out of the key groove 231; the driving device is connected to the key, and after key 310 is moved into the key groove 231, the driving device 320 drives the key 310 to rotate so as to drive the key groove 231 to rotate. In order to facilitate the in-out movement of the key 310, the size of the key groove 231 will be slightly larger than the size of the key 310, that is, there will be a gap between the key 310 and the key groove 231, which makes the rotation angles of the key 310 and the key groove 231 different. For example, as shown in FIG. 4, when the key 310 rotates counterclockwise by an angle of θ (i.e., 90°) from the horizontal state, the key 310 is vertical, and the key groove 231 can only be rotated by an angle of $\theta - \alpha$ because of the gap therebetween, at this time, there is a difference α between the rotation angles of the key 310 and key groove 231, and the size of α is determined by the gap mentioned-above. Similarly, when the key 310 rotates clockwise by an angle of θ (i.e., 90°) from the vertical state θ , there is also a difference α between the rotation angles of the key 310 and key groove 231. Due to the difference α , the lock body structure 230 cannot be locked or unlocked normally because the key groove 231 is not rotated in place, and the sealing door 220 cannot be opened or closed

normally.

[0030] To solve the above problem, the driving device 320 is used for driving the key 310 to rotate from the initial position to the first preset position that can make the sealing door 220 in an openable state when the sealing door 220 is in a closed state; when the sealing door 220 is in an openable state, the key 310 is driven to rotate from the first preset position to a second preset position that can make the sealing door 220 in a closed state. Specifically, the first preset position meets the following requirement: the sealing door 220 is ensured to be in an openable state, that is, the sealing door 220 can be normally opened. The second preset position meets the following requirement: the sealing door 220 is ensured to be in a closed state, that is, the sealing door 220 can be normally closed.

[0031] When the key groove 231 is in the vertical state, the sealing door 220 is in the closed state; when the key groove 231 is in the horizontal state, the sealing door 220 is in the openable state, when it is necessary to switch the sealing door 220 from the closed state to the openable state, the key 310 is inserted into the key groove 231, at this time, the key 310 is in the vertical state, which corresponds to the initial position; then, when the key 310 is driven by the driving device 320 to rotate by an angle of $(\theta+\alpha)$ from the vertical state in the clockwise direction, the key 310 is in the first preset position, the key groove 231 may rotate with the key 310 by an angle of θ , i.e., reaching the horizontal state, thereby enabling the sealing door 220 to be switched to the openable state. When it is necessary to switch the sealing door 220 from the openable state to the closed state, the key 310 is driven by the driving device 320 to rotate by an angle of $(\theta+2\alpha)$ from the first preset position in the counterclockwise direction, at this time, the key 310 is in the second preset position, the key groove 231 may rotate with the key 310 by an angle of θ , i.e., reaching the vertical state, thereby enabling the sealing door 220 to be switched to the closed state. Thereby, it can be ensured that the sealing door 220 can be opened or closed normally.

[0032] On this basis, the driving device 320 is further used for driving the key 310 to rotate from the second preset position to the initial position after the driving device 320 drives the key 310 to rotate from the first preset position to the second preset position, and the key 310 does not make contact with the key groove 231 at the initial position. Specifically, when the key 310 is in the second preset position, there is an angle (i.e., the difference α) between the key 310 and the key groove 231 in the vertical position, causing the key 310 and the key groove 231 to come into contact with each other (as shown in FIG. 4), when the key 310 is removed from the key groove 231, the key 310 will rub against the key groove 231, creating particulate matters, which may contaminate the wafers. For this purpose, key 310 is driven to rotate from the second preset position to the initial position by the driving device 320, the key 310 may be brought to the vertical state, as a result, the key 310 is not in contact with the key groove 231, when the key 310 is

removed from the key groove 231, friction between the key 310 and the key groove 231 is less likely to occur, which can reduce the generation of particulate matters, and reduce contamination of the wafers by the particulate matters, thereby increasing the production yield of the wafers, and ultimately solving the problem of easily contaminating the wafers during the unlocking process.

5 **[0033]** In a specific working process, the key 310 is moved into the key groove 231, such that the key 310 matches the key groove 231 in an inserted manner, next the driving device 320 starts to work to drive the key 310 to rotate to the first preset position, thereby ensuring that the sealing door 220 can be opened normally, after the sealing door 220 is opened, the wafers within the front opening unified pod 200 are transferred into the chamber portion 100 by a manipulator for
10 processing, after all the wafer processes are completed, the wafers are replaced back into the front opening unified pod 200 by the manipulator, at this time, the key 310 is driven to rotate from the first preset position to the second preset position by the driving device 320, to ensure that the sealing door 220 can be normally closed, the key 310 is then driven to rotate from the second preset position to the initial position by the driving device 320 so that the key 310 is not in contact
15 with the key groove 231, and the key 310 is then removed from the key groove 231 to complete the process.

[0034] Thus, the unlocking mechanism 300 disclosed herein can both ensure that the sealing door 220 can be normally opened or closed, reduce the generation of particulate matters, and reduce the contamination of the wafers by the particulate matters, thereby increasing the
20 production yield of the wafers, and ultimately solve the problem of easily contaminating the wafers during the unlocking process.

[0035] Optionally, the driving device 320 includes a telescoping mechanism 321 and a connecting rod mechanism, wherein the telescoping mechanism 321 is used for driving the movement of the connecting rod mechanism according to a first travel and a second travel which
25 are preset, the connecting rod mechanism being connected to the key 310. It is assumed that when the key groove 231 is in the vertical state, the sealing door 220 is in the closed state; when the key groove 231 is in the horizontal state, the sealing door 220 is in the openable state, as shown in FIG. 10A, when it is necessary to switch the sealing door 220 from the closed state to the openable state, the key 310 is inserted into the key groove 231, at this time, the key 310 is in the
30 vertical state, which corresponds to the initial position (i.e., the position in FIG. (1) in FIG. 10A).

[0036] In the first travel, the telescoping mechanism 321 always drives the connecting rod mechanism to move in a first linear direction (i.e. the direction A in FIG. 10A), such that the connecting rod mechanism is capable of driving the key 310 to rotate from the initial position to the second preset position (not shown) in a first direction (i.e., the counterclockwise direction in
35 FIG. 10A), and then from the second preset position to the first preset position (i.e., the position

in FIG. (3) in FIG. 10A) in a second direction opposite to the first direction (i.e., the clockwise direction in FIG. 10A), the key groove 231 can reach a horizontal state, thereby enabling the sealing door 220 to switch from the closed state to the openable state. It should be noted that, as shown in FIG. 10A, during rotation of the key 310 from the initial position to the first preset position, when the key 310 is rotated to the horizontal state (i.e., the position in FIG. (2) of FIG. 10A), the key groove 231 is not rotated to the horizontal state, and the sealing door 220 cannot be normally opened, whereas when the key 310 continues to be rotated from the horizontal state to the first preset position, the key groove 231 is rotated to the horizontal state, and at this time, the sealing door 220 can be normally opened.

[0037] When it is desired to switch the sealing door 220 from the openable state to the closed state, as shown in FIG. 10B, in the second travel, the telescoping mechanism 321 always drives the connecting rod mechanism to move in a second linear direction (i.e., the direction B in FIG. 10A) opposite to the first linear direction, such that the connecting rod mechanism is capable of driving the key 310 to rotate from the first preset position (i.e., the position in FIG. (3) of FIG. 10A) to the second preset position (i.e., the position in FIG. (2) of FIG. 10B) in a first direction (i.e., the counterclockwise direction in FIG. 10B), and then from the second preset position to the initial position in a second direction (i.e., the clockwise in FIG. 10B) to realize switching of the sealing door 220 from the openable state to the closed state. It should be noted that, as shown in FIG. 10B, during rotation of the key 310 from the first preset position to the second preset position, when the key 310 is rotated to the vertical state (i.e., the position in FIG. (1) of FIG. 10B), the key groove 231 is not rotated to the vertical state, and at this time, the sealing door 220 cannot be normally closed, whereas when the key 310 continues to rotate from the vertical state to the second preset position, the key groove 231 is rotated to the vertical state, and at this time, the sealing door 220 can be normally closed.

[0038] Table 1 shows the corresponding relationship between the rotation directions, positions, and angles of the key in the first travel and the second travel and the states of the sealing door.

Key rotation direction	Key position	Key angle	Sealing door State
-	Initial position	0°	Normally closed state
Counterclockwise	Second preset position	-5 °	Normally closed state
Clockwise	Horizontal position	90°	Non-normally openable state
Clockwise	First preset position	95°	Normally openable state
Counterclockwise	Initial position	0°	Non-normally closed state
Counterclockwise	Second preset position	-5 °	Normally closed state

Clockwise	Initial position	0°	Normally closed state
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[0039] As can be seen from the Table 1 above, in the first travel, the telescoping mechanism 321 always drives the connecting rod mechanism to move in the first linear direction, while the key 310 is rotated counter-clockwise and then clockwise under the driving of the connecting rod mechanism, i.e., the direction of rotation is changed; in the second travel, the telescoping mechanism 321 always drives the connecting rod mechanism to move in the second linear direction, while the key 310 is rotated counter-clockwise and then clockwise under the driving of the connecting rod mechanism, the direction of rotation is also changed, and in the second travel, this change in direction of rotation may realize rotation of the key 310 from the second preset position to the initial position, and the purpose that the key 310 is not in contact with the key groove 231 in the initial position is achieved. At the same time, since the telescopic mechanism 321 can maintain the same direction, it is unnecessary for the telescopic mechanism 321 to turn midway, extend and retract for many times, or locate at many points, so that not only can the movement of the telescoping mechanism 321 be simplified and controlled by staff, but also the telescoping mechanism 321 is not easily damaged. In addition, the linear motor can be selected, and the cylinder can also be selected as the telescopic mechanism 321, thus expanding the selection range of the telescopic mechanism 321. In practical application, the first travel can be the retraction travel of the telescopic mechanism 321, and the second travel can be the extension travel of the telescopic mechanism 321.

[0040] There can be many kinds of connecting rod mechanisms to realize the above solution. For example, as shown in FIGS. 6 and 7, the connecting rod mechanism includes a first connecting rod 322 and a second connecting rod 323, the first end of the first connecting rod 322 is hinged with the telescopic rod of the telescopic mechanism 321, the second end of the first connecting rod 322 is hinged with the first end of the second connecting rod 323, and the key 310 is connected with the second end of the second connecting rod 323. Driven by the telescopic mechanism 321, the first connecting rod 322 can drive the first end of the second connecting rod 323 to rotate around the second end of the second connecting rod 323 in the first direction or the second direction, while the second connecting rod 323 can drive the key 310 to rotate concentrically, that is, the rotation center of the second connecting rod 323 coincides with the rotation center of the key 310.

[0041] In the first travel or or the second travel, the telescoping mechanism 321 drives the movement of the first connecting rod 322 to cause the first connecting rod 322 to drive the second connecting rod 323 to rotate in the first direction or the second direction, therefore, the key 310 is driven to rotate in the first direction or the second direction. In practical applications, the structures and dimensions of the first connecting rod 322 and the second connecting rod 323 may

be designed according to specific needs to achieve the rotation directions, positions, and angles that the key 310 can achieve in the first travel and the second travel.

[0042] Typically, in order to improve the stability of the sealing door 220, at least two lock body structures 230 are typically arranged on the sealing door 220, the at least two lock body structures 230 enable a relatively stable connection of the sealing door 220 to the body of the FOUP 210 when the sealing door 220 is in the closed state, to facilitate unlocking of at least two lock body structures 230 by the unlocking mechanism 300 at the same time, thus improving the unlocking efficiency. Optionally, the quantity of the key grooves 231, the keys 310 and the second connecting rods 323 is each at least two, the second connecting rods 323 being connected with the keys 310 in one-to-one correspondence, each key 310 being movable into or out of its corresponding key groove; as shown in FIGS. 6 and 7, the unlocking mechanism 300 may further include a linkage mechanism 330, at least two second connecting rods 323 are connected by the linkage mechanism 330, the second end of the first connecting rod 322 is hinged with the first end of one of the second connecting rods 323, and the first connecting rod 322 is capable of causing the simultaneous rotation of the at least two second connecting rods 323 by the linkage mechanism 330 and thus the simultaneous rotation of the at least two keys 310 to enable simultaneous unlocking of the at least two lock body structures 230, when driven by the telescoping mechanism 321.

[0043] It can be seen from the above structure and working process that the unlocking mechanism 300 has at least two keys 310, and the at least two keys 310 can rotate synchronously, so that at least two lock body structures 230 on the sealing door 220 can be synchronously unlocked or closed, thereby improving the unlocking efficiency. At the same time, the setting of the linkage mechanism 330 can realize that a single driving device 320 can simultaneously drive at least two keys 310 to rotate synchronously, thereby reducing both the structural complexity of the unlocking mechanism 300 and the cost of the unlocking mechanism 300.

[0044] Optionally, the second connecting rod 323 can include a body and a connector 311. The second end of the first connecting rod 322 is hinged with the body, and the linkage mechanism 330 is connected with the connector 311 of each second connecting rod 323. The key 310 rotates concentrically with the body, and the connector 311 can provide a connecting position for the linkage mechanism 330 and the second connecting rod 323, which facilitates the connection of the linkage mechanism 330 and the second connecting rod 323, the installation of the unlocking mechanism 300 by the staff is facilitated and the design difficulty of the designers is reduced.

[0045] As described above, the driving device 320 may synchronously drive the at least two second connecting rods 323 to rotate by the linkage mechanism 330, which may optionally include a connecting bar to which each connector 311 is hinged. When one of the connectors 311

rotates, the connecting bar is driven to move and thus the remaining connectors 311 are driven to rotate. This linkage mechanism 330 is simple in structure, easy to set, and lower in cost, and the transmission effect of the connecting bar is good. Further, the connecting bar may be a telescoping rod to facilitate a worker to adjust the angle of rotation of the key 310, so that the key 310 can completely open or close the lock.

[0046] In order to improve the accuracy of the key 310 in opening or closing the lock and avoid the excessive rotation of the key 310, the unlocking mechanism 300 can optionally include a limit part 340, which can be used to limit the distance of the telescopic rod of the telescopic mechanism 321 to move according to the first travel or the second travel, that is, the displacement of the telescopic mechanism 321 along the first straight line direction or the second straight line direction, so as to avoid the excessive rotation of the key 310, thus, the key 310 can be turned to the specified position more accurately, thereby improving the accuracy of the key 310 in unlocking or locking.

[0047] Optionally, the limit part 340 can include a limit block 341 and a stop block 342, the limit block 341 can be fixedly set, the stop block 342 can be set on the telescopic rod, and can contact the limit block 341 when the telescopic rod moves according to the first travel or the second travel, so as to prevent the telescopic rod from continuing to move. The limiting process is simple and reliable. Further, the stop block 342 can be an elastic block or an elastic element can be arranged on the stop block 342 to realize elastic limit and avoid hard contact.

[0048] In the embodiment of the application, the telescopic mechanism 321 can be of various types, such as a hydraulic telescopic rod. Optionally, the telescopic mechanism 321 can be a linear motor or a cylinder. The driving of the linear motor and cylinder is reliable and the technology is mature, which is conducive to improving the stability of the unlocking mechanism 300.

[0049] Optionally, as shown in FIGS. 3 and 5, the lock body structure 230 can include a key groove 231, a rotary table 232, and locking rods 233, the locking rods 233 are movably connected with the sealing door 220 and can be moved to a locking position that makes the sealing door 220 in a closed state (i.e., the positions of the locking rods 233 in FIG. 3), or an unlocked position that makes the sealing door 220 in an openable state (i.e., the positions of the locking rods 233 in FIG. 5). Specifically, as shown in FIG. 3, one end of the locking rod 233 extends to the outside of the side of the sealing door 220 relative to the side of the sealing door 220, so that it can extend into the corresponding fixing groove in the box 210, thus realizing the locking of the sealing door 220. As shown in FIG. 5, one end of the locking rod 233 retracts to the inside of the side of the sealing door 220 to move out of the corresponding fixing groove in the box 210, thus realizing the unlocking of the sealing door 220.

[0050] The rotary table 232 is movably connected with the locking rods 233, and the rotary

table 232 is fixedly connected with a connecting piece which is provided with the key groove 231; when the driving device 320 drives the key 310 located in the key groove 231 to rotate, the key 310 drives the rotary table 232 to rotate by matching with the key groove 231, so that the rotary table 232 synchronously drives the locking rods 233 to move to the locking position or the unlocking position. The lock body structure 230 of this structure is simple, reliable and easy to set, thus reducing the structural complexity of the unlocking mechanism 300 and the design difficulty of designers.

[0051] The rotary table 232 can be movably connected with the locking rods 233 in a variety of ways. For example, as shown in FIGS. 8 and 9, the rotary table 232 is provided with arc grooves 232a. The unlocking mechanism 300 also includes sliding pieces 233a, one end of the sliding piece 233a is movably connected with the rotary table 232 and can rotate along the arc groove 232a, and the other end of the sliding piece 233a is fixedly connected with the locking rod 233. The sliding piece 233a is, for example, a bulge arranged on the locking rod 233 and projecting relative to the rod body of the locking rod 233. The bulge penetrates through the arc groove 232a and can rotate along the arc groove 232a.

[0052] Optionally, the locking rods 233 are multiple and set in pairs. The two locking rods 233 in pairs are set at intervals in the vertical direction in FIGS. 3 and 5, and the rotary tables 232 are set at intervals between them. For example, if two pairs of locking rods 233 are set in FIGS. 3 and 5, the corresponding rotary tables 232 are two. Corresponding to each rotary table 232, the arc grooves 232a are two, which are symmetrically arranged relative to the rotation center of rotary table 232, and the sliding pieces 233a are two, one end of each sliding piece 233a is connected with one locking rod 233 in one pair, and the other end is movably connected with the rotary table 232, the sliding pieces 233a can rotate along the two arc grooves 232a, respectively.

[0053] As shown in FIG. 8, when the key groove 231 is in the vertical state, the sliding piece 233a is located at one end of the arc groove 232a. When the key groove 231 rotates clockwise with the drive of the key 310, the rotary table 232 rotates clockwise with the key groove 231. At the same time, the sliding piece 233a slides along the arc groove 232a to drive the locking rod 233 to move. As shown in FIG. 9, the two paired locking rods 233 move towards each other until the sliding piece 233a slides to the other end of the arc groove 232a, the rotary table 232 drives the locking rod 233 to move through the sliding fit of the sliding piece 233a and the arc groove 232a, which can further reduce the structural complexity of the unlocking mechanism 300 and reduce the design difficulty of the designers.

[0054] Of course, in practical applications, the rotary table 232 can also use any other structure to drive the locking rod 233 to move. For example, the rotary table 232 can be equipped with a gear, the locking rod 233 can be equipped with a rack, and the rotary table 232 can drive the

locking rod 233 to move through the engagement of the gear and the rack. For another example, the rotary table 232 can drive the locking rod 233 to move through a cam mechanism, a crank-slider structure, a screw transmission mechanism, etc.

[0055] As another technical solution, the embodiment of the application also discloses a semiconductor processing apparatus. Taking the semiconductor processing apparatus shown in FIG. 1 as an example, the disclosed semiconductor processing apparatus includes a chamber portion 100 and an unlocking mechanism 300. Generally speaking, the chamber portion 100 can include a transmission chamber, a process chamber, etc. The front opening unified pod 200 used by the semiconductor processing apparatus is located outside the chamber portion 100, as shown in FIGS. 2 and 3. The front opening unified pod 200 includes a body of the FOUP 210 and a sealing door 220 movably connected with the body of the FOUP 210. The sealing door 220 is provided with lock body structures 230 to lock or unlock the sealing door 220 so that the sealing door 220 can be in a closed state or an openable state. The unlocking mechanism 300 is used to open or close the lock body structures 230 to realize the locking or unlocking of the lock body structures 230 to the sealing door 220. The unlocking mechanism adopts the above unlocking mechanism disclosed in the embodiment of the application.

[0056] In summary, in the technical solution of the unlocking mechanism of the semiconductor processing apparatus and the semiconductor processing apparatus disclosed in the application, the driving device is connected with the key, which is used to drive the key to rotate from the initial position to the first preset position that can make the sealing door in an openable state when the sealing door is in a closed state; when the sealing door is in the openable state, the key is driven to rotate from the first preset position to the second preset position that can make the sealing door in the closed state, so that the switching between the openable state and the closed state of the sealing door can be realized. At the same time, the driving device is also used for driving the key to rotate from the second preset position to the initial position after driving the key to rotate from the first preset position to the second preset position, and the key does not contact the key groove at the initial position, that is, the driving device first drives the key to rotate to the second preset position to ensure that the sealing door is closed, and then drives the key to rotate from the second preset position to the initial position, since the key does not contact the key groove at the initial position, when the key is taken out of the key groove, it is not easy to generate friction between the key and the key groove, which can reduce the generation of particulate matters, and further reduce the contamination of wafers by particulate matters, thus improving the production yield of wafers, and finally solving the problem of easy contamination of wafers during the unlocking process.

[0057] The above embodiments of the application focus on the differences among the

embodiments. As long as the different optimization features between the embodiments are not contradictory, they can be combined to form better embodiments. In view of the simplicity of the text, it will not be repeated here.

[0058] The above is only the embodiments of the application and is not intended to limit the
5 application. For those skilled in the art, the application may have various changes and variations. Any modification, equivalent replacement, improvement, etc. made within the spirit and principle of this application shall be included in the scope of claims of this application.

WHAT IS CLAIMED IS:

1. An unlocking mechanism of a semiconductor processing apparatus for opening or closing a lock body structure on a sealing door of a front opening unified pod, comprising a key and a driving device, wherein the key is able to move into or out of a key groove of the lock body structure and matches the key groove in an inserted manner;

the driving device is used for driving the key, when the sealing door is in a closed state, to rotate from an initial position to a first preset position which enables the sealing door to be in an openable state, and driving the key, when the sealing door is in the openable state, to rotate from the first preset position to a second preset position which enables the sealing door to be in the closed state; and

the driving device is further used for driving the key to rotate from the second preset position to the initial position after the driving device drives the key to rotate from the first preset position to the second preset position, and the key does not make contact with the groove at the initial position.

2. The unlocking mechanism according to claim 1, wherein the driving device comprises a telescoping mechanism and a connecting rod mechanism, wherein

the telescoping mechanism is used for driving the connecting rod mechanism to move according to a preset first travel and a preset second travel, and the connecting rod mechanism is connected with the key;

in the first travel, the telescoping mechanism always drives the connecting rod mechanism to move in a first linear direction, such that the connecting rod mechanism able to drive the key to rotate from the initial position to the second preset position in a first direction, and then from the second preset position to the first preset position in a second direction opposite to the first direction so as to switch the sealing door from the closed state to the openable state; and

in the second travel, the telescoping mechanism always drives the connecting rod mechanism to move in a second linear direction opposite to the first linear direction, such that the connecting rod structure is able to drive the key to rotate from the first preset position to the second preset position in the first direction, and then from the second preset position to the initial position in the second direction so as to switch the sealing door from the openable state to the closed state.

3. The unlocking mechanism according to claim 2, wherein the connecting rod mechanism comprises a first connecting rod and a second connecting rod, a first end of the first connecting rod being hinged with a telescoping rod of the telescoping mechanism, a second end of the first

connecting rod being hinged with a first end of the second connecting rod, and the key being connected with a second end of the second connecting rod; and

driven by the telescoping mechanism, the first connecting rod is able to drive the first end of the second connecting rod to rotate in the first direction or the second direction about the second end of the second connecting rod while the second connecting rod is able to drive concentric rotation of the key.

4. The unlocking mechanism according to claim 3, wherein the quantity of the key grooves, the keys and the second connecting rods is each at least two, the second connecting rods being connected in one-to-one correspondence with the keys, and each key being able to move into or out of the corresponding key groove; the unlocking mechanism further comprises a linkage mechanism, wherein at least two second connecting rods are connected by the linkage mechanism, the second end of the first connecting rod is hinged with the first end of one of the second connecting rods, and the first connecting rod is able to drive the at least two second connecting rods to rotate synchronously by the linkage mechanism when driven by the telescoping mechanism.

5. The unlocking mechanism according to claim 4, wherein each of the second connecting rods comprises a body and a connector, the second end of the first connecting rod is hinged with the body, and the linkage mechanism is connected to the connector of each of the second connecting rods.

6. The unlocking mechanism according to claim 5, wherein the linkage mechanism comprises a connecting bar, and each connector is hinged with the connecting bar.

7. The unlocking mechanism according to any one of claims 2 to 6, wherein the unlocking mechanism further comprises a limit part, and the limit part is used for limiting the distance that the telescopic rod of the telescopic mechanism moves according to the first travel or the second travel.

8. The unlocking mechanism according to claim 7, wherein the limit part comprises a limit block and a stop block, the limit block is fixedly arranged, and the stop block is arranged on the telescoping rod and being able to be in contact with the stop block during movement of the telescoping rod according to the first travel or the second travel so as to stop continued movement of the telescoping rod.

9. The unlocking mechanism according to any one of claims 2 to 6, wherein the telescoping mechanism is a linear motor or a cylinder.

10. The unlocking mechanism according to any one of claims 1 to 6, wherein the lock body

structure comprises a rotary table and a locking rod, wherein the locking rod is movably connected to the sealing door and is able to move to a locked position in which the sealing door is in the closed state, or an unlocked position in which the sealing door is in the openable state; and

5 the rotary table is movably connected to the locking rod and the rotary table is fixedly connected to a connecting piece, the connecting piece is provided with the key groove; when the driving device drives the key in the key groove to rotate, the key drives the rotary table to rotate so as to make the rotary table synchronously move the locking rod to either the locked position or the unlocked position.

10 11. The unlocking mechanism according to claim 10, wherein the rotary table is provided with an arc groove; the unlocking mechanism further includes a sliding piece, one end of the sliding piece is movably connected with the rotary table, and is able to rotate along the arc groove, and the other end of the sliding piece is fixedly connected with the locking rod.

15 12. A semiconductor processing apparatus, comprising a sealing door of a front opening unified pod and an unlocking mechanism, a lock body structure being arranged on the sealing door, and the unlocking mechanism being used for opening or closing the lock body structure, wherein the unlocking mechanism employs the unlocking mechanism of any one of claims 1-12.