SUBSTRATE TREATING DEVICE AND METHOD, AND EXPOSURE DEVICE AND METHOD

Technical Field

The present invention relates to a substrate treating device and method therefore, in which a specific treatment is performed using a substrate. More particularly, the present invention relates to an exposure device and method therefore, in which a projecting and transferring treatment is performed using a substrate such as a mask or the like.

Related Art

When producing a semiconductor element or liquid crystal element using a photolithography process, substrate treating devices, i.e., exposure devices, are generally employed, in which the pattern image formed by the photomask or reticle is projected via a projection optical system onto a substrate such as a semiconductor wafer or glass plate that has been coated with a photosensitive agent. In order to make multiple circuit patterns on the wafer surface when producing the semiconductor element in these types of exposure devices, the exposure is performed using from several to 10 to 20 or more reticles to stack the aforementioned patterns on top of one another.

Each of these reticles is subject to contamination due to adherence of environmental dust or from direct contact during

handling by workers, as well as damage from contact with nearby parts. For this reason, it is the general practice to handle the reticles after housing them in specialized reticle cases. A reticle stocker for storing the reticles is provided in the clean room where the exposure device is located. A number of reticles are housed and stored inside this reticle stocker. Recently, it has been proposed to guide the reticles between the reticle stocker and the exposure device using an automated guiding robot that guides the reticle case.

Figure 9 shows the automated guiding robot (referred to as an "AGV", i.e., automated guided vehicle, hereinafter), the exposure device and the reticle stocker that are disposed inside the clean room. Reticle stocker 1 has several hundred reticle storing selves inside an air-conditioned chamber.

Multiple exposure devices 2A~2H are disposed adjacent to reticle stocker 1. Each exposure device 2A~2H is provided with a chamber, the inside of which is maintained at a constant environment by means of various air-conditioning devices. The main portion of the exposure device is housed in the chamber, along with a reticle guiding device and a wafer guiding device.

One or several AGV 3,3 run between reticle stocker 1 and the various exposure devices 2A~2H. AGV 3,3 are provided with a guiding arm that has multiple degrees of freedom. AGV 3,3 give reticle cases to and receive reticle cases from a reticle case guiding device that is disposed inside reticle stocker 1 through opening door 4 of reticle stocker 1. AGV 3,3 also

give reticle cases to and receive reticle cases from guiding arms that are disposed inside exposure devices 2A~2H via the opening doors 5A~5H of the chambers.

Respective opening door 4 and opening doors 5A~5D of reticle stocker 1 and exposure devices 2A~2D are provided in a row so as to meet running path 6 of AGV 3,3 that extends in one direction. Opening doors 5E~5H, which are formed in the front surface of exposure devices 2E~2H, are provided in a line opposite reticle stocker 1 and exposure device 2A~2D and so as to meet running path 6.

The reticle which is required in exposure devices 2A~2H is guided by AGV 3,3 from reticle stocker 1 to exposure devices 2A~2H. Reticles not needed in exposure devices 2A~2H are returned by AGV 3,3 from exposure devices 2A~2H to reticle stocker 1.

In other words, when removing the reticles required in exposure devices 2A~2H, AGV 3,3 stops at a specific site in reticle stocker 1. Next, opening door 4 on the front surface of reticle stocker 1 opens, and the required reticle is taken from reticle stocker 1.

AGV 3,3 moves to the location of the specified exposure device 2A~2H by automatically running along running path 6. AGV 3,3 faces the reticle case transfer position, drives the guiding arm, and gives the reticle case to or receives the reticle case from the guiding device that is disposed inside exposure devices 2A~2H.

A conventional substrate treating device such as described above has the following problems, however. Namely, reticle stocker 1 and exposure devices 2A~2H, which must give reticle cases to and receive reticle cases from AGV 3,3, are disposed so as that opening doors 4 and 5A~5H which are formed in the front surface meet running path 6. For this reason, when disposing a plurality of exposure devices as described above, the exposure devices must be arrayed in a straight line so as to face the same direction. This results in an unnecessary restriction being placed on the layout design.

Further, as shown in Figure 10, a plurality of exposure devices 2,2, in which opening doors are not provided in the front surface F but rather in side surface S, can be disposed in the same direction. In this case, it is necessary to maintain a fixed space at the front surface of exposure device 2 for the purpose of maintenance and the like. This impairs effective utilization of space for disposing the exposure device as a result.

When the devices are not disposed in a straight line due to the requirements of the layout, it becomes necessary to provide a running path 6 for AGV 3,3 that meets the opening doors of each of the devices. Accordingly, a single running path 6 is not sufficient for this purpose. For this reason, running path 6 must to provided in separate segments so as to enable AGV 3,3 to access all of the devices. As a result, AGV 3,3 are no longer able to efficiently guide the reticles. Thus, in the same manner as described above, effective

utilization of the space for disposing the devices is impaired.

The present invention was conceived in view of the preceding matters, and has as its objective the provision of a substrate treating device and method, and an exposure device and method, that makes effective utilization of the space for disposing the device and enables efficient guiding of the substrate, without placing restrictions on the design of the layout during installation.

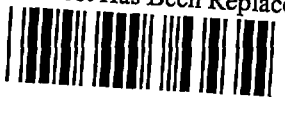
Disclosure of the Invention

In order to achieve the above-stated objective, the present invention employs the following design corresponding to Figures 1 through 8 in which embodiments of the present invention are pictured.

The substrate treating device according to claim 1 is provided with a substrate guiding device (16) for guiding substrate (R) received from the outside, and carries out a specific treatment using the substrate (R) guided by substrate guiding device (16). This substrate treating device is characterized in the provision of a plurality of receiving portions (12,13) for receiving substrate (R) from the outside.

Accordingly, in the present invention's substrate treating device, it is possible to select from a plurality of receiving portions (12,13) for substrate (R) in substrate guiding device (16). Thus, when disposing substrate treating devices (7A~7D), it is not absolutely essential that the

This Sheet Has Been Replaced



devices all face the same direction. Rather, substrate treating devices (7A~7D) can be disposed so that at least one of the plurality of receiving portions (12,13) for substrate guiding device (16) meets running paths (6A~6D). Conversely, it is also possible to provide running paths (6A~6D) for AGV (3) after disposing substrate treating devices (7A~7D) is the most optimal arrangement.

The substrate treating device according to claim 2 is characterized in that, in the substrate treating device of claim 1, the first receiving portion (12) and the second receiving portion (13) of the plurality of receiving portions (12,13) are provided on different surfaces (FA,SA).

Accordingly, in the present invention's substrate treating device, the receiving portion for substrate (R) of substrate guiding device (16) can be selected from a first receiving portion (12) and a second receiving portion (13) that are present on different surfaces (FA, SA). For this reason, when disposing the substrate treating devices (7A~7D), it is not absolutely essential that the devices all face the same direction. Rather, substrate treating devices (7A~7D) can be disposed so that at least one surface of the different surfaces (FA, SA) to which first receiving portion (12) and second receiving portion (13) are disposed meets running paths (6A~6D).

Conversely, it is also possible to provide the running paths (6A~6D) for AGV (3) so as to meet at least one surface of the aforementioned different surfaces (FA, SA) after

This Sheet Has Been Replaced

disposing substrate treating devices (7A~7D) in the most optimal arrangement in the layout design.

The substrate treating device according to claim 3 is characterized in that, in the substrate treating device according to claim 2, the different surfaces (FA, SA) are roughly perpendicular to one another.

Accordingly, in the present invention's substrate treating device, the receiving portion for substrate (R) of substrate guiding device (16) can be selected from a first receiving portion (12) and a second receiving portion (13) that are present on surfaces (FA, SA) that are roughly perpendicular to one another. For this reason, when disposing the substrate treating devices (7A~7D), it is not absolutely essential that the devices all face the same direction. Rather, substrate treating devices (7A~7D) can be disposed so that at least one surface of perpendicular surfaces (FA, SA) to which first receiving portion (12) and second receiving portion (13) are disposed meets running paths (6A~6D).

Conversely, it is also possible to provide the running paths (6A~6D) for AGV (3) so as to meet at least one surface of the aforementioned roughly perpendicular surfaces (FA, SA) after disposing substrate treating devices (7A~7D) in the most optimal arrangement in the layout design.

The exposure device according to claim 4 exposes the pattern of a mask (R), which is a patterned substrate, onto a photosensitive substrate (W), and is characterized in

This Sheet Has Been Replaced

employing one of the substrate guiding device (16) according to claims 1 through 3 for guiding mask (R).

Accordingly, the present invention's exposure device enables the pattern image on a mask (R) to be exposed onto a photosensitive substrate (W). When guiding this mask (R), it is possible to select a receiving portion (12,13) for mask (R) of substrate guiding device (16) from a plurality of receiving portions. For this reason, when disposing the exposure devices (7A~7D), it is not absolutely essential that the devices all face the same direction. Rather, exposure devices (7A~7D) can be disposed so that at least one of the plurality of receiving portions (12,13) for substrate guiding device (16) meets running paths (6A~6D).

Conversely, it is also possible to provide the running paths (6A~6D) for AGV (3) after disposing exposure devices (7A~7D) in the most optimal arrangement in the layout design.

The exposure device according to claim 5 is characterized in that, in the exposure device according to claim 4, a box-shaped chamber (9) is provided that encloses exposure devices (7A~7D), and in that at least one of the plurality of receiving portions (12,13) is present on the side surface (SA) of box-shaped chamber (9).

Accordingly, the present invention's exposure device enables the pattern image on a mask (R) to be exposed onto a photosensitive substrate (W). When guiding this mask (R), it is possible to select the receiving portion (12,13) for mask

This Sheet Has Been Replaced

(R) of substrate guiding device (16) from a plurality of receiving portions.

When receiving portion (13) on the side surface (SA) of box-shaped chamber (9) is selected, substrate guiding device (16) can receive mask (R) from the outside at side surface (SA).

The substrate treating method according to claim 6 is characterized in that substrate (R) is received via at least one of a plurality of receiving portions (12,13) that are provided to substrate guiding device (16), the substrate is guided by substrate guiding device (16), and a specific treatment is performed using substrate (R).

Accordingly, in the present invention's substrate treating method, it is possible to select a receiving portion (12,13) for substrate (R) of substrate guiding device (16) from a plurality of receiving portions. Thus, when disposing substrate treating devices (7A~7D), it is not absolutely essential that the devices all face the same direction. Rather, substrate treating devices (7A~7D) can be disposed so that at least one of the plurality of receiving portions (12,13) for substrate guiding device (16) meets running paths (6A~6D). Conversely, it is also possible to provide the running paths (6A~6D) for AGV (3) after disposing substrate treating devices (7A~7D) in the most optimal arrangement in the layout design.

The substrate treating method according to claim 7 is characterized in that, in the substrate treating method

This Sheet Has Been Replaced

according to claim 6, the substrate is received via at least one of a first receiving portion (12) and a second receiving portion (13) from among a plurality of receiving portions (12,13) that are provided on different surfaces (FA,SA).

Accordingly, in the present invention's substrate treating method, the receiving portion for substrate (R) of substrate guiding device (16) can be selected from a first receiving portion (12) and a second receiving portion (13) that are present on different surfaces (FA, SA). For this reason, when disposing the substrate treating devices (7A~7D), it is not absolutely essential that the devices all face the same direction. Rather, substrate treating devices (7A~7D) can be disposed so that at least one surface of the different surfaces (FA, SA) to which first receiving portion (12) and second receiving portion (13) are disposed meets running paths (6A~6D).

Conversely, it is also possible to provide the running paths (6A~6D) for AGV (3) so as to meet at least one surface of the aforementioned different surfaces (FA, SA) after disposing substrate treating devices (7A~7D) in the most optimal arrangement in the layout design.

The substrate treating method according to claim 8 is characterized in that, in the substrate treating method according to claim 7, the substrate is received via at least one of the first receiving portion (12) and the second receiving portion (13) which are provided to different

This Sheet Has Been Replaced

surfaces (FA, SA) that are roughly perpendicular to one another.

Accordingly, in the present invention's substrate treating device, the receiving portion for substrate (R) of substrate guiding device (16) can be selected from a first receiving portion (12) and a second receiving portion (13) that are present on surfaces (FA, SA) that are roughly perpendicular to one another. For this reason, when disposing the substrate treating devices (7A~7D), it is not absolutely essential that the devices all face the same direction. Rather, substrate treating devices (7A~7D) can be disposed so that at least one surface of perpendicular surfaces (FA, SA) to which first receiving portion (12) and second receiving portion (13) are disposed meets running paths (6A~6D).

Conversely, it is also possible to provide the running paths (6A~6D) for AGV (3) so as to meet at least one surface of the aforementioned roughly perpendicular surfaces (FA, SA) after disposing substrate treating devices (7A~7D) in the most optimal arrangement in the layout design.

The exposure method according to claim 9 exposes the pattern of a mask (R), which is a patterned substrate, onto a photosensitive substrate (W), and is characterized in employing one of the substrate treating methods according to claims 6 through 8 for guiding mask (R).

Accordingly, the present invention's exposure method enables the pattern image on a mask (R) to be exposed onto a photosensitive substrate (W). When guiding this mask (R), it

This Sheet Has Been Replaced



is possible to select a receiving portion (12,13) for mask (R) of substrate guiding device (16) from a plurality of receiving portions. For this reason, when disposing the exposure devices (7A~7D), it is not absolutely essential that the devices all face the same direction. Rather, exposure devices (7A~7D) can be disposed so that at least one of the plurality of receiving portions (12,13) for substrate guiding device (16) meets running paths (6A~6D).

Conversely, it is also possible to provide the running paths (6A~6D) for AGV (3) after disposing exposure devices (7A~7D) in the most optimal arrangement in the layout design.

The exposure method according to claim 10 is characterized in that, in the exposure method according to claim 9, mask (R) is received via at least one of the plurality of receiving portions (12,13) that are present on the side surface (SA) of a box-shaped chamber (9) that encloses exposure devices (7A~7D).

Accordingly, the present invention's exposure method enables the pattern image on a mask (R) to be exposed onto a photosensitive substrate (W). When guiding this mask (R), it is possible to select a receiving portion (12,13) for mask (R) of substrate guiding device (16) from a plurality of receiving portions.

When receiving portion (13) on the side surface (SA) of box-shaped chamber (9) is selected, substrate guiding device (16) can receive mask (R) from the outside at side surface (SA).

This Sheet Has Been Replaced

Brief Description of the Drawings

Figure 1 shows a first embodiment of the present invention, and is a schematic structural view in which a guiding device that can receive reticle cases by projecting out through a plurality of opening doors is disposed inside the chamber of an exposure device.

Figure 2 shows a first embodiment of the present invention, and is a schematic structural view in which exposure devices are disposed so that a plurality of opening doors all meet running paths.

Figure 3 is a front view of the visible mark forming the present invention's exposure device.

Figure 4 is an external perspective view of the reticle case positioning device that is provided to the present invention's exposure device.

Figure 5A to 5H show a first embodiment of the present invention, and are planar views for explaining the reticle case guiding sequence in the guiding device disposed inside the exposure device.

Figure 6 is a planar view showing a reticle case that has been placed on to the reticle case loading surface of the reticle case positioning device that forms the present invention's exposure device.

Figure 7 shows a second embodiment of the present invention, and is a schematic structural view in which a plurality of guiding devices that can receive reticle cases by

This Sheet Has Been Replaced

projecting out from a plurality of opening doors are disposed inside the chamber of an exposure device.

Figure 8 shows a second embodiment of the present invention, and is a schematic structural view in which exposure devices are disposed so that a plurality of opening doors all meet running paths.

Figure 9 is an external perspective view of one example of an exposure device according to the conventional technology.

Figure 10 is a planar view in which an exposure device according to the conventional technology is disposed so that the opening doors meet the running path.

Preferred Embodiments of the Present Invention

A first embodiment of the present invention's substrate treating device will now be explained with reference to Figures 1 through 6. The substrate treating device will be explained using as an example the case of an exposure device that performs a projecting and transferring treatment on a substrate. This explanation further employs an example of the case in which there are two sites at which substrate transfer by a substrate giving and receiving device is performed. In these figures, structural components equivalent to those shown in Figures 9 and 10, in which a conventional example is pictured, have been assigned the same numeric symbol, and an explanation thereof has been omitted.

Numeric symbols 7A~7D in Figure 2 indicate exposure devices that are disposed in a clean room. Numeric symbol 3 is an AGV. Exposure devices (substrate treating devices) 7A~7D are disposed to device installation 8, which is surrounded on its four sides by the running paths 6A~6D for AGV 3 and is provided in the form of a lattice, so that the respective front surfaces FA~FD of exposure devices 7A~7D meet different running paths 6A~6D.

Figure 1 is a schematic structural view showing an example of the internal structure of exposure device 7A. (Exposure devices 7B~7C have the same design as exposure device 7A, so that an explanation thereof will be omitted.) This figure shows only the reticle guiding system and the exposure system. The wafer guiding system and air-conditioning system for maintaining a specific environment within the chamber have been omitted from the figure. Note that Z designates the vertical direction (i.e., the direction of the optical axis in the exposure and projecting systems) in this figure, while the directions perpendicular to Z are denoted as the X and Y directions.

Employing reticle R (mask), which is the substrate received from the outside, exposure device 7A exposes wafer W (photosensitive substrate) to the pattern on reticle R. Exposure device 7A is provided with a box-shaped chamber 9 enclosing the device. Respective opening/closing doors 10,11 are provided to front surface FA and side surface SA, which is roughly perpendicular to front surface FA, of chamber 9, and

are capable of opening and closing via a hinge. Horizontally long opening door (first receiving portion) 12 and opening door (second receiving portion) 13 are provided to opening/closing doors 10,11. Further, visible marks 14,14 as shown in Figure 3 are provided to opening/closing doors 10,11 respectively.

A guiding device (substrate guiding device) 16 for receiving reticle R which is guided from the outside while housed in a roughly rectangular reticle case RC is provided to the inside of opening/closing door 10,11. Guiding device 16 is designed so that a guiding arm 15 projects outward from either opening door 12,13 and can receive reticle case RC.

Guiding arm 15 is designed to enable movement of its entirety in the vertical direction (Z direction). In addition, guiding arm 15 can rotate within the X-Y plane and is capable of telescopic motion with respect to its rotational axis. A reticle case positioning device 17, for correcting the XYθ direction of reticle case RC, and a reticle library 18, for storing a plurality of reticles R housed in respective reticle cases RC, are disposed to the side of guiding device 16 on top of a base 19.

As shown in Figure 4, the upper surface of reticle case positioning device 17 forms a reticle case loading surface 17A on which reticle cases RC transferred from guiding arm 15 are disposed. Three reticle case transferring pins 50A, 50B, 50C, and alignment pins 51A~51G for correcting the position of the XYθ direction of reticle case RC, are provided to the reticle

case loading surface 17A. Transfer pins 50A, 50B, 50C are designed so as to give reticle case RC to and receive reticle case RC from guiding arm 15 by means of synchronized vertical motion for example.

A rotating roller 52 that can rotate freely around the Z axis is provided to the end of alignment pins 51A~51G. Alignment pins 51A,51B,51C can move in the Y direction along slots 53A,53B,53C which are formed to reticle case loading surface 17A and are long and narrow in the Y direction.

Alignment pins 51D, 51E, 51F, and 51G can move in the X direction along slots 53D, 53E, 53F, and 53G which are formed to reticle case loading surface 17A and are long and narrow in the X direction. These transfer pins 50A~50C and alignment pins 51A~51G are designed to be driven by a driving device such as an air cylinder or motor that is housed inside reticle case positioning device 17.

An exposure system 20 is disposed inside chamber 9 as shown in Figure 1.

Exposure system 20 consists of an illuminating optical system, not shown in the figures, for illuminating a reticle R held on top of reticle stage RS with exposure light; a substrate stage ST on which a wafer W is loaded that is capable of moving in the XY direction; and a projection optical system PL for projecting the pattern image of reticle R held on top of reticle stage RS onto wafer W.

A reticle guiding device 21 is disposed in between reticle library 18 and exposure system 20. Reticle guiding

device 21 guides a specific reticle R from a plurality of reticle cases RC that are stored in reticle library 18 on to reticle stage RS of exposure system 20. In addition, reticle guiding device 21 returns a reticle R no longer in use from reticle stage RS to reticle case RC held in reticle library 18. Reticle guiding device 21 is provided with a slider 22, carrier 23, loading arm 24, and unloading arm 25.

Slider 22 is provided so as to enable movement in the Y and Z directions inside reticle case RC stored in reticle library 18, slider 22 extracting a reticle R housed parallel to the XY plane from reticle case RC, and returning reticle R to reticle case RC. Vacuum suction holes are provided in slider 22 for maintaining and releasing vacuum suction holding of reticle R by means of turning a vacuum pump, not shown in the figures, ON or OFF.

Carrier 23 is designed to enable movement in the X direction. Carrier 23 has a vacuum suction hole on its bottom portion and performs vacuum suction holding and releasing of reticle R. Carrier 23 guides reticle R from the transfer position CA1 with slider 22, to position CA2. A mechanism (not shown in the figures) is provided to carrier 23 for pre-aligning reticle R by holding it from two directions taking four sides as a standard.

Loading arm 24 and unloading arm 25 can move in the Y and Z directions. Further, loading arm 24 and unloading arm 25 are designed to move individually in the Y direction between position CA2 and reticle stage RS. Loading arm 24 and

unloading arm 25 are designed to move in a unitary manner in the Z direction. As in the case of slider 22, a vacuum suction hole is provided to loading arm 24 and unloading arm 25 for holding reticle R, with the vacuum suction holding and releasing of reticle R enabled by turning the vacuum ON or OFF.

The operation of an exposure device 7A (exposure devices 7B~7C being equivalent) having the structure described above will now be explained.

As shown in Figure 2, a reticle case RC, in which the desired reticle from the reticle stocker (not shown) is housed, has been passed to AGV 3. Under the direction of a host computer, AGV 3 moves to and stops at a position in front of the front surface FA of exposure device 7A to which reticle case RC is to be transferred.

As shown in Figure 1, a visible mark 14, consisting of a mark 14A such as a round mark or circular mark as shown in Figure 3 for example, is provided to opening/closing door 10 which is provided to front surface FA of exposure device 7A. AGV 3 picks up the image of this visible mark 14 with an image pick-up device (not shown), and determines the transfer position for reticle case RC with guiding device 16, which is provided inside exposure device 7A, based on the position of this visible mark 14.

Based on the directives from the host computer, a computer for controlling exposure device 7A overall drives guiding device 16 on the exposure device 7A side.

Namely, opening door 12 on the front surface FA of chamber 9 opens. Next, guiding arm 15 of guiding device 16 which is provided inside exposure device 7A projects out from opening door 12 to the reticle case transfer position outside chamber 9.

AGV 3 communicates with the control computer for exposure device 7A by means of optical communications, for example. AGV 3 transfers reticle case RC, which has been guided from the reticle stocker, to guiding arm 15 of guiding device 16 while maintaining mutual timing.

Figure 5A to 5H are planar views for explaining the guiding sequence for reticle case RC of guiding device 16 which is disposed inside exposure device 7A. Figure 5A shows the case in which reticle case RC has been transferred to guiding arm 15 of guiding device 16 from AGV, at the reticle case transfer position.

AGV places reticle case RC on guiding arm 15 of guiding device 16, while at the same time the vacuum suction of guiding arm 15 is turned ON so that reticle case RC is held by vacuum suction. Next, as shown in Figure 5B, guiding arm 15 pulls reticle case RC to the home position inside chamber 9. Then, as shown in Figure 5C, guiding arm 15 is rotated 90° to direct reticle case RC in the direction of reticle case positioning device 17.

When transferring reticle case RC to reticle case positioning device 17, guiding arm 15 advances above reticle case positioning device 17 as shown in Figure 5D. Then,

reticle case transferring pins 50A, 50B, 50C rise to come in contact with the bottom surface of reticle case RC. The vacuum suction in guiding arm 15 is then turned OFF.

As a result, reticle case RC is transferred above reticle case transfer pins 50A, 50B, 50C. Guiding arm 15 then retreats below reticle case RC. Next, reticle case transfer pins 50A, 50B, 50C are lowered, and reticle case RC is loaded onto reticle case loading surface 17A.

Figure 6 is a planar view showing reticle case RC which has been loaded onto reticle case loading surface 17A of reticle case positioning device 17. The positioning of reticle case RC by the computer of exposure device 7A will now be explained with reference to the figures.

The computer in exposure device 7A drives alignment pins 51A, 51B to a specific position in the Y direction, while at the same time driving alignment pin 51C to a specific position in the -Y direction, by means of a driving device inside reticle case positioning device 17. As a result of this movement, alignment pins 51A,51B come into contact with guide 26A of reticle case RC, and are subjected to position control while being pushed in the +Y direction. Alignment pin 51C, which is on the opposite side, comes into contact with guide 26B, and is subjected to position control while being pushed in the -Y direction. As a result, the Y directional position and the rotational position in the θ direction of reticle case RC are controlled to a specific arrangement. Positioning of reticle case RC in the Y and θ directions is then carried.

Next, the computer in exposure device 7A drives alignment pins 51D to a specific position in the -X direction, while at the same time driving alignment pin 51E to a specific position in the +X direction. As a result of this driving, guide 26A defines the position in the X direction. At the same time, the computer drives alignment pin 51F to a specific position in the -X direction, and drives alignment pin 51G to a specific position in the +X direction. As a result, guide 26B defines the position in the X direction.

Reticle case RC moves in the X direction while being held by alignment pins 51A~51C which carry out position control in the Yθ direction. Alignment pins 51A~51C come in contact with guides 26A, 26B of reticle case RC via rotating roller 52. Therefore, positioning of reticle case RC in the X direction is not hindered due to pressing of guides 26A, 26B by alignment pins 51A~51C. In this way, the positioning of reticle case RC is completed.

Once the positioning of reticle case RC by reticle case positioning device 17 is completed, the computer in exposure device 7A drives alignment pins 51A~51G so that they move away from the outer periphery of reticle case RC. Next, reticle case transferring pins 50A~50C rise, lifting up reticle case RC.

Next, guiding arm 15 of guiding device 16 moves below reticle case RC, and receives reticle case RC which is loaded on reticle case transferring pins 50A~50C. When guiding arm 15 receives reticle case RC, the vacuum suction is turned ON

and reticle case RC is held in place. Guiding arm 15 which is holding reticle case RC once again returns to the home position as shown in Figure 5E.

Once at the home position, guiding arm 15 rotates 90° as shown in Figure 5F, to face in the direction of reticle library 18. Next, guiding arm 15 which is holding reticle case RC determines a position at a specific height along the vertical axis (Z direction) not shown in the figures, and then advances into reticle library 18 at a specific position as shown in Figure 5G. The vacuum suction in guiding arm 15 is turned OFF. Guiding arm 15 retreats downward, and reticle case RC is automatically fixed in position by a reticle case automated fixing mechanism not shown in the figures that is housed in reticle library 18.

Guiding arm 15, which is now empty, again returns to the home position as shown in Figure 5H, bringing the guiding sequence to an end. If guiding arm 15 rotates 180°, it returns to the state shown in Figure 5B. In the case where a reticle which is not needed is removed from reticle library 18, the preceding sequence is carried out in reverse.

As shown in Figure 1, slider 22 enters into reticle case RC and extracts a reticle R in reticle case RC, which is held inside reticle library 18. Slider 22 removes only this pre-designated reticle R, moving it in the -Y direction while holding it by means vacuum suction. While maintaining this arrangement, slider 22 moves to highest position along the Z

direction, guiding reticle R to transfer position CA1 for transfer to carrier 23.

The transfer of reticle R is carried out at transfer position CA1, where slider 22 releases the suction hold on reticle R, and carrier 23 begins suction holding of reticle R via its vacuum suction holes. Carrier 23 guides reticle R from transfer position CA1 to position CA2 while suction holding reticle R. Reticle R undergoes pre-alignment at this point in time.

The transfer of reticle R to loading arm 24 is carried out at position CA2, where suction holding by carrier 23 is released and suction holding by loading arm 24 begins. Loading arm 24 moves reticle R in the Y direction while suction holding reticle R. Reticle R is then loaded onto reticle stage RS by releasing suction holding.

Reticle R held on top of reticle stage RS is illuminated with exposure light from the illuminating optical system in exposure system 20. As a result, the pattern image on reticle R is projected and transferred onto wafer W which is loaded on substrate stage ST via projection optical system PL.

When a reticle R that is not needed is extracted from reticle stage RS, unloading arm 25 suction holds reticle R which has been loaded on reticle stage RS, and moves to position CA2. The above-described sequence is then carried out in reverse, with reticle R stored in reticle library 18 via carrier 23 and slider 22.

AGV 3, which has transferred reticle case RC to guiding device 16 of exposure device 7A, moves to a position in front of side surface SC of exposure device 7C by running along running path 6A shown in Figure 2. The transfer of reticle case RC is carried out here in the same manner as with exposure device 7A as described above. The guiding arm 15 of guiding device 16 which is disposed inside exposure device 7C projects outside chamber 9 through opening door 13 which meets running path 6A, and receives reticle case RC.

AGV 3 subsequently carries out the transfer of reticle case RC with guiding arm 15 of guiding device 16 which is projecting out from side surface SD of exposure device 7D and side surface SB of exposure device 7B by running along running path 6B and running path 6C sequentially.

When AGV 3 is traveling on a running path in this route, guiding arm 15 of guiding device 16 is projected out from the front surface FC of exposure device 7C, the front surface FD of exposure device 7D, and the side surface SB of exposure device 7B, enabling selection to carry out transfer of reticle case RC.

It is also possible to select a different route than that above.

Namely, by running in sequence on running paths 6D, 6C, and 6B, the guiding arm 15 of guiding device 16 is projected out from side surface SA of exposure device 7A, front surface FB or exposure device 7B, side surface SD of exposure device

7D and front surface FC of exposure device 7C, to enable optimal selection to carry out transfer of reticle case RC.

In the exposure device according to this embodiment of the present invention, opening doors 12,13 are provided to both the front surface FA and side surface SA, which is roughly perpendicular to front surface FA, of chamber 9. Guiding arm 15 of guiding device 16 projects to the outside from either of opening doors 12,13, to enable receipt of reticle case RC. Accordingly, it is possible to optimally select the position for receiving reticle case RC.

For this reason, the design of the layout when disposing exposure devices 7A~7D is not restricted by the position for receiving reticle case RC. Thus, the optimal disposition can be selected, and the installation space can be effectively utilized.

By disposing exposure devices 7A~7D so that both opening doors 12,13 of exposure devices 7A~7D meet one of running paths 6A~6D, the running path for AGV 3 for guiding reticle case RC can be optimally selected from a plurality of paths. Accordingly, the running path for AGV 3 when guiding reticle case RC can be selected for optimal efficiency.

Figures 7 and 8 show a second embodiment of the present invention's exposure device.

In these figures, structural elements that are the same as those of the first embodiment shown in Figures 1 through 6 have been assigned the same numeric symbol and an explanation thereof has been omitted. The second embodiment differs from

the first embodiment with respect to the design of the chamber and the guiding device.

Namely, as shown in Figure 7, opening/closing doors 10,28 that open and close via a hinge are provided to either edge of front surface FA of chamber 9. Horizontally long opening door 12 and opening door (first receiving portion) 30 are provided to these opening/closing doors 10,28. In addition, respective visible marks 14,14 as shown in Figure 3 are provided to opening/closing doors 10,28.

Opening/closing doors 11,27 that open and close via a hinge are provided to front surface FA and side surfaces SA and KA which are roughly perpendicular to front surface FA. Horizontally long opening door 13 and opening door (second receiving portion) 29 are provided to these opening/closing doors 11,27. In addition, respective visible marks 14,14 as shown in Figure 3 are provided to opening/closing doors 11,27.

A guiding device 16 for receiving reticle R which was guided from the outside while housed in reticle case RC is provided on the inner side of opening/closing door 10,11. A guiding device 31 (substrate guiding device) for receiving reticle R which was guided from the outside while housed in reticle case RC is provided to the inner side of opening/closing door 27,28.

Guiding device 31 is disposed opposite guiding device 16 with reticle case positioning device 17 held therebetween. Guiding device 31 can receive reticle case RC by projecting guiding arm 32 from either of opening doors 29,30. Guiding

arm 32 is designed to move in the vertical direction (Z direction). This guiding arm 32 can rotate in the XY plane, and is capable of telescopic motion with respect to its rotational axis. Guiding devices 16,31 are designed so that one or both of these can be freely selected and driven.

As shown in Figure 8, the exposure devices 7A,7B which are provided with a chamber 9 and guiding devices 16,31 respectively are disposed to device installation 8 so that front surfaces FA, FB meet running path 6D. Similarly, exposure devices 7C,7D which are provided with a chamber 9 and guiding devices 16,31 respectively are disposed to device installation 8 so that front surfaces FC, FD meet running path 6B.

In addition to equivalent operations and effects as obtained in the preceding first embodiment, the exposure device according to this embodiment enables reticle case RC to be received from three directions in box-shaped chamber 9, by optimally selecting and separately using guiding devices 16,31. For this reason, there is an even greater degree of freedom when disposing exposure devices 7A~7D in device installation 8, enabling selection of an effective layout design.

In addition, respective front surfaces FA,FB of exposure devices 7A,7B meet the same running path 6D, while respective front surfaces FC,FD of exposure devices 7C,7D meet the same running path 6B. As a result, little movement is required

when performing maintenance activities for example, so that operations can be carried out efficiently.

Note that in the preceding embodiment, the present invention's substrate treating device employed a design in which the substrate treatment was an exposure treatment in which a pattern image on a reticle was projected and transferred on to a wafer. However, this invention is not limited thereto. For example, the present invention may also have a design which is applied to a coater for coating a photoresist to a wafer, or a developer for developing a wafer that was exposed in an exposure device. Further, although the present invention's substrate treating device employed a design in which the object being guided was a reticle, the present invention is not limited thereto. For example, the present invention's substrate treating device is also applicable to the case where the object being guided is a glass substrate used in a liquid crystal displays, or other substrates such as a mask or wafer.

In the preceding embodiment of the present invention's substrate treating device, when there are a plurality of reticle cases RC that have been guided by AGV 3 to be stored in reticle library 18 of exposure device 7A, the reticle cases RS received by guiding arm 15 are loaded and positioned on reticle case positioning device 17, and the action of storing the positioned reticle cases RC one at a time in a specific location in reticle library 18 is carried out repeatedly. In this case, a long period of time is required to move all the

reticle cases RC from AGV 3 to reticle library 18 of exposure device 7A. Moreover, AGV 3 must remain stopped at the reticle transfer position of exposure device 7A during this time period. Conversely, even in the case where a plurality of reticle cases RC are removed from the reticle library 18 of one exposure device and transferred to AGV 3, considerable time is required to transfer all the reticle cases RC if the design employed is one in which the reticle cases RC removed from reticle library 18 are positioned one at a time on reticle case positioning device 17, and then the action of transferring a reticle case to AGV 3 is carried out repeatedly. As a result, AGV 3 is restricted during this time.

In order to eliminate this type of inconvenience, as shown in Figures 1 and 7, exposure device 7A as described above may be provided with a reticle case housing shelf 33 which can temporarily house a plurality of reticle cases RC near reticle case positioning device 17. In this case, when storing a plurality of reticle cases RC in reticle library 18 after receiving them from AGV 3, guiding arm 15 on the exposure device 7A side can sequentially house reticle cases RC transferred from AGV 3 in reticle housing shelf 33 without performing positioning. Once all of the reticle cases RC have been transferred, AGV 3 moves to the next operational position, and removes reticle cases RC that were temporarily housed in reticle case housing shelf 33 in order inside exposure device 7A. AGV 3 then guides the reticle cases RC

onto reticle case positioning device 17, positions them, and houses them in a specific position in reticle library 18.

Conversely, when transferring a plurality of reticle cases RC to AGV 3 from reticle library 18 in exposure device 7A, guiding arm 15 extracts the designated reticle case RC from reticle library 18, loads it onto reticle case positioning device 17 and performs positioning. Then, the action of housing the reticle cases in reticle case housing shelf 33 is repeated until the extraction of all of the reticle cases RC is completed. By transferring reticle cases RC on which positioning has been completed in advance from reticle case housing shelf 33 to AGV 3 in sequence, it is possible to transfer a plurality of reticle cases RC from exposure device 7A to AGV 3 over a short period of time. By providing a reticle case housing shelf 33 that can temporarily store a plurality of reticle cases RC near reticle case positioning device 17 in this way, the time during which AGV 3 is restricted can be shortened, so that AGV 3 can be operated efficiently.

The preceding embodiment employed a type of AGV which runs on the floor of the clean room. However, the AGV used in this invention is not limited thereto. Namely, the AGV may be of the type that employs a motor or linear motor to transfer a reticle case guiding carrier along a track which has been installed above the reticle stocker and exposure device i.e., a design that employs so-called OHT (over head transportation) guiding. In this case, the opening door that is provided to

the reticle stocker or exposure device for giving the reticle case and receiving the reticle case from the AGV may be provided in the upper surface of the reticle stocker or the exposure device.

Alternatively, a design may also be employed in which a track is provided to the floor surface where the reticle stocker and the exposure device are disposed, and the reticle case guiding carrier is sent along this track. In this case, the opening door for giving and receiving the reticle case may be provided in the lower surface of the reticle stocker and the exposure device. In addition, a design may also be employed in which AGV guiding and OHT guiding are combined, with AGV guiding used to guide the wafer and OHT guiding used to guide the reticle.

Regarding the exposure device, a step-and-repeat exposure device may be employed in which the pattern of reticle R is exposed while reticle R and wafer W are held still, and wafer W is then moved in sequential steps, or a scanning exposure device may be used in which the pattern of reticle R is exposed by synchronized moving of reticle R and wafer W. The type of exposure device is not limited to the exposure devices employed in semiconductor manufacturing. Rather, for example, liquid crystal exposure devices in which a liquid crystal display element pattern is exposed on a square glass plate, or exposure devices for manufacturing thin film magnetic heads, are also broadly applicable.

Regarding the light source for the illuminating optical system, not only KrF eximer lasers (248 nm), ArF eximer lasers (193 nm) and F_2 lasers (157 nm) may be used, but also charged particle beams such as X rays or electron beams can be used. For example, when employing an electron beam, thermoelectron radiating lanthanum hexaboride (LaB_6) or tantalum (Ta) can be used as the electron gun.

The magnification of the projection optical system PL may be a reducing system, equimultipling system, or an enlarging system. When an eximer laser is employed as the projection optical system PL, quartz or fluorite may be used as the transparent material. When using X-rays, a cata-dioptric system is used (with a reflecting type also employed for the reticle). In the case where an electron particle beam is employed, an electronic optical system consisting of an electronic lens and polarizing device can be employed as the optical system. The path taken by the electron beam is of course linear.

In addition, the present invention can also be employed in a proximity exposure device which does not employ a projection optical system and which exposes the pattern of a reticle R by closely adhering the reticle R and a wafer W together.

Industrial Field of Application

As explained above, the substrate treating device according to claim 1 is provided with plurality of receiving portions where the substrate guiding device receives a

This Sheet Has Been Replaced



substrate from the outside. As a result, in this substrate treating device, the position for receiving the substrate does not impose a restriction on the design of the layout for disposing the devices. Thus, the optimal disposition can be selected and the installation space can be effectively utilized. By disposing the substrate treating devices so that the receiving portion of each substrate treating device meets one of the running paths, it is possible to optimally select the running path for the AGV guiding the substrate from a plurality of running paths. Accordingly, since the running path for the AGV guiding the substrate can be selected for optimal efficiency, an improvement in production efficiency can be realized.

The substrate treating device according to claim 2 is designed so that the first and second receiving portions from among a plurality of receiving portions are provided on different surfaces. As a result, in this substrate treating device, the substrate treating device can be disposed so that at least one of the different surfaces to which the first and second receiving portions are disposed meets a running path. Thus, in this substrate treating device, the position for receiving the substrate does not impose a restriction on the design of the layout for disposing the devices. Thus, the optimal disposition can be selected, and the installation space can be used effectively. Moreover, the running path for the AGV when guiding the substrate can be selected for optimal

This Sheet Has Been Replaced



efficiency, so that an improvement in production efficiency can be realized.

The substrate treating device according to claim 3 is designed so that the aforementioned different surfaces are roughly perpendicular to one another. Accordingly, in this substrate treating device, it is not absolutely essential that the devices all face the same direction. For example, the devices can be disposed back-to-back. As a result, in this substrate treating device, the position for receiving the substrate does not impose a restriction on the design of the layout for disposing the devices. Thus, the optimal disposition can be selected, and the installation space can be used effectively. Moreover, the running path for the AGV when guiding the substrate can be selected for optimal efficiency, so that an improvement in production efficiency can be realized.

The exposure device according to claim 4 is designed to employ one of the substrate guiding device according to claims 1 through 3 for guiding a mask. Thus, in this exposure device, the position for receiving the mask does not impose a restriction on the design of the layout for disposing the devices. Thus, the optimal disposition can be selected, and the installation space can be used effectively. Moreover, by disposing the exposure devices so that the receiving portions for each of the exposure devices meet one of the running paths, the running path for the AGV when guiding the mask can be optimally selected from a plurality of running paths.

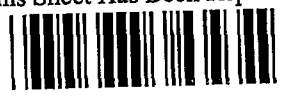
This Sheet Has Been Replaced

Accordingly, the running path for the AGV guiding the mask can be selected for optimal efficiency, so that an improvement in production efficiency can be realized.

The exposure device according to claim 5 is designed so that at least one of the plurality of receiving portions is present on the side surface of a box-shaped chamber that surrounds the exposure device. As a result, in this exposure device, the position for receiving the mask does not impose a restriction on the design of the layout for disposing the devices. Thus, the optimal disposition can be selected, and the installation space can be used effectively. Moreover, by disposing the exposure devices so that the receiving portion for each of the exposure devices meets one of the running paths, the running path for the AGV when guiding the mask can be optimally selected from a plurality of running paths. Accordingly, the running path for the AGV guiding the mask can be selected for optimal efficiency, so that an improvement in production efficiency can be realized.

The substrate treating method according to claim 6 has a step in which a substrate guiding device receives a substrate from the outside via at least one of a plurality of receiving portions. As a result, when executing this substrate treating method, the position for receiving the substrate does not impose a restriction on the design of the layout for disposing the devices. Thus, the optimal disposition can be selected, and the installation space can be used effectively. Moreover, by disposing the substrate treating devices so that the

This Sheet Has Been Replaced



receiving portion for each of the substrate treating devices meets one of the running paths, the running path for the AGV when guiding the substrate can be optimally selected from a plurality of running paths. Accordingly, the running path for the AGV guiding the substrate can be selected for optimal efficiency, so that an improvement in production efficiency can be realized.

The substrate treating method according to claim 7 has a step in which the substrate is received via at least one of a first receiving portion and a second receiving portion that are provided on different surfaces. Accordingly, when executing this substrate treating method, the substrate treating device is disposed so that at least one of the different surfaces to which the first and second receiving portions are disposed meets a running path. As a result, when disposing the devices, there is no restriction imposed on the layout design by the position for receiving the substrate. Thus, the optimal disposition can be selected, and the installation space can be used effectively. Moreover, the running path for the AGV when guiding the substrate can be selected for optimal efficiency, so that an improvement in production efficiency can be realized.

The substrate treating method according to claim 8 has a step in which the substrate is received via at least one of a first receiving portion and a second receiving portion that are provided on different surfaces that are roughly perpendicular to one another. Accordingly, when executing

This Sheet Has Been Replaced

this substrate treating method, it is not absolutely essential that the devices all face the same direction. For example, the devices can be disposed back-to-back. As a result, when disposing the devices, there is no restriction imposed on the layout design by the position for receiving the substrate. Thus, the optimal disposition can be selected, and the installation space can be used effectively. Moreover, the running path for the AGV when guiding the substrate can be selected for optimal efficiency, so that an improvement in production efficiency can be realized.

The exposure method according to claim 9 is designed to employ one of the substrate treating methods according to claims 1 through 3 for guiding a mask. Thus, in this exposure method, when disposing the devices, there is no restriction imposed on the layout design by the position for receiving the mask. Thus, the optimal disposition can be selected, and the installation space can be used effectively. Moreover, by disposing the exposure devices so that the receiving portions for each of the exposure devices meet one of the running paths, the running path for the AGV when guiding the mask can be optimally selected from a plurality of running paths. Accordingly, the running path for the AGV guiding the mask can be selected for optimal efficiency, so that an improvement in production efficiency can be realized.

The exposure device according to claim 10 is designed so that at least one of the plurality of receiving portions is present on the side surface of a box-shaped chamber that

This Sheet Has Been Replaced



surrounds the exposure device. Accordingly, in this exposure method, when disposing the devices, there is no restriction imposed on the layout design by the position for receiving the mask. Thus, the optimal disposition can be selected, and the installation space can be used effectively. Moreover, by disposing the exposure devices so that the receiving portions for each of the exposure devices meet one of the running paths, the running path for the AGV when guiding the mask can be optimally selected from a plurality of running paths. Accordingly, the running path for the AGV guiding the mask can be selected for optimal efficiency, so that an improvement in production efficiency can be realized.

This Sheet Has Been Replaced



What is claimed:

1. A substrate treating device having a substrate guiding device that guides a substrate received from the outside, which carries out a specific treatment using said substrate guided by said substrate guiding device, wherein said substrate guiding device has a plurality of receiving portions that receives said substrate from the outside.

2. A substrate treating device according to claim 1, wherein a first receiving portion and a second receiving portion from among said plurality of receiving portions are provided on different surfaces.

3. A substrate treating device according to claim 2, wherein said different surfaces are roughly perpendicular to one another.

4. An exposure device that exposes said pattern of a mask, which is a patterned substrate, onto a photosensitive substrate, comprising one of said substrate guiding device according to claims 1 through 3 for guiding said mask.

5. An exposure device according to claim 4, further comprising a box-shaped chamber for enclosing said exposure devices, wherein at least one of said plurality of receiving

This Sheet Has Been Replaced

* C L M S *

portions is present on the side surface of said box-shaped chamber.

6. A substrate treating method, wherein a substrate is received via at least one of a plurality of receiving portions that are provided to a substrate guiding device, said substrate is guided by said substrate guiding device, and a specific treatment is performed using said substrate.

7. A substrate treating method according to claim 6, wherein a substrate is received via at least one of a first receiving portion and a second receiving portion that are provided on different surfaces from among said plurality of receiving portions.

8. The substrate treating method according to claim 7, wherein a substrate is received via at least one of said first receiving portion and said second receiving portion which are provided to said different surfaces that are approximately perpendicular with one another.

9. An exposure method for exposing said pattern of a mask, which is a patterned substrate, onto a photosensitive substrate, employing one of said substrate guiding methods according to claims 6 through 8 for said guiding mask.

This Sheet Has Been Replaced

10. An exposure method according to claim 9, wherein said mask is received via at least one of said plurality of receiving portions that are present on the side surface of a box-shaped chamber that encloses exposure devices.



This Sheet Has Been Replaced

