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Substrate processing apparatus and substrate processing method

Abstract

A substrate processing apparatus includes: a carrier block including carrier placement parts and configured to load/unload a substrate into/from a carrier; a processing block provided on one side of the carrier block to process the substrate; first and second carrier placement parts of the carrier placement parts and provided side by side in a front-rear direction in a plan view; substrate placement parts provided to be arranged step by step vertically on one side of a substrate transfer region formed between the first and second carrier placement parts; a first substrate transfer mechanism provided in the substrate transfer region to deliver the substrate between the carrier of the first carrier placement part and a first substrate placement part of the substrate placement parts; and a second substrate transfer mechanism for moving upward and downward so as to deliver the substrate between first and second substrate placement parts.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATION

(1) This application is based upon and claims the benefit of priority from Japanese Patent Application No. 2021-163665, filed on Oct. 4, 2021, the entire contents of which are incorporated herein by reference.

TECHNICAL FIELD

(2) The present disclosure relates to a substrate processing apparatus and a substrate processing method.

BACKGROUND

(3) In a semiconductor device manufacturing process, processes such as a liquid process and a heating process are performed on a semiconductor wafer (hereinafter referred to as a “wafer”) which is transferred between various processing modules inside a substrate processing apparatus. The wafer is transferred to the substrate processing apparatus by a carrier. Patent Document 1

discloses a substrate processing apparatus including a carrier block for delivering and receiving a wafer to and from a carrier. This carrier block is provided with two transfer mechanisms between which a stack including a plurality of substrate placement parts is sandwiched. Each of the two transfer mechanism includes a holder for delivering the wafer to and from the placement parts, and a holder for delivering the wafer to and from the carrier.

PRIOR ART DOCUMENTS

Patent Documents

(4) Patent Document 1: Japanese Laid-Open Publication No. 2013-069916

SUMMARY

(5) According to one embodiment of the present disclosure, there is provided a substrate processing apparatus including: a carrier block including a plurality of carrier placement parts on each of which a carrier configured to receive a substrate is placed to perform a loading/unloading of the substrate with respect to the carrier; a processing block provided on one of left and right sides of the carrier block to process the substrate; a first carrier placement part and a second carrier placement part included in the plurality of carrier placement parts and provided side by side in a front-rear direction in a plan view, wherein at least one of the first carrier placement part or the second carrier placement part is at least one substrate loading/unloading carrier placement part; a plurality of substrate placement parts provided to be arranged step by step in a vertical direction on one of left and right sides of a substrate transfer region formed between the first carrier placement part and the second carrier placement part in the plan view, wherein the substrate is placed on each of the plurality of substrate placement parts; a first substrate transfer mechanism provided in the substrate transfer region and configured to rotate around a vertical axis so as to deliver the substrate between the carrier of the first carrier placement part and a first substrate placement part included in the plurality of substrate placement parts; and a second substrate transfer mechanism configured to move upward and downward so as to deliver the substrate between the first substrate placement part and a second substrate placement part included in the plurality of substrate placement parts, wherein the substrate is placed on the second substrate placement part to be delivered to the processing block.

Description

BRIEF DESCRIPTION OF DRAWINGS

(1) The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate embodiments of the present disclosure, and together with the general description given above and the detailed description of the embodiments given below, serve to explain the principles of the present disclosure.

(2) FIG. **1** is a horizontal cross-sectional plan view of a coating/developing apparatus according to an embodiment of a substrate processing apparatus of the present disclosure.

(3) FIG. **2** is a vertical cross-sectional front view of the coating/developing apparatus.

(4) FIG. **3** is a schematic perspective view of a carrier block provided in the coating/developing apparatus.

(5) FIG. **4** is a side view of the carrier block.

(6) FIG. **5** is an explanatory view illustrating transfer of a carrier in the carrier block.

(7) FIG. **6** is an explanatory view illustrating the transfer of the carrier in the carrier block.

(8) FIG. **7** is an explanatory view illustrating the transfer of the carrier in the carrier block.

(9) FIG. **8** is a plan view of the carrier block.

(10) FIG. **9** is an explanatory view illustrating an operation of a transfer mechanism provided in the carrier block.

(11) FIG. **10** is a vertical cross-sectional side view of a processing block provided in the

coating/developing apparatus.
(12) FIG. **11** is a schematic front view of the carrier block and the processing block.
(13) FIG. **12** is a plan view of a shuttle provided in the processing block.
(14) FIG. **13** is an explanatory view illustrating a wafer transfer route in the coating/developing apparatus.
(15) FIG. **14** is an explanatory view illustrating the wafer transfer route in the coating/developing apparatus.
(16) FIG. **15** is a plan view illustrating a modification of the carrier block.
(17) FIG. **16** is a side view of the modification.
(18) FIG. **17** is a plan view illustrating another modification of the carrier block.
(19) FIG. **18** is a schematic front view illustrating another configuration example of the substrate processing apparatus.

DETAILED DESCRIPTION

(20) Reference will now be made in detail to various embodiments, examples of which are illustrated in the accompanying drawings. In the following detailed description, numerous specific details are set forth in order to provide a thorough understanding of the present disclosure. However, it will be apparent to one of ordinary skill in the art that the present disclosure may be practiced without these specific details. In other instances, well-known methods, procedures, systems, and components have not been described in detail so as not to unnecessarily obscure aspects of the various embodiments.

(21) A coating/developing apparatus **1** according to an embodiment of the substrate processing apparatus of the present disclosure will be described with reference to each of a cross-sectional plan view of FIG. **1** and a vertical cross-sectional front view of FIG. **2**. In the coating/developing apparatus **1**, a carrier block D**1**, a first stacked processing block D**2**, a second stacked processing block D**3**, and an interface block D**4** are arranged linearly in a horizontal direction in this order. In addition, adjacent ones of these blocks (the carrier block, the first and second stacked processing blocks, and the interface block) D**1** to D**4** are connected to each other. These blocks D**1** to D**4** are separated from each other by respective housings. A transfer region for wafers W, which are circular substrates, is formed inside each housing.

(22) The arrangement direction of the blocks D**1** to D**4** will be referred to as a “left-right direction”. For the sake of convenience in description, a side of the carrier block D**1** will be referred to as a “left side”, and a side of the interface block D**4** will be referred to as a “right side”. In addition, when the carrier block D**1** is viewed as the left with respect to a front-rear direction of the apparatus, the near side will be referred to as a “front side” and the deep side will be referred to as a “rear side”. An exposure machine **20** is connected to the interface block D**4** from the right side. In each figure, the arrangement direction of the blocks D**1** to D**4** (the left to right direction) is indicated as an X direction in each figure, and the front-rear direction is indicated as a Y direction. The X direction and the Y direction are linear directions which are orthogonal to each other.

(23) Before explaining each of the blocks D**1** to D**4** in detail, a schematic configuration of the coating/developing apparatus **1** will be described. A wafer W is transferred to the coating/developing apparatus **1** in a state of being stored in a carrier C called, for example, a front opening unify pod (FOUP). Each of the first stacked processing block D**2** and the second stacked processing block D**3** are partitioned to be divided into two in the vertical direction. Each Partitioned block constitutes a processing block including a processing module (first processing module) and a main transfer mechanism capable of delivering the wafer W to and from the processing module. A lower side and an upper side of the first stacked processing block D**2** partitioned into two blocks as described above will be referred to as a “processing block **2**A” and a “processing block **2**B”, respectively. A lower side and an upper side of the second stacked processing block D**3** partitioned into two blocks will be referred to as a “processing block **2**C” and a “processing block **2**D”, respectively.

(24) Since the processing blocks **2**A and **2**C are adjacent to each other, these processing blocks **2**A and **2**C may be collectively referred to as "lower processing blocks". In addition, since the processing blocks **2**B and **2**D are adjacent to each other, these processing blocks **2**B and **2**D may be collectively referred to as "upper processing blocks". FIG. **1** illustrates these upper processing blocks. Each of the upper processing blocks **2**B and **2**D is provided with a transfer mechanism (a bypass transfer mechanism) different from the main transfer mechanism. Hereinafter, the different transfer mechanism will be referred to as a "shuttle". The shuttle transfers the wafer W toward the block on the downstream side of a transfer route without passing through a processing module.
(25) The lower processing blocks form a forward route for transferring the wafer W from the carrier block D**1** toward the interface block D**4**. A coating film such as a resist film is formed on the wafer W in the forward route. The upper processing blocks form a rearward route for transferring the wafer W, which has been exposed by the exposure machine **20**, from the interface block D**4** to the carrier block D**1**. In the rearward route, the wafer W is transferred to a processing module by the main transfer mechanism in one of the processing blocks **2**B and **2**D and processed, and in the other processing block, the wafer W is transferred by a shuttle. In other words, there are two transfer routes for the rearward route. The wafer W is transferred via one of the two routes. The module is a place in which the wafer W is placed other than the transfer mechanism (including the shuttle). A module that performs a process on the wafer W will be described as a processing module as described above. This process also includes capturing an image for inspection.
(26) Hereinafter, the carrier block D**1** will be described with reference to a schematic perspective view of FIG. **3** and a side view of FIG. **4**. Inside a clean room in which the coating/developing apparatus **1** is installed, a transfer mechanism for carrier C called an overhead hoist transfer (OHT), for example, is provided. By the transfer mechanism (hereinafter, referred to as an "external transfer mechanism"), the carrier C is loaded into and unloaded from the carrier block D**1**. The carrier block D**1** performs the loading/unloading of the wafer W with respect to the carrier C transferred by the external transfer mechanism, and delivers the wafer W between the lower processing blocks and the upper processing blocks.
(27) The carrier C includes a rectangular container main body and a lid C**1**. The lid C**1** is detachable from the container main body, and closes a wafer loading/unloading opening formed in a side surface of the container main body. When viewed in an opening direction of the opening, a left-right width L**1** of the carrier C is larger than a front-rear width L**2** thereof. In addition, the front, rear, left, and right described in the description of the carrier C do not necessarily correspond to the front, rear, left, and right described in the description of the apparatus. A handle C**2** is provided on the top of the container main body of the carrier C. For the sake of avoiding complexity of description, the handles C**2** and the lids C**1** are omitted in some of the figures, and the lids C**1** are indicated only in some of the carriers C in FIG. **4**. Since the lids C**1** are provided as described above, the lids C**1** represent the opening directions of the openings of the carriers C.
(28) In the carrier block D**1**, each member constituting the carrier block D**1** is arranged in a layout that prevents the carrier block D**1** from increasing in size. Further, the carrier block D**1** is configured to prevent an increase in size when a large number of carriers C having the widths L**1** and L**2** are placed. The carrier block D**1** is provided with three stages **11** to **13** having different roles as carrier placement parts.
(29) The stage **11** constituting a third carrier placement part is a stage to which the above-mentioned external transfer mechanism delivers the carrier C, and will be referred to as an "external delivery stage **11**" below. The stage **12** is a stage on which the carrier C is placed for performing the loading (carrying-in) and unloading (carrying-out) of the wafer W with respect to the carrier block D**1**, and is a carrier placement part for substrate loading/unloading. Since the stage **12** moves for loading and unloading as will be described later, the stage **12** will be referred to as a "moving stage **12**" below. The stage **13** is a standby carrier placement part for temporarily retreating and placing the carrier C when it is impossible to transfer the carrier C to the stages **11**

and **12** of a transfer destination, and will be referred to as a "retreating stage **13**" below. The carrier block D**1** includes a rectangular housing **14**, and the stages **11** to **13** are provided at the left side of the housing **14** symmetrically with respect to the front-rear center.

(30) The arrangement of the stages **11** to **13** will be described in detail. A loading/unloading shelf **15** is provided above a left vertical (perpendicular) side surface of the housing **14**. The loading/unloading shelf **15** is formed from the front end to the rear end of the side surface. In addition, on the loading/unloading shelf **15**, four external delivery stages **11** are arranged in the front-rear direction. On each external delivery stage **11**, the carrier C is placed to be in a first orientation in which the opening of the carrier C faces the right side (that is, the lid C**1** is positioned at the right side) in accordance with an orientation in which the external transfer mechanism transfers the carrier C. For example, the two external delivery stages **11** on the rear side and the two external delivery stages **11** on the front side are used, respectively, as stages for loading carriers C into the carrier block D**1** and stages for unloading carriers C from the carrier block D**1**.

(31) In addition, a front-rear central portion of the left wall of the housing **14** below the loading/unloading shelf **15** is formed to be drawn out and protrude leftward so as to form a vertically elongated rectangular protruding wall portion **16**. A region surrounded by the protruding wall portion **16** is configured as a transfer region **17**. Two openings **21** for loading/unloading the wafer W are provided on each of the front side surface and the rear side surface of the protruding wall portion **16**. The two openings **21** formed in the same side surface are spaced apart from each other in the vertical direction. As a result, a total of four openings **21** are arranged in a 2×2 matrix form when viewed in the left-right direction. The left and right positions of respective openings **21** are the same. Each opening **21** is closed by a door **22** from the inner side of the housing **14**.

(32) A lower portion of each opening **21** on the rear side surface of the protruding wall portion **16** protrudes rearward, and a lower portion of each opening **21** on the front side surface of the protruding wall portion **16** protrudes forward, thereby constituting support portions **23**, respectively. Therefore, the support portions **23** are also arranged in a 2×2 matrix form when viewed in the left-right direction, and are provided to correspond to the openings **21** and the doors **22**, respectively. The moving stages **12** are provided on the support portions **23**, and the carriers C are placed on the moving stages **12**, respectively, to be in a second orientation in which the openings thereof face the openings **21** in the projecting wall portions **16**, respectively. The moving stages **12** provided at one side of the protruding wall portion **16** in the front-rear direction serve as first carrier placement parts, and the moving stages **12** provided on the other side in the front-rear direction serve as second carrier placement parts. The positions of respective moving stages **12** in the left-right direction are aligned with the positions of the external delivery stages **11**. Each support portion **23** is provided with a moving mechanism for moving, for example, the moving stage **12** and the door **22** corresponding to the support portion **23**.

(33) Each moving stage **12** described above is movable in the front-rear direction between a loading position relatively close to the opening **21** and an unloading position relatively far from the opening **21**. The loading position is a position at which the wafer W is loaded into and unloaded from the carrier C, and the unloading position is a position at which the carrier C is delivered to and from a carrier transfer mechanism **26**, which will be described later. The door **22** is switchable between holding and non-holding of the lid C**1** with respect to the carrier C at the loading position, and is movable to the height of the support portion **23** below the opening **21** in the state of holding the lid C**1**. Therefore, the door **22** performs attachment/detachment of the lid C**1** of the carrier C and opening/closing the door **22**.

(34) Three stages of shelves **24** are provided on each of the front side and rear side of the protruding wall portion **16**. The shelves **24** on the front side are provided in front of the support portions **23** on the front side, and the shelves **24** on the rear side are provided in rear of the support portions **23** on the rear side. The retreating stage **13** is disposed on each shelf **24**. As a result, the retreating stages **13** are positioned in a 2×3 matrix form when viewed in the left-right direction.

The carriers C are placed on the retreating stages **13** on the shelves **24** such that the openings are oriented in the left-right direction. More specifically, the openings face the protruding wall portion **16**. The positions of respective retreating stages **13** on the shelves **24** in the left-right direction are the same as each other, and are also the same as the positions of the moving stages **12** in the left-right direction.
(35) The carriers C are placed on the uppermost retreating stages **13** at the same height as the carrier C on the moving stage **12** positioned in the upper stage. The carriers C on these stages **12** and **13** are arranged in the front-rear direction. The carriers C are placed on the lowermost retreating stages **13** at the same height as the carriers C on the moving stages **12** positioned in the lower stage. The carriers C on these stages **12** and **13** are arranged in the front-rear direction. On the intermediate retreating stages **13**, the carriers C are placed at the same height as the support portions **23** in the upper stage.
(36) In addition, a bottom portion of the left side surface of the housing **14** is drawn out to the left side to form a bottom stage **25**. The retreating stages **13** are also provided on the bottom stage **25**. The retreating stages **13** on the bottom stage **25** are located in the left side of the retreating stages **13** on the shelves **24**. Four retreating stages **13** on the bottom stage **25** are arranged side by side in the front-rear direction. Each carrier C is placed such that the opening of each carrier C faces the left side.
(37) Next, the carrier transfer mechanism **26**, which is a carrier transfer mechanism, will be described. The carrier transfer mechanism **26** includes an articulated arm **27** capable of holding the handle C**2** of the carrier C, and a moving mechanism **28** capable of moving the articulated arm **27** upward and downward and rearward and forward. Each arm portion of the articulated arm **27** is rotatable around a vertical axis. A distal end portion of the articulated arm **27** is configured as a claw portion **29** that is openable/closable to grip the handle C**2** of the carrier C. The claw portion **29** is also rotatable around the vertical axis.
(38) By the carrier transfer mechanism **26**, the carrier C is transported (transferred) in the order of: the external delivery stage **11**, the moving stage **12** for dispensing the wafer W, the moving stage **12** for recovering the wafer W, and the external delivery stage **11**. In transferring the carrier C among respective stages in this way, when a transfer-destination stage is not empty (when the stage is occupied by another carrier C), the carrier C is placed on the retreating stage **13** until the transfer-destination stage becomes empty.
(39) The carrier C is placed on each of the stages **11** to **13** in the orientation described above. However, when the orientation of the carrier C differs between a transfer-source stage and the transfer-destination stage, the orientation of the carrier C is changed during transfer. As an example, FIGS. **5** to **7** illustrate an example in which the carrier C is transferred from the external delivery stage **11** to the moving stage **12** on the rear side.
(40) The claw portion **29** of the carrier transfer mechanism **26** grips the handle C**2** of the carrier C on the external delivery stage **11**, and the carrier C is separated from the external delivery stage **11** (FIG. **5**). Then, while the carrier C is moving toward the moving stage **12**, the claw portion **29** of the carrier transfer mechanism **26** is rotated by 90 degrees such that the orientation of the carrier C changes from a state in which the opening is directed rightward to a state in which the opening is directed rearward (FIG. **6**), and the carrier C is placed on the moving stage **12** (FIG. **7**). Even if the carrier C is transferred between other stages, when the placement direction of the carrier C differs between the transfer-source stage and the transfer-destination stage, the orientation of the carrier changes while the carrier C is being transferred in the transfer route, as in the example illustrated in FIGS. **5** to **7**.
(41) The configuration of the carrier block D**1** will be described again. Two inspection modules **39** are provided below the loading/unloading shelf **15** and above the region where the carriers C is placed on the retreating stages **13** on the upper stage and the moving stages **12**, and arranged in the rear and front sides, respectively, with respect to the protruding wall portion **16**. Therefore, as

illustrated in FIG. **8**, in a plan view, the inspection module **39** on the rear side is arranged to overlap the moving stage **12** on the rear side and the retreating stage **13** on the shelf **24**, and the inspection module **39** on the front side is arranged to overlap the moving stage **12** on the front side and the retreating stage **13** on the shelf **24**.

(42) Each of the inspection modules **39** has, for example, a housing extending in the front-rear direction. A stage that is movable, for example, in the front-rear direction, and a capturing part equipped with a camera are provided inside the housing. The wafer W, which is placed on the stage and moving, is intermittently captured by the capturing part so that image data of the entire front surface of the wafer W is acquired. A controller **10**, which will be described later, determines whether an abnormality occurs in the wafer W based on the image data transmitted from the capturing part. In this example, each inspection module **39** captures an image of the wafer W before being processed by the coating/developing apparatus **1**.

(43) Next, an internal configuration of the housing **14** will be described. A space **19** extending linearly in the front-rear direction in a plan view is formed inside the housing **14**. That is, the space **19** is formed to extend in the Y direction. The transfer region **17** formed by the protruding wall portion **16** is a space protruding in the XY direction from the central portion of the space **19** in the Y direction. A transfer mechanism **31** that is a first substrate transfer mechanism is provided in the transfer region **17**. The transfer mechanism **31** includes a base **32** that is movable upward and downward and rotatable around a perpendicular axis, that is, around the vertical axis, and a holder **33** for the wafer W that is movable forward and rearward relative to the base **32**. With this configuration, the transfer mechanism **31** is capable of delivering the wafer W to the carrier C placed on each moving stage **12** and the inspection module **39** described above. That is, the transfer mechanism **31** is shared by these moving stages **12** and inspection modules **39**.

(44) In FIG. **9**, one side of the Y direction is indicated as a −Y side and the other side as a +Y side. When delivering the wafer W to the carrier C of the moving stage **12** on the rear side, the forward direction of the holder **33** is the −Y direction (rearward). When the wafer W is delivered to the carrier C of the moving stage **12** on the front side, the operation of the transfer mechanism **31** is controlled such that the forward direction of the holder **33** is the +Y direction (forward). That is, the holder **33** takes one orientation and the other orientation opposite the one orientation. In addition, even when the wafers W are delivered to the inspection module **39** on the rear side and the inspection module **39** on the front side, respectively, the base **32** is rotated such that the holder **33** takes one orientation and the other orientation.

(45) Next, the space **19** will be described. The space **19** is configured as the wafer transfer region from the central portion to the rear end portion in the extension direction in a plan view. A transfer mechanism and a module are arranged in the space **19**. More specifically, a module stack T**1** is provided on the right side of the transfer mechanism **31** (that is, one of the left and right sides) in the central portion of the space **19** in the front-rear direction in a plan view. The module stack T**1** is configured by overlapping a delivery module TRS on which the wafer W is temporarily disposed (temporarily placed), a temperature adjustment module SCPL for adjusting a temperature of the temporarily-placed wafer W, and the like in the perpendicular direction, that is, in the vertical direction. Other module stacks to be described later have the same configuration.

(46) The transfer mechanism **31** described above delivers the wafer W to the modules constituting the module stack T**1**. In this case, the orientation of the base **32** is controlled such that the advancing direction of the holder **33** is directed toward this module stack T**1** (that is, oriented in the Y direction). A transfer mechanism **34** is provided on the rear side of the module stack T**1**. The transfer mechanism **34**, which is a second substrate transfer mechanism, has the same configuration as the transfer mechanism **31**, for example, except that the holder **33** has a different shape.

(47) In addition, at the rear end of the space **19** on the rear side of the transfer mechanism **34**, for example, a plurality of hydrophobizing modules **35** are provided in a stacked form. The hydrophobizing module **35**, which is a second processing module, is a module that performs a

hydrophobizing process by supplying a processing gas to the wafer W before forming a coating film. The wafer W is delivered to the hydrophobizing module **35** by the transfer mechanism **34**. The hydrophobizing module **35** includes a hot plate for heating the wafer W placed thereon, and a cover that is capable of being raised and lowered and covers the hot plate. The wafer W is hydrophobized by supplying the processing gas into a closed space formed by the cover above the hot plate.

(48) The temperature adjustment module SCPL is capable of adjusting the temperature of the wafer W. The wafer W is delivered by the raising/lowering operation of the transfer mechanism. The delivery module TRS includes, for example, a plurality of pins arranged in the horizontal direction, and is configured such that the wafer W is delivered to the pins by the raising/lowering operation of the transfer mechanism. The TRS and SCPL, which are substrate placement parts, are provided to form module stacks even in a block other than the carrier block D**1**. The modules constituting each module stack include a role of delivering the wafer W between blocks.

(49) A shuttle TRS for delivering the wafer W to and from the shuttle is movable upward and downward differently from the above-described configuration, and will be described in detail together with the shuttle. Hereinafter, in order to distinguish SCPLs and TRSs at respective locations from each other, numerals are added after SCPL and TRS. The modules constituting the module stack T**1** of the carrier block D**1** are indicated as TRS**1**, TRS**2**, SCPL**1**, TRS**3**, and SCPL**2** from bottom to top. In this specification, the term “module stack” refers to modules that are provided to overlap each other in a plan view, and the modules may be spaced apart from each other or may be in contact with each other.

(50) The SCPL**1** is located at the height of the lower processing block so as to form a forward route, and the TRS**3** and SCPL**2** are located at the height of the upper processing block so as to form a rearward route. The TRS**1** and TRS**2** are used for delivering the wafer W between the transfer mechanisms **31** and **34**. In order to transfer the wafer W along transfer routes which will be described later with reference to FIGS. **13** and **14**, the transfer mechanism **31** is accessible to the TRS**1** and TRS**2**, and the transfer mechanism **34** is accessible to the TRS**1** to TRS**3**, the SCPL**1**, and a shuttle TRS**12**B.

(51) A region on the front side of the space **19** with respect to the module stack T**1** and at the height of the lower processing block is configured as a chemical liquid storage region **36**. For example, a large number of bottles are arranged vertically and horizontally in the chemical liquid storage region **36**. Therefore, the bottles, which are storage parts for a chemical liquid, are provided on the side opposite the side on which the transfer mechanism **34** is provided in the front-rear direction with respect to the module stack T**1**. Each bottle stores a processing liquid used in the processing block **2**A, which will be described later. The details of the processing liquid will be described in the description of the processing block **2**A.

(52) Next, the first stacked processing block D**2** (the processing blocks **2**A and **2**B) will be described with reference to FIG. **10**, which is a vertical cross-sectional side view, as well. The front side of the first stacked processing block D**2** is partitioned in the vertical direction to form eight layers. These layers are denoted by “E**1**” to “E**8**” from the bottom to the top. The lower layers E**1** to E**4** are included in the processing block **2**A, and the upper layers E**5** to E**8** are included in the processing block **2**B. Each layer is a region in which a liquid processing module is installable.

(53) First, the upper processing block **2**B will be described. In this example, developing modules **41** for supplying a developer to the wafer W are provided as liquid processing modules in the layers E**6** to E**8**, respectively. A transfer region **42** for the wafer W is provided on the rear side of the layers E**5** to E**8**. The transfer region **42** is formed linearly from the left end to the right end of the processing block **2**B in a plan view, and is provided from the height of the layer E**5** to the height of the layer E**8**. On the rear side of the transfer region **42**, processing modules are stacked vertically, for example, in seven stages to form a processing module stack **43**. Two processing module stacks **43** are provided at an interval in the left-right direction.

(54) Each of the two processing module stacks **43** includes a heating module **44** which performs a post exposure bake (PEB), and an inspection module **45**. The inspection module **45** is the same as the inspection module **39** of the carrier block D**1**, except that an image acquisition target is the wafer W after processing in the apparatus.
(55) A main transfer mechanism **3**B is provided in the transfer region **42**. The main transfer mechanism **3**B has the same configuration as the transfer mechanism **31**, except that the base **32** is connected to a moving mechanism **46** to be also movable in the left-right direction. For example, two holders **33** are provided for each transfer mechanism other than a shuttle in the coating/developing apparatus **1** including the main transfer mechanism **3**B, and are capable of advancing and retreating on the base **32** independently of each other. The above-described moving mechanism **46** is provided below the processing module stack **43**.
(56) By the main transfer mechanism **3**B, the wafer W is delivered to each processing module in the processing block **2**B and a module positioned at the same height as that of the processing block **2**B in the module stacks (T**1**, and T**2** to be described later) provided in a block adjacent to the processing block **2**B. The main transfer mechanism **3**B may also deliver the wafer W to a shuttle TRS provided in the processing block **2**B.
(57) A partitioned flat space **5**B is provided on the lower side of the processing module stack **43**. The space **5**B is formed from the left end to the right end of the processing block **2**B. A shuttle **4**B, the shuttle TRS**12**B and the shuttle TRS**12**D are provided in the space **5**B. The configurations of the shuttle and the shuttle TRSs will be described in detail later.
(58) Each processing block other than the processing block **2**B, which will be described later, has substantially the same configuration as that of the processing block **2**B, except for the differences that will be described later. Each processing block is provided with a main transfer mechanism corresponding to the main transfer mechanism **3**B. For the reference numeral for this main transfer mechanism, instead of “B”, the same letter as that given to that of the processing block will be added. Specifically, when the processing block is denoted by “2A”, the main transfer mechanism will be denoted by “3A”. Other main transfer mechanisms corresponding to the main transfer mechanism **3**B are also configured such that the wafer W is capable of being delivered to a processing module and a shuttle TRS inside the processing block provided with the main transfer mechanism, or a module stack inside the processing block or a processing block adjacent to the processing block in the left-right direction.
(59) In addition, as for the reference numeral of a space in which a shuttle can be installed and which corresponds to the above-described space **5**B as well, instead of “B”, the same English letter as that given to that of the processing block will be added. When a processing block is provided with a shuttle, as the reference numeral of the shuttle, the same English letter as that given to that of the processing block will be added. As for the reference numeral of a shuttle TRS, the same English letter as that given to that of the processing block, which is provided with the shuttle, will be added, wherein a TRS serving as a transfer source and a TRS serving as a transfer destination will be denoted by reference numerals in which “11” and “12” are added in front of English letters, respectively. As for the reference numeral of a wafer transfer path by a shuttle, the same English letter as that given to that of the shuttle will be added after the number “40”. As a specific example of the above-described reference numeral rule, a shuttle provided in a processing block **2**D to be described later will be denoted by “4D”, and the TRS of the transfer source and the TRS of the transfer destination of this shuttle **4**D will be denoted by “TRS**11**D” and “TRS**12**D”, respectively. A wafer transfer path by the shuttle **4**D will be denoted by “40D”.
(60) Returning to the description of the configurations of the processing blocks, the processing block **2**A below the processing block **2**B is different from the processing block **2**B in that each of the layers E**2** to E**4** is provided with an antireflection film forming module **47** as a liquid processing module. The antireflection film forming module **47** supplies and applies a chemical liquid for forming an antireflection film from a nozzle onto the front surface of the wafer W to form an

antireflection film, which is a coating film. The processing module stack **43** of the processing block **2**A is provided with heating modules **48**. These heating module **48** have a role different from that of the heating modules **44** of the processing block **2**B, and are for removing a solvent in the coating film. The processing block **2**A is provided with a transfer region **42** over the height of the layers E**1** to E**4**. The processing block **2**A is not provided with a shuttle and a shuttle TRS.
(61) The antireflection film forming module **47** will be further described with reference to FIG. **11**. The chemical liquid (processing liquid) for forming the antireflection film is stored in a bottle installed in a chemical liquid storage region **36** of the carrier block D**1**. The bottle and a nozzle in each antireflection film forming module **47** is connected to each other via a pipe **52**. The pipe **52** is provided with a filter **53** for cleaning the chemical liquid flowing toward the nozzle. The filter **53** is installed in the layer E**1** of the processing block **2**B. As described above, the bottle serving as a chemical liquid source is provided on the front side of the carrier block D**1** adjacent to the processing block **2**A. The antireflection film forming module **47** is located on the front side with respect to the transfer region **42**, and the chemical liquid storage region **36** is located on the front side of the space **19** of the carrier block D**1**. Therefore, it is possible to make the length of the pipe **52** relatively short, which is advantageous in that it is possible to more reliably suppress the risk of contamination of the antireflection film by particles generated from the pipe **52**.
(62) Next, returning back to FIGS. **1** and **2**, the second stacked processing block D**3** (the processing blocks **2**C and **2**D) forming each processing block on the right side of the apparatus will be described. The second stacked processing block D**3** has substantially the same configuration as the first stacked processing block D**2**, and thus the differences from the first stacking processing block D**2** will be mainly described. First, the upper processing block **2**D (another processing block) is the same as the processing block **2**B (the one processing block) in terms of the positional relationship of the transfer region **42**, the processing module stack **43**, the main transfer mechanism, and the space for installing the shuttle stacked on the processing modules. The processing modules installed in the processing block **2**D are the same as the processing modules in the processing block **2**B. In addition, the shuttle space **5**D in the processing block **2**D is located at the same height as the space **5**B and communicates with the space **5**B. The space **5**D is provided with a shuttle **4**D, a shuttle TRS**11**B and a shuttle TRS**11**D.
(63) The lower processing block **2**C will be described. The lower processing block **2**C is provided with resist film forming modules **49** on the layers E**2** to E**4**. The resist film forming modules **49** have the same configuration as the developing modules **41**, except that the former supplies a processing liquid to wafers W instead of a developer. The processing module stack **43** also includes heating modules **48** as in the processing block **2**A.
(64) The transfer region **42** of the second stacked processing block D**3** is provided with a module stack T**2** at the left end thereof. The module stack T**2** is located to partially overlap the right end of the transfer region **42** of the first stacking block D**2** in a plan view. The module stack T**2** includes SCPL**4** located at the height of the lower processing block and SCPL**3** located at the height of the upper processing block.
(65) Next, the interface block D**4** will be described. The interface block D**4** includes a module stack T**3** provided in the central portion in the front-rear direction. The module stack T**3** includes TRS**5** to TRS**7** and a temperature control module ICPL, which are stacked one above another. The ICPL is a module to which the wafer W is transferred immediately before exposure, is provided on the lower side of the module stack T**3**, and adjusts a temperature of the placed wafer W in the same manner as the SCPL. In order to transfer the wafer W to a transfer route which will be described, TRS**5** and TRS**6** are provided at the height of the lower processing block, and TRS**7** is provided at the height of the upper processing block. Transfer mechanisms **61**, **62**, and **63** are provided on the front, rear, and right sides of the module stack T**3**, respectively. These transfer mechanisms **61** to **63** are configured similarly to the transfer mechanism **31** of the carrier block D**1**.
(66) In front of the transfer mechanism **61**, a plurality of rear surface cleaning modules **65** for

supplying a cleaning liquid to the rear surfaces of the wafers W for washing are provided in a stacked form. A plurality of post-exposure cleaning modules **66** for supplying a cleaning liquid to the front surfaces of the wafers W after exposure are provided in a stacked form on the rear side of the transfer mechanism **62**. The transfer mechanisms **61** and **62** are capable of transferring the wafers W between the modules constituting the module stack T**3**. The transfer mechanism **61** and the transfer mechanism **62** is also capable of delivering the wafers W to the rear surface cleaning modules **65** and the post-exposure cleaning modules **66**, respectively. The transfer mechanism **63** transfers the wafer W among the ICPL, the TRS**6**, and the exposure machine **20**.
(67) Next, the shuttles **4**B and **4**D and the shuttle TRS for the shuttles **4**B and **4**D will now be described. The shuttle **4**B carries the wafers W from the processing block **2**D to the carrier block D**1**. As illustrated in FIG. **1**, of the shuttle TRS**11**B and the shuttle TRS**12**B for the shuttle **4**B, the shuttle TRS**12**B of the transfer destination, is located at the left end of the space **5**B so that the wafers W can be delivered to and from the transfer mechanism **34** of the carrier block D**1**. The shuttle TRS**11**B of the transfer source is provided at the left end of the space **5**D on the right side of the module stack T**2** so that the wafers W can be delivered to and from the main transfer mechanism **3**D of the processing block **2**D.
(68) The shuttle **4**D transfers the wafers W from the interface block D**4** toward the processing block **2**B. Of the shuttle TRS**11**D and the shuttle TRS**12**D for the shuttle **4**D, the shuttle TRS**11**D of the transfer source is provided at the right end of the space **5**D so that the wafers W can be delivered to and from the transfer mechanism **62** of the interface block D**4**. The shuttle TRS**12**D of the transfer destination is provided on the left side of the module stack T**2** at the right end of the space **5**B so that the wafers W can be delivered to and from the main transfer mechanism **3**B of the processing block **2**B.
(69) Next, the shuttle **4**B, the shuttle TRS**11**B, and the shuttle TRS**12**B will be described below with reference to FIG. **12** as well. The shuttle **4**B includes a base body **71**, an intermediate moving body **72**, and a support **73**. The base body **71** is configured with a long member extending in the left-right direction, and is provided to be accommodated in the space **5**B of the processing block **2**B. The intermediate moving body **72** is also a long member extending in the left-right direction, and is connected to the front side of the base body **71**. The support **73** is connected to the front side of the intermediate moving body **72** and formed in the shape of an elongated rectangular parallelepiped in the left-right direction. The wafer W is supported on the support **73** and transferred horizontally and linearly in the left-right direction.
(70) The base body **71** allows the intermediate moving body **72** to move in the left-right direction with respect to the base body **71**. As the intermediate moving body **72** moves with respect to the base body **71**, the support **73** moves in the left-right direction with respect to the intermediate moving body **72**. More specifically, as the intermediate moving body **72** moves leftward (toward the carrier block D**1**), the support **73** moves leftward, and as the intermediate moving body **72** moves rightward (toward the interface block D**4**), the support **73** moves rightward.
(71) At a position where the support **73** delivers the wafer W to the shuttle TRS**11**B (the right transfer position), for example, the right end of the support **73** is located on the right side of the right end of the intermediate moving body **72**, and the right end of the intermediate moving body **72** is located on the right side of the right end of the base body **71** (see the upper side of FIG. **12**). At a position when the support **73** delivers the wafer W to the shuttle TRS**12**B (the left transfer position), for example, the left end of the support **73** is located on the left side of the left end of the intermediate moving body **72**, and the left end of the intermediate moving body **72** is located on the left side of the left end of the base body **71** (see the lower side of FIG. **12**).
(72) The shuttle TRS**11**B includes a support plate **75** provided to form a recess the left side of which is opened in a plan view, three pins **76** protruding upward from the support plate **75**, and a lifting mechanism (not illustrated) that raises and lowers the support plate **75**. This lifting mechanism is connected to the lower side of the support plate **75** so as not to interfere with the

intermediate moving body **72** and the support **73** of the shuttle **4**B or the support plate **75**. As illustrated at the upper side of FIG. **12**, the right end of the support **73** at the right transfer position is in the state of being accommodated in the recess formed by the support plate **75** in a plan view, and the wafer W may be delivered between the support **73** and the shuttle TRS**11**B by moving the pins **76** upward and downward. The shuttle TRS**12**B has the same configuration as the shuttle TRS**11**B except that the support plate **75** is formed to form a recess the right side of which is opened in a plan view. As illustrated at the lower side of FIG. **12**, the left end of the support **73** at the left transfer position is in the state of being accommodated in the recess formed by the support plate **75** in a plan view, and the wafer W may be delivered between the support **73** and the shuttle TRS**12**B by moving the pins **76** upward and downward.
(73) The main transfer mechanism **3**D of the processing block **2**D delivers the wafer W processed in the processing block **2**D onto the pins **76** at the raised position of the shuttle TRS**11**B. When the pins **76** move to the lowered position and the wafer W is supported by the support **73** at the above-described right transfer position, each of the intermediate moving body **72** and the support **73** moves to the left side, while the pins **76** of the shuttle TRS**11**B return to the raised position. When the support **73** moves to the above-described left transfer position, the pins **76** at the lowered position of the shuttle TRS**12**B move to the raised position to support the wafer W. As the support **73** moves toward the right transfer position, the pins **76** return to the lowered position thereof. Thereafter, the transfer mechanism **34** of the carrier block D**1** receives the wafer W.
(74) The shuttles **4**D, the shuttle TRS**11**D, and the shuttle TRS**12**D are configured in the same manner as the shuttle **4**B, the shuttle TRS**11**B, and the shuttle TRS**12**B, respectively. Briefly, the base body **71** of the shuttle **4**D is provided to be accommodated in the space **5**D of the processing block **2**D. The set of the shuttle **4**D, the shuttle TRS**11**D, and the shuttle TRS**12**D is provided at a height different from that of the set of the shuttle **4**B, the shuttle TRS**11**B, and the shuttle TRS**12**B, for example, on the lower side of the set. Positions before and after a wafer transfer path **40**B by the shuttle **4**B and a wafer transfer path **40**D by the shuttle **4**D are the same.
(75) To correspond to the position of each of the above-described TRS**11**B, TRS**12**B, TRS**11**D, and TRS**12**D, the transfer path **40**B protrudes to the processing block **2**D, and the transfer path **40**D protrudes to the processing block **2**D. By protruding in this way, the right side of the transfer path **40**B and the left side of the transfer path **40**D overlap each other in a plan view.
(76) The coating/developing apparatus **1** also includes the controller **10** (see FIG. **1**). The controller **10** is configured with a computer, and includes a program, a memory, and a CPU. The program incorporates a group of steps such that a series of operations of the coating/developing apparatus **1** can be implemented. Based on the program, the controller **10** outputs a control signal to each part of the coating/developing apparatus **1** so as to control the operation of each part. Specifically, the operations of the transfer mechanisms **31**, **32**, **61** to **63**, the main transfer mechanisms **3**A to **3**D, the shuttles **4**B and **4**D, and each processing module are controlled. As a result, the transfer and processing of the wafer W to be described later are performed. The control of the operation of the processing modules also includes abnormality determination of the wafer W based on the above-described image data. The above-mentioned program is stored in a non-transitory computer-readable storage medium such as a compact disc, a hard disc, or a DVD, and is installed in the controller **10**.
(77) Next, examples of a wafer processing and wafer transfer routes in the coating/developing apparatus **1** will be described with reference to FIGS. **13** and **14** which illustrate the above-described forward route and rearward route, respectively. In FIGS. **13** and **14**, above or near some arrows indicating transfer of the wafer W between modules, transfer mechanisms used for the transfer are indicated. In this example, it is assumed that, of four moving stages **12**, two lower moving stages **12** are stages (loaders) for dispensing the wafer W, and two upper moving stages **12** are stages (unloaders) for recovering the wafer W.
(78) First, the wafer W is unloaded from the carrier C of the lower moving stage **12** by the transfer

mechanism **31** and transferred to the inspection module **39** so that image data is acquired and the presence or absence of an abnormality is determined. Subsequently, the wafer W is transferred in the order of the transfer mechanism **31**, the TRS**1**, the transfer mechanism **34**, the hydrophobizing module **35**, the transfer mechanism **34**, and the SCPL**1**. After being subjected to the hydrophobizing process, the wafer W is introduced into the processing block **2**A by the main transfer mechanism **3**A and transferred in the order of the antireflection film forming module **47** and the heating module **48**, so that the antireflection film is formed. Thereafter, the wafer W is transferred to the SCPL **4** of the module stack T**2**, and transferred in the order of the resist film forming module **49** and the heating module **48** by the main transfer mechanism **3**C of the processing block **2**C, so that a resist film is formed. Thereafter, the wafer W is transferred to the TRS**5** of the module stack T**3** in the interface block D**4**.
(79) Thereafter, the wafer W is transferred via the rear surface cleaning module **65** and the ICPL in this order by the transfer mechanism **61** on the front side of the block, and further transferred to the exposure machine **20** by the transfer mechanism **63**, so that a resist film on the front surface of the wafer W is exposed along a predetermined pattern. After the exposure, the wafer W is transferred in the order of the transfer mechanism **63**, the TRS**6**, the transfer mechanism **62** on the rear side of the block, the post-exposure cleaning module **66**, and the transfer mechanism **62**.
(80) The transfer route of the wafer W thereafter is divided into a route for processing in the processing block **2**D (referred to as a “first transfer route”) and a route for processing in the processing block **2**B (referred to as a “second transfer route”). Regarding the first transfer route, the transfer mechanism **62** transfers the wafer W to the TRS**7** of the module stack T**3**, and the wafer W is introduced into the processing block **2**D by the main transfer mechanism **3**D. Then, as the wafer W is transferred in the order of the heating module **44**, the SCPL **3**, the developing module **41**, and the inspection module **45**, a resist pattern is formed thereon and then image data is acquired, so that the presence or absence of an abnormality is determined. Thereafter, as described with reference to FIG. **12**, the wafer W is transferred in the order of the main transfer mechanism **3**D, the shuttle TRS**11**B, the shuttle **4**B, and the shuttle TRS**12**B, and subsequently, the transfer mechanism **34** of the carrier block D**1** receives the wafer W. The wafer W is transferred in the order of the TRS**2** and the transfer mechanism **31** to be stored in the carrier C.
(81) Regarding the second transfer route, the wafer W is transferred in the order of the transfer mechanism **62**, the shuttle TRS**11**D, the shuttle **4**D, the TRS**12**D, and the main transfer mechanism **3**B, and introduced into processing block **2**B. Then, the wafer W is transferred by the main transfer mechanism **3**B in the order of the heating module **44**, the SCPL**2**, the developing module **41**, and the inspection module **45**. After being subjected to the same processing as the wafer W on the first transfer route, the wafer W is transferred to the TRS**3** of the carrier block D**1**. Subsequently, the wafer W is transferred in the order of the transfer mechanism **34** and the TRS**2**, and thereafter stored in the carrier C by the transfer mechanism **31** in the same manner as the wafer W on the first transfer route.
(82) Since the transfer is performed as described above, the TRS**1** in the module stack T**1** is a first substrate placement part to which the wafer W is delivered by the transfer mechanism **31**. In addition, the SCPL**1**, the TRS**2**, and the TRS**3** on which the wafer W is placed so that the wafer W is delivered among the carrier block D**1**, the lower processing block, and the upper processing block, are second substrate placement parts. Among them, the SCPL**1** is a lower substrate placement part corresponding to the lower processing block, and the TRS**2** and the TRS**3** are upper substrate placement parts corresponding to the upper processing block.
(83) As described above, in the carrier block D**1** of the coating/developing apparatus **1**, the transfer mechanisms **31** and **34** are disposed at the left side and the rear side, respectively, with respect to the module stack T**1** (TRS, SCPL) for delivering the wafer W among the carrier C, the lower processing block, and the upper processing block. The transfer mechanism **31** is disposed in the transfer region **17** formed by providing the protruding wall portion **16** so as to be aligned with the

moving stage **12** for loading/unloading of the wafer W in the front-rear direction. The roles of the transfer mechanisms **31** and **34** are separated such that the transfer mechanism **31** performs the delivery of the wafer W to and from the carrier C on the moving stage **12** and the transfer mechanism **34** performs the delivery of the wafer W between the modules of the module stack T**1**. Since the roles of the transfer mechanisms are separated in this manner, it is possible to increase the throughput of the apparatus by suppressing either the number of operation steps of the transfer mechanisms **31** and **34** (the number of sections in which the transfer mechanisms **31** and **34** perform the transfer operation on the above-described transfer routes) or the moving distances of the transfer mechanisms **31** and **34** in one round of operation step. Due to the above-described layout of the transfer mechanisms **31** and **34**, the module stack T**1**, and the moving stage **12**, it is possible to secure a relatively large space on the front side of the module stack T**1**, and it is possible to use the space as the chemical liquid storage region **36**. As a result, the dedicated floor area (footprint) of the coating/developing apparatus **1** is suppressed and an increase in size of the coating/developing apparatus **1** is prevented, which allows the chemical liquid storage region **36** and the liquid processing modules to be located close to each other as described above. Therefore, mixing of particles into the coating film due to the length of the pipe **52** is suppressed, and deterioration in the yield of semiconductor products is suppressed.
(84) In addition, the moving stages **12** are arranged on both the front side and the rear side of the transfer mechanism **31**, and the transfer mechanism **31** is accessible to the carrier C on each moving stage **12** through the change of the orientation of the base **32** and the advancing/retracting of the holder **33**. With such a configuration, when accessing each carrier C, there is no need to connect the transfer mechanism **31** to a moving mechanism to move the transfer mechanism **31** laterally. Therefore, it is possible to more reliably reduce the footprint, and to improve the throughput. In addition, since such a laterally moving mechanism is not required, it is possible to reduce the manufacturing costs of the apparatus.
(85) In addition, on the front and rear sides of the transfer region **17**, a plurality of moving stages **12** are vertically stacked one above another. By providing the moving stages **12** in this way, a sufficient number of moving stages **12** are ensured while making the lateral movement of the base **32** of the transfer mechanism **31** unnecessary. Thus, the transfer mechanism **31** is accessible to the carrier C at desired timing. That is, with this configuration, it is possible to more reliably suppress the footprint of the apparatus, and to suppress the deterioration in throughput.
(86) The orientation of the carrier C when the transfer mechanism **31** accesses the carrier C differs from the orientation of the carrier C placed on the external delivery stage **11** by the external transfer mechanism (OHT). The orientation may be changed, for example, by connecting the moving stage **12** to a rotating mechanism and rotating the moving stage **12** by the rotating mechanism. When such a rotating mechanism is provided, the external transfer mechanism may be configured to directly deliver the carrier C to the moving stage **12**. That is, the external delivery stage **11** and the moving stage **12** may be the same as each other.
(87) However, it is preferable to use the carrier transfer mechanism **26** as the orientation changing mechanism as described above, rather than using the rotating mechanism as the orientation changing mechanism. As illustrated in FIGS. **5** to **7**, while the carrier transfer mechanism **26** is transferring the carrier C between stages, by using the space for this transfer to change the orientation, there is no need to secure the space required for rotating the carrier C around the moving stage **12**. As a result, the increase in the size of the apparatus is suppressed, and the change in orientation and the movement to the transfer-destination stage are performed in parallel, so that a decrease in throughput is prevented, which is preferable.
(88) Then, the carrier C on the retreating stage **13** of the shelf **24** is placed to be arranged in the front-rear direction with respect to the carrier C on the moving stage **12** and the lower support portion **23** of the moving stage **12**. Like the carrier C on the moving stage **12**, the opening of the carrier C on the retreating stage **13** is also oriented in the front-rear direction. As described above,

since the width L**1** of the carrier C in the left-right direction of the carrier C is greater than the width L**2** in the front-rear direction, the carrier C is arranged with the orientation thereof being changed such that the space occupied by the carrier C in the front-rear direction becomes smaller. Therefore, even if the space on the left side of the carrier block D**1** is reduced by the amount of the protruding wall portion **16** provided for installing the transfer mechanism **31**, it is possible to dispose a large number of retreating stages **13** while suppressing the increase of the width of the carrier block D**1** in the front-rear width. The example shown in FIG. **4** and the like illustrates that respective carriers C are placed on the retreating stages **13** of each shelf **24** on the front side such that the openings of the carriers C are oriented rearward such that, on the retreating stages **13** of each shelf **24** on the rear side, the openings of the carriers C are oriented forward, but the front and rear orientations may be reversed.
(89) By providing a large number of retreating stages **13** in that way, it is possible to retreat unnecessary carriers C from the moving stages **12** at free timing, and to place other carriers C on the moving stages **12** to perform the loading/unloading of the wafers W. Thus, it is possible to efficiently perform this loading/unloading. Therefore, disposing carriers C on the retreating stages **13** having the above-described layout while changing the orientation from that at the time of placement on the external delivery stage **11** as described above contributes to preventing deterioration in throughput of the apparatus while preventing the increase in the size of the carrier block D**1** and the increase in footprint of the apparatus.
(90) In addition, since the above-described protruding wall portion **16** is provided, by using the spaces formed on the front and rear sides of the protruding wall portion **16**, the inspection modules **39**, which have a horizontally long configuration since the internal stages move, are disposed to extend in the front-rear direction from the protruding wall portion and to overlap respective stages **11** to **13**. This arrangement prevents the increase in the footprint of the apparatus due to the provision of the inspection modules **39**.
(91) In addition, by using the space formed on the rear side of the transfer mechanism **34** that accesses each module of the module stack T**1**, the hydrophobizing module **35** is arranged as a processing module so that the wafer W is delivered thereto by the transfer mechanism **34**. This arrangement of the hydrophobizing module **35** also prevents the expansion of the width of the coating/developing apparatus **1** in the left-right direction.
(92) Instead of the hydrophobizing module **35**, another module such as an inspection module **45** may be provided so that the transfer may be performed by the transfer mechanism **34**. However, the hydrophobizing module **35** does not have to laterally move a placement part (hot plate) on which the wafer W is placed when performing a process. That is, when a processing module is provided on the rear side of the transfer mechanism **34**, in order to prevent the increase in size of the carrier block D**1**, it is preferable to provide the processing module that performs the process without laterally moving the wafer W placement part as described above.
(93) The arrangement of the hydrophobizing module **35** will be supplementarily described. Airflow forming units are provided in the upper portion of the housing **14** of the carrier block D**1**, and the upper portion of each of the housings of the first and second stacked processing blocks D**2** and D**3**, and the interface block D**4**. Each airflow forming unit takes in air from the exterior of the coating/developing apparatus **1** and supplies the air to the wafer transfer path in the block in which the airflow forming unit is provided, thereby forming a downward airflow. Each block is also provided with an exhaust port so as to form the downward airflow.
(94) In the carrier block D**1**, a vertically long filter is provided on the front side of the module stack T**1**. The airflow forming unit of the carrier block D**1** also supplies air to this filter. The air is supplied toward the rear side of the space **19** from this filter, passes between the modules that constitute the module stack T**1** toward the hydrophobizing module **35**, and is exhausted through an exhaust port located on the rear side of the module stack T**1** and opened at the bottom of the apparatus. By adjusting the balance between an amount of air supplied by the airflow forming unit

and an amount of exhausted air in each block, the transfer region **42** of the first stacked processing block D**2** is under a higher pressure than that of the space **19** of the carrier block D**1**. As a result, some of the air supplied to the transfer region **42** flows into the space **19** toward the rear side. The air is also exhausted from the exhaust port on the rear side of the module stack T**1**.
(95) With the supply of the air from the filter as the gas supply part and the inflow of the air from the transfer region **42** as described above, the processing gas used in the hydrophobizing module **35** is more reliably prevented from flowing into the transfer region **42** of the first stacked processing block D**2**. When the processing gas flows into the developing module **41** through the transfer region **42** and reacts with the developer, development defects may occur, but the above-described airflow control prevents the occurrence of such defects.
(96) The processing blocks **2**B and **2**D are provided with the shuttles **4**B and **4**D, respectively. Then, the shuttles **4**B and **4**D transfer wafers W to be processed in one of the processing blocks **2**B and **2**D toward the carrier block D**1** such that the processing modules in the other processing block are bypassed. Specifically, via respective TRSs, the shuttle **4**B delivers the wafers W to the transfer mechanism **34** of the carrier block D**1**, and the shuttle **4**D delivers the wafers W to the main transfer mechanism **3**B of the processing block **2**B. By the shuttles **4**B and **4**D that transfer the wafers W in this way, the load on the main transfer mechanism **3**B of the processing block **2**B and the main transfer mechanism **3**D of the processing block **2**D (more specifically, the number of transfer steps required within the blocks) is reduced. As a result, the throughput of the coating/developing apparatus **1** can be further improved.
(97) Instead of capturing and inspecting the wafers W processed by the apparatus by the inspection modules **45** of the processing blocks **2**B and **2**D, the inspection modules **39** in the carrier block D**1** may capture and inspect an image of the processed wafer W. In that case, the wafers W, which have been processed and transferred to the module stack T**1**, may be transferred to the inspection modules **39** by the transfer mechanism **31** before being returned to the carriers C. In addition, an inspection module may be provided in the processing module stack **43** of the processing block **2**A, and the wafers W before processing may be transferred in each processing block to be captured and inspected. Only one of the two inspection modules **39** may be provided in the carrier block D**1**, or the carrier block D**1** may be configured such that these inspection modules **39** are not provided.
(98) As for the four moving stages **12** of the carrier block D**1**, a stage used as a loader and a stage used as an unloader are different in the above transfer example, but a single moving stage **12** may serve as both a loader and an unloader. Even when a loader and an unloader are used separately, any moving stage may be set at a loader or an unloader without being limited to setting a lower moving stage **12** as a loader and setting an upper moving stage **12** as an unloader as in the above-described example. Since the transfer mechanism **31** is configured to be shared by the four moving stages **12**, there is an advantage in that it is easy to perform the application switching of the moving stages **12**. Since the orientation of the carriers C on the moving stages **12** and the orientation of the carriers C on the retreating stages **13** of the loading/unloading shelf **15** are the same, the retreating stages **13** may be provided instead of the moving stages **12** on one of the front and rear sides of the transfer region **17**.
(99) The wafers W are stored in the carrier C for each lot. In manufacturing semiconductor devices, there is a tendency to produce various types of products in small quantities. According to this tendency, there is a case where a relatively small number of wafers W are stored in the carrier C and a large number of carriers C are carried into the apparatus to be processed. In such a case, it is advantageous to install a larger number of the above-mentioned retreating stages **13**. The plan view of FIG. **15** and the side view of FIG. **16** illustrate a carrier block D**11** having such a configuration in which a larger number of retreating stages **13** are installed.
(100) In the carrier block D**11**, on the shelf **15** on which the external delivery stages **11** are provided in the above-described carrier block D**1**, retreating stages **13** are provided instead of external delivery stages **11**. The carrier block D**11** is provided with three stages of shelves **81**,

which are located to the left side of the retreating stage **13** of a bottom stage **25**. On the top shelf **81**, four external delivery stages **11** are arranged in the front-rear direction. In addition, on each of the middle shelf **81** and the bottom shelf **81**, for example, four retreating stages **13** are arranged in the front-rear direction. The carriers C may be transferred by the carrier transfer mechanism **26** to the stages **11** and **13** of each shelf **81** as well.

(101) In the carrier block D**11**, carriers C are placed on the retreating stages **13** of the shelf **15** and the middle and bottom shelves **81** in the same orientation as the carriers C on the external delivery stages **11**, but may be placed to be oriented in the front-rear direction like the carriers C on the shelves **24**. In addition, since the external delivery stages **11** may be provided at positions where the carriers C can be loaded and unloaded by the external transfer mechanism accessed from above the apparatus, the external delivery stages **11** may be provided on the shelf **15** as in the carrier block D**1**.

(102) The plan view of FIG. **17** illustrates a carrier block D**12**, which is a modification of the carrier block D**1**. Schematically speaking, the carrier block D**12** is configured as follows: the carrier block D**1** is separated left and right at the boundary between the transfer region **17** and the space **19** of the carrier block D**1**, and a region **82** including a module and a transfer mechanism is formed therebetween. Thus, it may be seen that a separate block is interposed therebetween. In the region **82**, a module stack T**4** having a plurality of TRSs is provided at the left side in the central portion in the front-rear direction. A transfer mechanism **83** configured similarly to the transfer mechanism **34** or the like is provided to be interposed between the module stacks T**1** and T**4**. An inspection module **84** is provided on the rear side of the module stack T**4** and the transfer mechanism **83** in a plan view. The transfer mechanism **83** delivers the wafers W between the module stacks T**1** and T**4** and the inspection module **84**. Then, the transfer mechanism **31** delivers the wafers W to the module stack T**4** instead of the module stack T**1**.

(103) Therefore, when transferring the wafer W from the carrier C to the module stack T**1**, the wafer W passes through the module stack T**4** and the transfer mechanism **83** in this order. When transferring the wafer W from the module stack T**1** to the carrier C, the wafer W passes through the transfer mechanism **83** and the module stack T**4** in this order. The inspection module **84** may be for inspection before or after processing in the processing block. When inspecting the wafer W before being processed, the wafer W is transferred to the inspection module **84** while the wafer W is being transferred from the module stack T**4** to the module stack T**1**. When inspecting a processed wafer W, the wafer W is transferred to the inspection module **84** while the wafer W is being transferred from the module stack T**1** to the module stack T**4**. As described above, a configuration may be adopted in which the transfer of the wafers W between the transfer mechanism **31**, which is a first substrate transfer mechanism, and the module stack T**1**, which corresponds to a plurality of substrate placement parts arranged in the vertical direction, may be performed via the transfer mechanism **83** (a third substrate transfer mechanism) different from the transfer mechanism **31**.

(104) In addition, in the coating/developing apparatus **1**, the upper processing block may be used as a forward route of the wafer W, and the lower processing block may be used as a return route of the wafer W. Specifically, for example, formation of an antireflection film is not performed in the apparatus, and the resist film forming module **49** is provided as a liquid processing module for each of the upper processing blocks **2**B and **2**D. In addition, developing modules **41** are installed as liquid processing modules of the lower processing blocks **2**A and **2**C, respectively. A resist pattern may be formed by transferring the wafer W between blocks along a transfer route opposite to the above-described transfer route and sequentially performing formation, exposure, and development of a resist.

(105) Therefore, the shuttle is not limited to forming the rearward route. For the carrier block D**1** as well, the shuttle is not limited to the configuration in which the wafer W is delivered to a shuttle TRS that forms the rearward route. In addition, shuttles may also be provided in each of the lower processing blocks **2**A and **2**C. For example, the liquid processing modules of these processing

blocks **2**A and **2**C are both resist film forming modules **49**, and a shuttle may be used to transfer wafers W such that the wafers W are processed in the resist film forming module **49** of one of the processing blocks.

(106) In addition, liquid processing performed in the apparatus is not limited to the above examples, and may include the formation of an insulating film by applying a chemical liquid, the formation of a protective film for front surface protection of a resist film by applying a chemical liquid, the application of adhesive for bonding wafers W to each other, or the like. In addition, a cleaning process in which the front surface or the rear surface of the wafer W is supplied with a cleaning liquid may be performed. Therefore, the substrate processing apparatus of the present technology is not limited to being a coating/developing apparatus.

(107) In addition, the lower processing block and the upper processing block may not be connected to each other by the interface block D**4**. A specific description will be given with reference to the schematic view of the substrate processing apparatus **8** in FIG. **18**. In FIG. **18**, the lower processing block and the upper processing block are denoted by G**1** and G**2**, respectively. It is assumed that the module stack T**1** includes TRS**21** to TRS**23**. The TRS**21** is for delivery to the carrier C. The wafers W are transferred between the carrier C and the TRS**21** by a transfer mechanism **31**. The TRS**22** and the TRS**23** are for delivery to the lower processing block G**1** and the upper processing block G**2**, respectively. The wafers W are transferred between the TRS**21** and the TRS**22** and between TRS**21** and TRS**23** by the transfer mechanisms **34**, respectively. The wafers W transferred from the carrier C via the TRS**21** and loaded into the lower processing block G**1** and the upper processing block G**2** from the TRS**22** and TRS**23**, respectively, are returned to the carrier C from the TRS**22** and TRS**23** via the TRS**21** after processing. That is, the apparatus may be configured such that the wafers W are processed in only one of the lower processing block and the upper processing block and returned to the carrier C.

(108) In addition, each of the lower processing block and the upper processing block is not limited to including two processing blocks arranged in the left-right direction, and may include one processing block. Furthermore, each of the lower processing block and the upper processing block may include a plurality of (three or more) processing blocks arranged in the left-right direction, and the wafers W may be transferred between the processing blocks arranged in the left-right direction. The processing blocks are not limited to being stacked one above another vertically, and the carrier block D**1** may be connected to only one processing block.

(109) In each processing block, the liquid processing module is located on the front side and the processing module stack **43** is located on the rear side, but this layout may be reversed in the front-rear direction. In addition, in the carrier block D**1**, the layout of the transfer mechanisms **31** and **34** and each stage for the carrier C may be reversed in the front-rear direction. The arrangement of the carrier block D**1** and other blocks may be reversed in the left-right direction. Regarding the TRS and the SCPL constituting the module stack T**1**, the heights thereof may be appropriately changed, and the stacking order thereof may be changed as long as the wafers W can be transferred within the apparatus.

(110) The hydrophobizing module **35** may be disposed to overlap the TRS and the SCPL of the module stack T**1**. However, by disposing a large number of TRSs and SCPLs on the module stack T**1** and placing the wafers W thereon, it is possible to perform quick delivery of the wafers W between the carrier block D**1** and the first processing block D**2** and between the carriers C and the carrier block D**1**. Therefore, it is preferable to dispose the hydrophobizing modules **35** on the rear side of the module stack T**1** as described above.

(111) In FIG. **11**, it has been described that the bottle in the chemical liquid storage region **36** is for liquid processing in the lower processing block **2**A, the bottle for liquid processing in the processing block **2**B may also be provided in the chemical liquid storage region **36** depending on the liquid processing performed in the upper processing block **2**B. Even if the bottle of the processing block **2**B is installed in the chemical liquid storage region **36** in this way, the same

effect as in the case of installing the bottle of the processing block **2**A in the chemical liquid storage region **36** is exhibited.
(112) According to the present disclosure, it is possible to increase throughput and reduce an occupied floor space in a substrate processing apparatus.
(113) It should be noted that the embodiments disclosed herein are exemplary in all respects and are not restrictive. The above-described embodiments may be omitted, replaced, modified, and combined in various forms without departing from the scope and spirit of the appended claims.

Claims

1. A substrate processing apparatus comprising: a carrier block including a plurality of carrier placement parts on each of which a carrier configured to receive a substrate is placed to perform a loading/unloading of the substrate with respect to the carrier; a processing block provided on one of left and right sides of the carrier block to process the substrate; a first carrier placement part and a second carrier placement part included in the plurality of carrier placement parts and provided side by side in a front-rear direction in a plan view, wherein at least one of the first carrier placement part or the second carrier placement part is at least one substrate loading/unloading carrier placement part; a plurality of substrate placement parts provided to be arranged step by step in a vertical direction on one of left and right sides of a substrate transfer region formed between the first carrier placement part and the second carrier placement part in the plan view, wherein the substrate is placed on each of the plurality of substrate placement parts; a first substrate transfer mechanism provided in the substrate transfer region and configured to rotate around a vertical axis so as to deliver the substrate between the carrier of the first carrier placement part and a first substrate placement part included in the plurality of substrate placement parts; and a second substrate transfer mechanism configured to move upward and downward so as to deliver the substrate between the first substrate placement part and a second substrate placement part included in the plurality of substrate placement parts, wherein the substrate is placed on the second substrate placement part to be delivered to the processing block, wherein the plurality of carrier placement parts include a third carrier placement part on which the carrier is placed in a third orientation so as to perform the loading/unloading of the carrier with respect to the carrier block, the substrate loading/unloading carrier placement part is configured to place the carrier thereon in a fourth orientation different from the third orientation so that an opening provided in the carrier and through which the substrate is loaded and unloaded faces either a front side or a rear side on which the first substrate transfer mechanism is located, and the substrate processing apparatus further comprises an orientation changing mechanism configured to change an orientation of the carrier between the third orientation and the fourth orientation.
2. The substrate processing apparatus of claim 1, wherein each of the first carrier placement part and the second carrier placement part is the at least one substrate loading/unloading carrier placement part, and the first substrate transfer mechanism is configured to rotate to be in a first orientation for delivering the substrate to the carrier on the first carrier placement part and a second orientation for delivering the substrate to the carrier on the second carrier placement part, wherein the second orientation is opposite to the first orientation.
3. The substrate processing apparatus of claim 1, further comprising: a carrier transfer mechanism configured to transfer the carrier between the plurality of carrier placement parts, wherein the orientation changing mechanism corresponds to the carrier transfer mechanism.
4. The substrate processing apparatus of claim 3, wherein the plurality of carrier placement parts include a standby carrier placement part configured to make the carrier stand by, in addition to the at least one substrate loading/unloading carrier placement part and the third carrier placement part, and on each of the at least one substrate loading/unloading carrier placement part and the standby carrier placement part, the carrier is placed while being aligned in the front-rear direction in a state

in which the opening faces either the front side or the rear side.

5. The substrate processing apparatus of claim 1, wherein the at least one substrate loading/unloading carrier placement part includes a plurality of substrate loading/unloading carrier placement parts provided in the vertical direction, and the first substrate transfer mechanism is configured to move upward and downward to be shared by the plurality of substrate loading/unloading carrier placement parts.

6. The substrate processing apparatus of claim 1, wherein the processing block includes a lower processing block and an upper processing block stacked one above another, wherein each of the lower processing block and the upper processing block includes a first processing module configured to process the substrate and a main transfer mechanism configured to transfer the substrate to the first processing module, and the second substrate placement part includes a lower substrate placement part and an upper substrate placement part configured to deliver the substrate to the main transfer mechanism of the lower processing block and the main transfer mechanism of the upper processing block, respectively.

7. The substrate processing apparatus of claim 6, wherein a side where the plurality of substrate placement parts are positioned is a front side with respect to the second substrate transfer mechanism, the substrate is delivered by the second substrate transfer mechanism, and a second processing module configured to perform a gas processing on the substrate is provided on a rear side of the second substrate transfer mechanism.

8. The substrate processing apparatus of claim 6, wherein at least one of the upper processing block or the lower processing block includes a first processing block and a second processing block arranged in a left-right direction and each of which includes the first processing module, the main transfer mechanism, and a bypass transfer mechanism configured to transfer the substrate to a downstream side of a transfer path without passing through the first processing module, in the first processing block positioned on a side of the carrier block among the first processing block and the second processing block, the substrate is delivered between the bypass transfer mechanism in the first processing block and the second substrate transfer mechanism, and in the second processing block positioned to be spaced apart from the carrier block among the first processing block and the second processing block, the substrate is delivered between the bypass transfer mechanism in the second processing block, and the main transfer mechanism in the first processing block.

9. A substrate processing apparatus comprising: a carrier block including a plurality of carrier placement parts on each of which a carrier configured to receive a substrate is placed to perform a loading/unloading of the substrate with respect to the carrier; a processing block provided on one of left and right sides of the carrier block to process the substrate; a first carrier placement part and a second carrier placement part included in the plurality of carrier placement parts and provided side by side in a front-rear direction in a plan view, wherein at least one of the first carrier placement part or the second carrier placement part is at least one substrate loading/unloading carrier placement part; a plurality of substrate placement parts provided to be arranged step by step in a vertical direction on one of left and right sides of a substrate transfer region formed between the first carrier placement part and the second carrier placement part in the plan view, wherein the substrate is placed on each of the plurality of substrate placement parts; a first substrate transfer mechanism provided in the substrate transfer region and configured to rotate around a vertical axis so as to deliver the substrate between the carrier of the first carrier placement part and a first substrate placement part included in the plurality of substrate placement parts; and a second substrate transfer mechanism configured to move upward and downward so as to deliver the substrate between the first substrate placement part and a second substrate placement part included in the plurality of substrate placement parts, wherein the substrate is placed on the second substrate placement part to be delivered to the processing block, wherein the processing block includes a lower processing block and an upper processing block stacked one above another, wherein each of the lower processing block and the upper processing block includes a first processing module

configured to process the substrate and a main transfer mechanism configured to transfer the substrate to the first processing module, the second substrate placement part includes a lower substrate placement part and an upper substrate placement part configured to deliver the substrate to the main transfer mechanism of the lower processing block and the main transfer mechanism of the upper processing block, respectively, the first processing module of at least one of the lower processing block or the upper processing block includes a liquid processing module configured to supply a processing liquid to the substrate, and the substrate processing apparatus further comprises: a storage part provided on an opposite side to a side on which the second substrate transfer mechanism is provided in the front-rear direction with respect to the plurality of substrate placement parts in the plan view and configured to store the processing liquid to supply the processing liquid to the liquid processing module.

10. A substrate processing apparatus comprising: a carrier block including a plurality of carrier placement parts on each of which a carrier configured to receive a substrate is placed to perform a loading/unloading of the substrate with respect to the carrier; a processing block provided on one of left and right sides of the carrier block to process the substrate; a first carrier placement part and a second carrier placement part included in the plurality of carrier placement parts and provided side by side in a front-rear direction in a plan view, wherein at least one of the first carrier placement part or the second carrier placement part is at least one substrate loading/unloading carrier placement part; a plurality of substrate placement parts provided to be arranged step by step in a vertical direction on one of left and right sides of a substrate transfer region formed between the first carrier placement part and the second carrier placement part in the plan view, wherein the substrate is placed on each of the plurality of substrate placement parts; a first substrate transfer mechanism provided in the substrate transfer region and configured to rotate around a vertical axis so as to deliver the substrate between the carrier of the first carrier placement part and a first substrate placement part included in the plurality of substrate placement parts; a second substrate transfer mechanism configured to move upward and downward so as to deliver the substrate between the first substrate placement part and a second substrate placement part included in the plurality of substrate placement parts, wherein the substrate is placed on the second substrate placement part to be delivered to the processing block; and an inspection module provided to overlap the first carrier placement part or the second carrier placement part in the plan view and configured to inspect the substrate, wherein the first substrate transfer mechanism moves upward and downward to be shared by the substrate loading/unloading carrier placement part and the inspection module.

11. The substrate processing apparatus of claim 9, wherein each of the first carrier placement part and the second carrier placement part is the at least one substrate loading/unloading carrier placement part, and the first substrate transfer mechanism is configured to rotate to be in a first orientation for delivering the substrate to the carrier on the first carrier placement part and a second orientation for delivering the substrate to the carrier on the second carrier placement part, wherein the second orientation is opposite to the first orientation.

12. The substrate processing apparatus of claim 9, wherein the plurality of carrier placement parts include a third carrier placement part on which the carrier is placed in a third orientation so as to perform the loading/unloading of the carrier with respect to the carrier block, the substrate loading/unloading carrier placement part is configured to place the carrier thereon in a fourth orientation different from the third orientation so that an opening provided in the carrier and through which the substrate is loaded and unloaded faces either a front side or a rear side on which the first substrate transfer mechanism is located, and the substrate processing apparatus further comprises an orientation changing mechanism configured to change an orientation of the carrier between the third orientation and the fourth orientation.

13. The substrate processing apparatus of claim 12, further comprising: a carrier transfer mechanism configured to transfer the carrier between the plurality of carrier placement parts,

wherein the orientation changing mechanism corresponds to the carrier transfer mechanism.

14. The substrate processing apparatus of claim 13, wherein the plurality of carrier placement parts include a standby carrier placement part configured to make the carrier stand by, in addition to the at least one substrate loading/unloading carrier placement part and the third carrier placement part, and on each of the at least one substrate loading/unloading carrier placement part and the standby carrier placement part, the carrier is placed while being aligned in the front-rear direction in a state in which the opening faces either the front side or the rear side.

15. The substrate processing apparatus of claim 9, wherein the at least one substrate loading/unloading carrier placement part includes a plurality of substrate loading/unloading carrier placement parts provided in the vertical direction, and the first substrate transfer mechanism is configured to move upward and downward to be shared by the plurality of substrate loading/unloading carrier placement parts.

16. The substrate processing apparatus of claim 10, wherein each of the first carrier placement part and the second carrier placement part is the at least one substrate loading/unloading carrier placement part, and the first substrate transfer mechanism is configured to rotate to be in a first orientation for delivering the substrate to the carrier on the first carrier placement part and a second orientation for delivering the substrate to the carrier on the second carrier placement part, wherein the second orientation is opposite to the first orientation.

17. The substrate processing apparatus of claim 10, wherein the plurality of carrier placement parts include a third carrier placement part on which the carrier is placed in a third orientation so as to perform the loading/unloading of the carrier with respect to the carrier block, the substrate loading/unloading carrier placement part is configured to place the carrier thereon in a fourth orientation different from the third orientation so that an opening provided in the carrier and through which the substrate is loaded and unloaded faces either a front side or a rear side on which the first substrate transfer mechanism is located, and the substrate processing apparatus further comprises an orientation changing mechanism configured to change an orientation of the carrier between the third orientation and the fourth orientation.

18. The substrate processing apparatus of claim 17, further comprising a carrier transfer mechanism configured to transfer the carrier between the plurality of carrier placement parts, wherein the orientation changing mechanism corresponds to the carrier transfer mechanism.

19. The substrate processing apparatus of claim 18, wherein the plurality of carrier placement parts include a standby carrier placement part configured to make the carrier stand by, in addition to the at least one substrate loading/unloading carrier placement part and the third carrier placement part, and on each of the at least one substrate loading/unloading carrier placement part and the standby carrier placement part, the carrier is placed while being aligned in the front-rear direction in a state in which the opening faces either the front side or the rear side.

20. The substrate processing apparatus of claim 10, wherein the at least one substrate loading/unloading carrier placement part includes a plurality of substrate loading/unloading carrier placement parts provided in the vertical direction, and the first substrate transfer mechanism is configured to move upward and downward to be shared by the plurality of substrate loading/unloading carrier placement parts.