

in the angle alignment device 3, and carries the plurality of aligned substrates out of the angle alignment device 3. Thus, in the first exchange step S1, the hands 6A to 6E switch the substrates held on the hands 6A to 6E, from the substrates which are unaligned and untreated to the aligned substrates.

[0053] The angle alignment device 3 is capable of receiving the plurality of substrates placed to be oriented horizontally, and performing the angle alignment of the plurality of substrates carried thereinto, while maintaining a state in which the plurality of substrates are placed to be oriented horizontally. The angle alignment device 3 is capable of supporting the plurality of aligned substrates in a state in which the aligned substrates are placed to be oriented horizontally, and preparing for the carry-out of the aligned substrates. Thus, the angle alignment device 3 according to the present embodiment is configured to receive the plurality of unaligned substrates while preparing for the carry-out of the plurality of aligned substrates. Therefore, the first exchange step S1 can be performed.

[0054] In the first transfer step S2, the transfer robot 5 transfers the aligned substrates to the treatment device 4. At this time, the transfer robot 5 may transfer the plurality of aligned substrates having been carried out of the angle alignment device 3 in the first exchange step S1, directly from the angle alignment device 3 to the treatment device 4.

[0055] In the second exchange step S3, the transfer robot 5 carries the aligned substrates into the treatment device 4 and carries the treated substrates out of the treatment device 34.

Specifically, the hands 6A to 6E move into the treatment chamber 4a (see Fig. 1) through the substrate inlet/outlet 4b (see Fig. 1), and thereby carry the plurality of aligned substrates being held on the hands 6A to 6E (see Fig. 2) from the transfer space 9 (see Fig. 1) into the interior of treatment chamber 4a. Then, the hands 6A to 6E move down together and thereby place the plurality of aligned substrates being held on the hands 6A to 6E in predetermined carry-in positions, respectively, in the interior of treatment chamber 4a. Just after this carry-in has ended, the hands 6A to 6E which are empty hold the plurality of treated substrates, respectively which are preparing for the carry-out in predetermined carry-out positions, respectively, in the interior of treatment chamber 4a. Then, the hands 6A to 6E exit the treatment chamber 4a through the substrate inlet/outlet 4b and thereby carries the plurality of treated substrates being held on the hands 6A to 6E out of the treatment chamber 4a and to the transfer space 9. Thus, in the second exchange step S3, the hands 6A to 6E switch the substrates held on the hands 6A to 6E from the aligned substrates to the treated substrates.

[0056] In the second transfer step S4, the transfer robot 5 transfers the treated substrates to the storage unit 2. At this time, the transfer robot 5 may transfer the plurality of treated substrates

having been carried out of the treatment device 4 in the second exchange step S3, directly from the treatment device 4 to the storage unit 2.

[0057] In the third exchange step S5, the transfer robot 5 carries the treated substrates into the storage unit 2 and carries the unaligned and untreated substrates out of the storage unit 2. Specifically, the hands 6A to 6E move into the container 2a (Fig. 1) through the substrate inlet/outlet 2b (see Fig. 1), and thereby carry the plurality of treated substrates being held on the hands 6A to 6E (see Fig. 2) from the transfer space 9 (see Fig. 1) into the container 2a. Then, the hands 6A to 6E move down together and place the plurality of treated substrates being held on the hands 6A to 6E in predetermined storage positions, respectively, in the interior of the container 2a. At this time, the plurality of substrates are stored in the interior of the container 2a in a state in which the substrates are placed to be oriented horizontally and arranged to be vertically spaced apart from each other. Just after this carry-in has ended, the hands 6A to 6E which are empty exit the container 2a through the ~~container~~substrate inlet/outlet 2b of the container 2a. Then, the hands 6A to 6E which are empty move into another container 2a in which the unaligned and untreated substrates are stored, through the ~~container~~substrate inlet/outlet 2b of another container 2a. Then, the hands 6A to 6E move up together, and thereby hold the plurality of unaligned and untreated substrates placed in the predetermined storage positions, respectively, in the interior of another container 2a. Then, the hands 6A to 6E exit the container 2a through the ~~container~~substrate inlet/outlet 2b and thereby carries the plurality of unaligned and untreated substrates being held on the hands 6A to 6E out of the container 2a and to the transfer space 9. Thus, in the third exchange step S5, the hands 6A to 6E switch the substrates held on the hands 6A to 6E, from the treated substrates to the unaligned and untreated substrates.

[0058] In the third transfer step S6, the transfer robot 5 transfers the unaligned and untreated substrates to the angle alignment device 3. At this time, the transfer robot 5 may transfer the plurality of unaligned and untreated substrates having been carried out of the storage unit 2 in the third exchange step S5, directly from the storage unit 2 to the angle alignment device 3.

[0059] The operation of the substrate transfer method S0 according to the present embodiment will be described with reference to the comparative example. Fig. 5 is a flowchart showing the flow of the steps of a substrate transfer method S900 performed within a substrate treatment system 901 according to a comparative example. Fig. 6 is a flowchart showing the flow of the substrates within the substrate treatment system 901 in a case where the substrate transfer method S900 of Fig. 5 is performed.

[0060] As shown in Fig. 6, the substrate treatment system 901 according to the comparative example includes a storage unit 902, an angle alignment device 903, a treatment device 904, and

aligned substrates 100. After the hand 6 holds the five substrates 100, the hand 6 exits in a carry-out direction X2 which is opposite to the carry-in direction X1. In this way, the five substrates 100 are carried together out of the angle alignment device 3 together with the hand 6, through the substrate entrance/exit 3a.

[0083] In accordance with the angle alignment device 3 of the present invention, while the five second support sections 12A to 12E are preparing for the carry-out of the five aligned substrates 100 carried thereinto, respectively, the five holding sections 10A to 10E can receive the five unaligned substrates 100, respectively. While the five holding sections 10A to 10E are preparing for the carry-out of the five aligned substrates 100 carried thereinto, respectively, the five second support sections 12A to 12E can receive the five unaligned substrates 100, respectively. In this way, the angle alignment device 3 can exchange one set of the five unaligned substrates 100 for one set of the five aligned substrates 100. As a result, as described above, the transfer efficiency of the substrates 100 and the operation efficiency of the angle alignment device 3 can be improved.

[0084] Hereinafter, the carry-in direction X1 and the carry-out direction X2 will be collectively referred to as “in/out direction X” when the carry-in direction X1 and the carry-out direction X2 are not distinguished from each other and indicated as one direction, and the “in/out direction X” is horizontal. A horizontal direction perpendicular to the “in/out direction X” will be referred to as a “perpendicular direction Y”. To distinguish the five holding sections ~~11A~~10A to ~~11E~~10E arranged vertically from each other, the five holding sections 10A to 10E will be referred to as the holding section 10A at the first stage, the holding section 10B at the second stage, the holding section 10C at the third stage, the holding section 10D at the fourth stage, and the holding section 10E at the fifth stage, respectively, from the bottom to the top. The other elements corresponding to the holding sections 10A to 10E will be referred to in the same manner.

[0085] Fig. 9 is a plan view of the angle alignment device 3 of Fig. 8. As shown in Figs. 8 and 9, the five holding sections 10A to 10E are driven to be rotated together by a rotation drive unit 30. The rotation drive unit 30 according to the present embodiment includes a single rotation drive source 31 such as an electric motor, and a rotation transmission mechanism 32 which transmits a driving force generated by the rotation drive source 31 to each of the plurality of holding sections 10A to 10E to rotate the five holding sections 10A to 10E together. The rotation transmission mechanism 32 includes a reduction gear mechanism 33, a drive shaft 34, and five belt transmission mechanisms 35A to 35E. The drive shaft 34 extends vertically and is rotatably supported. The drive shaft 34 is coupled to the output shaft of the rotation drive source 31 via the reduction gear mechanism 33. The five belt transmission mechanisms 35A to

parallel with each other and to be distant from each other in the perpendicular direction Y. The side wall 57 located on a first side connects the first end portions of the bases 51, 52 to each other, and connects the poles 53, 55 located on the first side to each other. The side wall 5458 located on a second side connects the second end portions of the two bases 51, 52 to each other, and connects the two poles 54, 56 located on the second side to each other. In this manner, the second up-down unit 22 constitutes the above-described box unit.

[0094] As shown in Figs. 8 and 9, the five first up-down units 21A to 21E are arranged in the in/out direction X and collectively disposed within the inner region of the second up-down unit 22. Although the five first up-down units 21A to 21E are arranged in the carry-out direction X2 in the order of first to fifth stages, the order of the arrangement may be selected as desired.

[0095] Now, an attention is paid to the first up-down unit 21E at the fifth stage shown in Fig. 10 as well as Figs. 8 and 9. The first up-down unit 21E includes a base 61E extending in the perpendicular direction, and a pair of poles 62E, 63E extending vertically upward from the first end portion and second end portion of the base 61E, respectively. The first up-down unit 21E has a U-shape as in the second up-down unit 22, when viewed in the in/out direction X. The size of the first up-down unit 21E is set to be smaller than that of the second up-down unit 22. This allows the first up-down unit 21E to be accommodated in the inner region of the second up-down unit 22. The base 61E is slightly shorter than the bases 51, 52 of the second up-down unit 22 and is disposed between the pair of side walls 57, 58 of the second up-down unit 22 (see in particular Fig. 9). The pair of poles 62E, 63E are disposed inward relative to the four poles 53 to 56 of the second up-down unit 22. The pair of poles 62E, 63E extend vertically and face the inner surfaces of the pair of side walls 57, 58 of the second up-down unit 22 (see in particular Fig. 9). In this way, the first up-down unit 21E at the fifth stage is nested into the second up-down unit 22.

[0096] The remaining first up-down units 21A to 21D are configured as in the first up-down unit 21E at the fifth stage and nested into the second up-down unit 22. The five bases 61A to 61E extend in parallel with each other within the inner region of the second up-down unit 22 (see in particular Fig. 9). On a first side in the perpendicular direction Y, the five poles 62A to 62E extend vertically and are arranged in the in/out direction X within the inner region of the second up-down unit 22 (the detail is not shown). On a second side in the perpendicular direction Y, the five poles 63A to 63E also extend vertically and are also arranged in the in/out direction X within the inner region of the second up-down unit 22 (see in particular Fig. 8). The five poles 63A to 63E have different heights corresponding to the heights of the corresponding holding sections 10A to 10E, respectively. The pole 63A at the first stage has a minimum height, while

[0108] When the second up-down unit 22 is viewed in the carry-in direction X1, the carry-out side base 52 and the two poles 55, 56 extending vertically upward from the base 52 are configured to form a U-shape, and the five first up-down units 21A to 21E are configured to form a U-shape in the same manner at a location that is away on the carry-in side in the in/out direction X, from the second up-down unit 22 (see in particular in Fig. 10). The five holding sections 10A to 10E are disposed at a location that is away on the carry-in side in the in/out direction X, from the five first up-down units 21A to 21E. The five holding sections 10A to 10E are arranged vertically between the poles 62A to 62E and the poles 63A to 63E in the perpendicular direction Y.

[0109] The first up-down units 21A to 21E and the second up-down unit 22 are opened on the carry-out side in the in/out direction X as described above, and this opening portion on the carry-out side constitutes the substrate entrance/exit 3a through which the substrates 100 are carried into and out of the angle alignment device 3. The hand 6 can move in the carry-in direction X1 into the inner regions of the first up-down units 21A to 21E through the substrate entrance/exit 3a and move in the carry-out direction X2 out of the first up-down units 21A to 21E and the second up-down unit 22 through the substrate entrance/exit 3a (see in particular Fig. 9).

[0110] While the holding sections 10A to 10E are holding the substrates 100 of a disc shape, only the center portions of the substrates 100 are placed on the upper surfaces of the holding sections 10A to 10E, respectively, and the remaining portions of the substrates 100 protrude horizontally from the holding sections 10A to 10E, respectively, and have a ring-shape when viewed from above. The bases 61A to 61E of the first up-down units 21A to 21E are shorter than the bases 51, 52 of the second up-down unit 22 and longer than the diameter of the substrates 100. This makes it possible to carry the substrates 100 into the first up-down units 21A to 21E, respectively, as described above, without interference between the substrates 100 and the up-down units 21A to 21E, 22. In a state in which the substrates 100 carried into the first up-down units 21A to 21E are held on the five holding sections 10A to 10E, respectively, the held substrates 100 face the poles 62A to 62E and 63A to 63E of the first up-down units 21A to 21E, forming gaps with the poles 62A to 62E and 63A to 63E.

[0111] As shown in Fig. 9, the drive shaft 34 is disposed to be distant in the carry-in direction X1 from the second up-down unit 22, together with the rotation drive source 31. For this reason, the drive shaft 34 does not impede the carry-out or carry-in of the substrates 100. The first up-down units 21A to 21E and the second up-down unit 22 constitute a box unit which is opened on the carry-in side in the in/out direction X. The belt transmission mechanisms 36A35A to 36E35E extend in the carry-out direction X2 from an outside region of the second up-down unit 22

into the inner regions of the five first up-down units 21A to 21E through the opening portion on the carry-in side. Since the up-down units 21A to 21E, 22 are opened in this way, the drive shaft 34 extending vertically can be disposed outside the up-down units 21A to 21E, 22, and the mechanisms 36A to 36E for rotating the holding sections 10A to 10E inside the up-down units 21A to 21E, 22 by utilizing the rotation of the drive shaft 34 can be disposed. In addition, the up-down units 21A to 21E, 22 are also opened on the carry-out side, and this opening portion serves as the substrate entrance/exit 3a. With these configurations, the whole of the rotation drive unit 30 can be disposed not to impede the carry-out or carry-in of the substrates 100.

[0112] As shown in Fig. 8, the first up-down units 21A to 21E include the first support sections 11A to 11E, respectively, in a one-to-one correspondence. The first support sections 11A to 11E are secured to the poles 62A to 62E and 63A to 63E, of the corresponding first up-down units 21A to 21E, respectively. In the first up-down units 21A to 21E, the poles 62A, 63A, the poles 62B, 63B, the poles 62C, 63C, the poles 62D, 63D, and the poles 62E, 63E form pairs, respectively. Each of the first support sections 11A to 11E forms a pair.

[0113] Now, an attention is paid to the first up-down unit 21E at the fifth stage. As shown in Fig. 10, the first support sections 11E at the fifth stage form a pair in the perpendicular direction Y. The pair of first support sections 11E have a flat plate claw shape. The pair of first support sections 11E are attached to the pair of poles 62E, 63E of the corresponding first up-down unit 21E, and disposed to sandwich the corresponding holding section 10E therebetween in the perpendicular direction Y. The pair of first support sections 11E are disposed to be equal in height on the basis of the base 61E of the corresponding first up-down unit 21E in such a manner that the first support sections 11E are substantially equal in height to the corresponding holding section 10E.

[0114] As shown in Fig. 9, the substrate 100 held on the holding section 10E extends horizontally from the holding section 10. The edge portion of the substrate 100 on the first side in the perpendicular direction Y is slightly apart from the poles 62A to 62E of the first up-down units 21A to 21E and the poles 53, 55 of the second up-down unit 22. The edge portion of the substrate 100 on the second side in the perpendicular direction Y is slightly apart from the poles 63A to 63E of the first up-down units 21A to 21E and the poles 54, 56 of the second up-down unit 22.

[0115] The pair of first support sections 11E protrude in the perpendicular direction Y from the corresponding poles 62E, 63E, respectively, and are disposed in the inner regions of the first up-down units 21A to 21E. The first support section 11E on the first side in the perpendicular direction Y do not overlap with the holding section 10E when viewed from above, and overlaps

sandwich therebetween in the in/out direction X the first support section 11E located on the same side (on the second side in the perpendicular direction Y), of the corresponding first support sections 11E, do not overlap with the corresponding holding section 10E and the corresponding first support section 11E when viewed from above, and overlap with the edge portion located on the second side of the substrate 100 held on the holding section 10E when viewed from above. The regions of these second support sections 12E which overlap with the substrate 100 are set to sandwich therebetween in the in/out direction X the region of the first support section 11E on the second side which overlaps with the substrate 100. As a result, the substrate 100 overlaps with the second support sections 12E, at four separate locations, respectively.

[0125] In particular, in the present embodiment, in both of the set on the first side in the perpendicular direction Y and the set on the second side in the perpendicular direction Y, the two second support sections 12E are disposed to be line-symmetric with respect to the above-described reference line LY as a symmetric axis. Also, the two second support sections 12E included in the set on the first side in the perpendicular direction Y is disposed to be line-symmetric with the two second support sections 12E included in the set on the second side in the perpendicular direction Y, with respect to the above-described reference line LX as a symmetric axis. Therefore, in a relation between the substrate 100 and the second support sections 12E, the four regions of the second support sections 12E which overlap with the substrate 100 are set to be line-symmetric with respect to the reference line (center line)LX as the symmetric axis and to be line-symmetric with respect to the reference line (center line)LY as the symmetric axis.

[0126] The remaining second support sections 12A to 12D are configured as in the second support section 12E at the fifth stage. The five second support sections 12A to 12E are disposed to perfectly overlap with each other when viewed from above. Therefore, in a relation between each of the five substrates 100 and the corresponding one of the five second support sections 12A to 12E, the regions of the substrate 100 which overlap with the corresponding ~~first~~second support sections ~~11A~~12A to ~~11E~~12E when viewed from above are configured in the same manner.

[0127] Fig. 11 is a schematic view showing a positional relationship among the holding section 10A, the first support sections 11A and the second support sections 12A of Figs. 8 to 10, when viewed in the in/out direction X. Although Fig. 11 shows the positional relationship between the holding section 10A at the first stage and the corresponding elements, the same positional relationship applies to the remaining holding sections 10B to 10E.

[0128] As shown in Fig. 11, the first support sections 11A are moved up and down between a first retracted position that is below the substrate 100 held on the corresponding holding section

surface of the holding section 10A, and the second support sections 12A are further moved down. This allows the substrate 100 to be transferred from the second support sections 12A and loaded onto the holding section 10A.

[0134] It should be noted that in a case where the second support sections 12A are moved up from the second retracted position to the second support position in a state in which the substrate 100 is held on the holding section 10A, the substrate 100 held on the holding section 10A can be lifted up by the second support sections 12A. Also, in a case where the second support sections 11A are moved down from the second support position to the second retracted position in a state in which the substrate 100 is supported on the second support sections 12A and the first support sections 11A are located at the first support position, the substrate 100 supported on the second support sections 12A can be transferred and loaded onto the first support sections 11A. However, such a transfer method is not employed in a substrate angle alignment method which will be described later.

[0135] The holding section 10A, the corresponding first support sections 11A, and the corresponding second support sections 12A are disposed in such a manner that they do not overlap with each other when viewed from above. In this structure, even when the first support sections 11A are moved up and down while crossing the upper surface level of the holding section 10A, the substrate 100 can be transferred and loaded between the first support sections 11A and the holding section 10A without interference of the first support sections 11A with the holding section 10A. Also, even when the second support sections 12A are moved up and down while crossing the upper surface level of the holding section 10A and the first support position level of the first support sections 11A, the substrate 100 can be transferred and loaded among the holding section 10A, the first support sections 11A and the second support sections 12A without interference of the second support sections 12A with the holding section 10A and the first support sections 11A.

[0136] The second support position is below the lower surface of the holding section 10B which is higher than the corresponding holding section 10A by one stage. In this configuration, when the substrate 100 is lifted up by the second support sections 12A, this substrate 100 does not collide against the holding section 10B which is higher by one stage. It is sufficient that the first retracted position and the second retracted position are below the upper surface of the corresponding holding section 10A. The first retracted position and the second retracted position may be above the lower surface of the corresponding holding section 10A. Although in the example Fig. 911, the second retracted position is below the first retracted position for the sake of simpler illustration, the second retracted position may be as high as the first retracted

position, or above the first retracted position in the vertical direction.

[0137] With reference to Fig. 11, the holding section 10A can receive the unaligned substrate 100 carried thereinto and held on the corresponding hand 6A, hold the aligned substrate 100, and prepare for the carry-out of the aligned substrate 100. The second support sections 12A located at the second support position can receive the unaligned substrate 100 carried thereinto, support the aligned substrate 100, and prepare for the carry-out of the aligned substrate 100.

[0138] When the substrate 100 is carried into the holding section 10A, the hand 6A moves in the carry-in direction X into the angle alignment device 3, at a first upper entrance/exit position that is above the upper surface of the holding section 10A, and moves down to a first lower entrance/exit position that is below the upper surface of the holding section 10A. This allows the substrate 100 held on the hand 6A to be transferred and loaded onto the upper surface of the holding section 10A. After that, the hand 6A moves in the carry-out direction X2 and exits the angle alignment device 3, and thus the carry-in of the substrate 100 to the holding section 10A is completed. When the substrate 100 held on the holding section 10A is carried out of the holding section 10A, the hand 6A moves into the angle alignment device 3 at a first lower entrance/exit position, and moves up to the first upper entrance/exit position. This allows the substrate 100 held on the holding section 10A to be transferred and loaded onto the hand 6A. After that, the hand 6A moves in the carry-out direction X2 and exits the angle alignment device 3, and thus the carry-out of the substrate 100 from the holding section 10A is completed.

[0139] When the substrate 100 is carried into the second support sections 12A, the hand 6A moves in the carry-in direction X into the angle alignment device 3, at a second upper entrance/exit position that is above the second support position and below the lower surface of the holding section ~~10A~~10B which is higher by one stage, and moves down to a second lower entrance/exit position that is below the second support position. This allows the substrate 100 held on the hand 6A to be transferred and loaded onto the second support sections 12A. After that, the hand 6A moves in the carry-out direction X2 and exits the angle alignment device 3, and thus the carry-in of the substrate 100 to the ~~holding section 10A~~second support section 12A is completed. When the substrate 100 supported on the second support sections 12A is carried out of the second support sections 12A, the hand 6A moves into the angle alignment device 3, at the second lower entrance/exit position and moves up to the second upper entrance/exit position. This allows the substrate 100 supported on the second support sections 12A to be transferred and loaded onto the hand 6A. After that, the hand 6A moves in the carry-out direction X2 and exits the angle alignment device 3, and thus the carry-out of the substrate 100 from the second support sections 12A is completed.

carry-out location of the substrates 100 is switched in an alternate manner. This allows the second support sections 12A to 12E to receive the unaligned substrates 100X carried thereinto, while preparing for the carry-out of the aligned substrates 100Z, without a need for the second support sections 12A to 12E to include a particular structure for circumventing the substrates 100. Therefore, the first exchange step S1 (see Figs. 3 and 4) of the substrate transfer method S0 can be performed.

[0159] Fig. 18 is a block diagram showing the configuration of an angle alignment device 203 according to Embodiment 2. Fig. 19 is a front view of the angle alignment device 203 of Fig. 18. The angle alignment device 203 according to the present embodiment is different from the angle alignment device 3 according to Embodiment 1 in that second support sections 212A to 212E are movable up and down while circumventing the substrates 100. Hereinafter, regarding the angle alignment device 203 according to Embodiment 2, this difference will be mainly described.

[0160] As shown in Fig. 18, in the angle alignment device 203, a second up-down unit 222 includes the five second support sections 212A to 212E and is movable up and down according to the operation of a single second up-down drive source 72. According to the up-down movement of the second up-down unit 222, the five second support sections 212A to 212E are moved up and down together between the second support positions and the second retracted positions. The five second support sections 212A to 212E are movable down from the second support positions to the second retracted positions while circumventing the substrates 100 held on the holding sections 10A to 10E, respectively. To this end, an up-down drive unit 270 includes circumvention drive sources 275 for moving the second support sections 212A to 212E in the radial direction of the substrates 100, in addition to the second up-down drive source 72. The circumvention drive sources 275 are able to retract the second support sections 212A to 212E to positions that are outward relative to the outer peripheries of the substrates 100 held on the holding sections 10A to 10E, respectively. A controller 280 controls the operation of the circumvention drive sources 275, as a part of the control performed for the rotation drive unit 30 and the up-down drive unit 270.

[0161] As shown in Fig. 19, for example, the second up-down unit 222 includes a base 252, and poles 255, 256 disposed to be distant from each other in the perpendicular direction Y. The five second support sections 212A to 212E are secured to the poles 255, 256 in such a manner that the second support sections 212A to 212E are arranged to be vertically spaced apart from each other. The circumvention drive sources 275 are, for example, cylinders for reciprocating in the perpendicular direction Y, the poles ~~255, 256~~ with respect to the base ~~255, 256~~, and are fastened

Claims

1. A substrate angle alignment device comprising:
 - a plurality of holding sections which hold a plurality of substrates, respectively in such a manner that the plurality of substrates are placed to be oriented horizontally and arranged vertically;
 - a rotation drive unit which rotates the plurality of holding sections together;
 - a first up-down unit which includes a plurality of first support sections corresponding to the plurality of holding sections, respectively, and moves the plurality of first support sections between first retracted positions that are below the substrates held on the holding sections corresponding to the first support sections, respectively, and first support positions that are above the holding sections corresponding to the first support sections, respectively;
 - a second up-down unit which includes a plurality of second support sections corresponding to the plurality of holding sections and the plurality of first support sections, respectively, and moves up and down the plurality of second support sections together between second retracted positions that are below the substrates held on the holding sections corresponding to the second support sections, respectively, and second support positions that are above the first support positions of the first support sections corresponding to the second support sections, respectively; and
 - an up-down drive unit which drives the first up-down unit and the second up-down unit.
2. The substrate angle alignment device according to claim 1,
 - wherein the rotation drive unit includes:
 - a single rotation drive source; and
 - a rotation transmission mechanism which transmits a driving force generated by the rotation drive source to each of the plurality of holding sections to rotate the plurality of holding sections together.
3. The substrate angle alignment device according to claim 1 or 2,
 - wherein the first up-down unit is one of a plurality of first up-down units,
 - wherein the plurality of first up-down units include the plurality of first support sections, respectively, and
 - wherein the up-down drive unit includes a plurality of first up-down drive sources corresponding to the plurality of first up-down units, respectively.

4. The substrate angle alignment device according to any one of claims 1 to 3,
wherein each of the plurality of holding sections is a turn table which is rotatable around
a center axis thereof,

wherein each of the plurality of first support sections constitutes a pair of first support
sections which are disposed to sandwich therebetween the turn table in a direction perpendicular
to a substrate carry-in direction, and

wherein each of the plurality of second support sections constitutes a pair of second
support sections which are disposed to sandwich therebetween the turn table in the direction
perpendicular to the substrate carry-in direction.

5. The substrate angle alignment device according to claim 4,
wherein the pair of first support sections are provided on a reference line extending
through a center of the turn table and in the direction perpendicular to the substrate carry-in
direction, when viewed from above, and

wherein the second support section on a first side in the direction perpendicular to the
substrate carry-in direction, of the pair of second support sections, is composed of a pair of
second support sections which are disposed to sandwich the first support section on the first side
in the substrate carry-in direction, and the second support section on a second side in the
direction perpendicular to the substrate carry-in direction, of the pair of second support sections,
is composed of a pair of second support sections which are disposed to sandwich the first support
section on the second side in the substrate carry-in direction.

6. The substrate angle alignment device according to claim 4 or 5,
wherein the first up-down unit includes:

a base mount disposed below the holding section at a lowermost stage and
extending in the direction perpendicular to the substrate carry-in direction; and

a pair of pole members extending upward from both ends of the base mount,
wherein the pair of first support sections are provided on the pair of pole members,
respectively, and

wherein the turn table is one of a plurality of turn tables which are arranged vertically in
a space surrounded by the base mount and the pair of pole members.

7. The substrate angle alignment device according to claim 6,

wherein the second up-down unit includes:

a base mount disposed below the holding section at the lowermost stage and extending in the direction perpendicular to the substrate carry-in direction; and

four pole members coupled to the base mount, and

wherein the first up-down unit is accommodated in an inner region of the second up-down unit which is surrounded by the four pole members, and the second support sections are provided on the four pole members, respectively.

8. The substrate angle alignment device according to claim 7,

wherein the up-down drive unit includes a circumvention drive source which retracts the plurality of second support sections to positions that are outward relative to outer peripheral edges of the substrates held on the holding sections, corresponding to the second support sections, respectively, and

wherein the up-down drive unit is configured to move down the plurality of second support sections together from the second support positions to the second retracted positions, respectively, while circumventing the substrates held on the holding sections, respectively.

9. A substrate angle alignment method which uses a substrate angle alignment device including a plurality of holding sections, a plurality of first support sections corresponding to the plurality of holding sections, respectively, and a plurality of second support sections corresponding to the plurality of holding sections and the plurality of first support sections, respectively, the substrate angle alignment method comprising:

holding a plurality of substrates on the plurality of holding sections, respectively in such a manner that the plurality of substrates are placed to be oriented horizontally and arranged vertically;

repeating a series of angle alignment operations in which the plurality of holding sections are rotated together to perform angle alignment of one of the plurality of substrates, and the first support section corresponding to the holding section holding the substrate which has been aligned is moved up to lift up the substrate with the first support section; and

performing a first transfer/loading operation in which the plurality of second support sections are moved up together to lift up the plurality of aligned substrates which are supported on the plurality of first support sections, with the plurality of second support sections, respectively.

10. The substrate angle alignment method according to claim 9,

wherein after the first transfer/loading operation is performed, the plurality of first support sections are moved down to positions that are below the plurality of holding sections corresponding to the plurality of first support sections, respectively, before the plurality of substrates which are unaligned are held on the plurality of holding sections, respectively.

11. The substrate angle alignment method according to claim 9 or 10, comprising:

when the first transfer/loading operation is performed, the plurality of unaligned substrates are carried into the plurality of holding sections, respectively, and the plurality of aligned substrates are carried out of the plurality of second support sections, respectively,

repeating the series of angle alignment operations; and

performing a second transfer/loading operation in which the plurality of first support sections are moved down together to transfer and load the plurality of aligned substrates which are supported on the plurality of first support sections, to the plurality of holding sections, respectively; and

when the second transfer/loading operation is performed, the plurality of unaligned substrates are carried into the plurality of second support sections, respectively, and the plurality of aligned substrates are carried out of the plurality of holding sections, respectively,

moving down the plurality of second support sections together to transfer and load the plurality of unaligned substrates which are supported on the plurality of second support sections, to the plurality of holding sections, respectively;

repeating the series of angle alignment operations; and

performing the first transfer/loading operation.

12. The substrate angle alignment method according to claim 9 or 10, comprising:

when the first transfer/loading operation is performed, the plurality of unaligned substrates are carried into the plurality of holding sections, respectively, and the plurality of aligned substrates are carried out of the plurality of second support sections, respectively,

moving down the plurality of second support sections together to positions that are below the holding sections corresponding to the second support sections, respectively, while circumventing the substrates held on the holding sections, respectively;

repeating the series of angle alignment operations; and

performing the first transfer/loading operation.

~~13. — A substrate transfer method which transfers substrates among a substrate storage unit which stores the substrates therein, a substrate angle alignment device which performs angle alignment of the substrates, and a substrate treatment device which treats the substrates, the substrate transfer method comprising:~~

- ~~—— a first exchange step in which the substrates which are unaligned are carried into the substrate angle alignment device, and the substrates which have been aligned are carried out of the substrate angle alignment device;~~
- ~~—— a first transfer step in which the aligned substrates are transferred to the substrate treatment device;~~
- ~~—— a second exchange step in which the aligned substrates are carried into the substrate treatment device and the substrates which have been treated are carried out of the substrate treatment device;~~
- ~~—— a second transfer step in which the treated substrates are transferred to the substrate storage unit;~~
- ~~—— a third exchange step in which the treated substrates are carried into the substrate storage unit, and the unaligned substrates are carried out of the substrate storage unit; and~~
- ~~—— a third transfer step in which the unaligned substrates are transferred to the substrate angle alignment device.~~