

the electromagnetic coil 31, the suction head 30 moves upward, and the suction head 30 picks up the semiconductor chip 14 from the wafer holder 12. In addition, the flip head 25 moves with the carriage 23 along the guide rail 21 in X direction in the state in which the suction head 30 sucks the semiconductor chip 14. [The flip head 25 supplies a suction force VAC by using a](#)

[vacuum device not shown herein to suck a semiconductor chip.](#)

[0025] Then, as shown in FIG. 3C, when arriving at the vertical bottom of the mounting head 46, the flip head 25 drives the stepping motor 26 and flips the flip head 25.

[0026] Then, as shown in FIG. 3D, by conducting power to the electromagnetic coil 31, the flip head 25 presses the semiconductor chip 14 against the mounting head 46 in the state in which the suction head 30 sucks the semiconductor chip 14.

[0027] Then, as shown in FIG. 3E, after the mounting head 46 sucks the semiconductor chip 14, the handling unit 20 separates the suction head 30 from the mounting head 46 by controlling the power conducted to the electromagnetic coil 31. Accordingly, the passing of the semiconductor chip 14 from the handling unit 20 to the mounting head 46 is completed.

[0028] In the following, the control configuration of the handling unit 20 is described.

As shown in FIG. 4, the handling unit 20, for example, includes an arithmetic processing unit 110, a storage unit 120, a driving motor 22A, the stepping motor 26, the flip head 25, an encoder 130, and an input/output device 140. The arithmetic processing unit 110 is a processor (central processing unit, CPU) performing processes executing the control and the program of the handling unit 20. The processor may have a configuration in which an application specific integrated circuit (ASIC) or a graphic processing unit (GPU), etc., cooperate with an arithmetic processing chip. The arithmetic processing unit 110 reads a suction control program stored in the storage unit 120, and executes various processes relating to suction control.

[0029] The storage unit 120 is a non-volatile storage medium, and is formed by a hard disk drive (HDD), for example. In addition to storing the program that executes the control or the processing of the handling unit 20, the storage unit 120 stores various parameter values,

functions, lookup tables, etc., for exerting control or carrying out calculation. A load threshold 122 is an example of the parameter values used for exerting control or carrying out calculation.

[0030] The driving motor 22A moves the slider 22 in X direction based on a driving signal output from the arithmetic processing unit 110. The arithmetic processing unit 110 generates a driving signal based on X-direction position information of the slider 22 measured by the encoder 130, and outputs the generated driving signal to the driving motor 22A.

[0031] The stepping motor 26 flips the flip head 25 by rotating the rotation shaft 24 based on the driving signal output from the arithmetic processing unit 110. The arithmetic processing unit 110 specifies the rotation position of the flip head 25 based on the driving signal output to the stepping motor 26. In addition, the arithmetic processing unit 110 generates a driving signal based on the specified rotation position, and outputs the generated driving signal to the stepping motor 26.

[0032] The flip head 25 adjusts the extension amount of the suction head from the end surface of the casing 29 by conducting power to the electromagnetic coil 31 based on the driving signal output from the arithmetic processing unit 110.

[0033] The input/output device 140 is a device including a keyboard, a mouse, a display monitor, for example, receives a menu operation by a user, and presents information to the user. The input/output device 140, for example, outputs a signal indicating a suction control start command to the arithmetic processing unit 110 based on an operation by the user.

[0034] The arithmetic processing unit 110 also serves as a functional arithmetic unit which executes various arithmetic operations in correspondence with the process instructed in the suction control program. The arithmetic processing unit 110 includes, for example, a movement control unit 112, a rotation control unit 114, a load control unit 116, and a suction control unit 118.

[0035] The movement control unit 112 moves the suction head 30. The movement control

unit 112, for example, moves the slider 22 along the guide rail 21 in X direction based on the position information measured by the encoder 130, and moves the suction head 30 of the flip head 25 attached to the slider 22 in X direction.

[0036] The rotation control unit 114 controls the rotation position of the suction head 30 with the predetermined rotation shaft 24 as the center. The predetermined rotation shaft 24, for example, is a shaft rotating in a horizontal direction. When the position of the slider 22 measured by the encoder 130 arrives at the vertical bottom of the mounting head 46, for example, the rotation control unit 114 flips the flip head 25 by driving the stepping motor 26 to rotate the rotation shaft 24.

[0037] The load control unit 116 controls the magnitude of the load acting on the semiconductor chip 14 from the suction head 30. The load control unit 116, for example, controls the magnitude of the load acting on the semiconductor chip 14 from the suction head 30 based on the amount of power conducted to the electromagnetic coil 31 and the movement amount of the suction head 30.

[0038] The suction control unit 118 causes the suction head 30 to suck the semiconductor chip 14, so that the load acting on the semiconductor chip 14 from the suction head 30 is equal to or lower than the load threshold 122 in conjunction with movement of the suction head 30. For example, when the suction head 30 moves to a suction position of sucking the semiconductor chip 14, the suction control unit 118 causes the suction head 30 to suck the semiconductor chip 14. The suction control unit 118, for example, ~~the suction control unit 118~~ extends the suction head 30 from the end surface of the casing 29 and makes the extending suction head 30 approach the semiconductor chip 14 by conducting power to the electromagnetic coil 31. Then, when the magnitude of the load acting on the semiconductor chip 14 from the suction head 30 is a positive value, the suction control unit 118 detects that the suction head 30 has moved to the suction position.