

DESCRIPTION

TITLE OF INVENTION: ELECTRONIC COMPONENT PROCESSING APPARATUS

5 TECHNICAL FIELD

[0001] The present disclosure relates to an electronic component processing apparatus that performs predetermined processing on an electronic component.

BACKGROUND ART

10 [0002] An electronic component processing apparatus that performs predetermined processing on electronic components using processing units such as an appearance inspection unit includes a pickup unit (rotary pick-up mechanism) that sequentially picks up electronic components attached to the front surface of a wafer sheet using a suction nozzle (pickup
15 nozzle), and a transport unit (a unit consisting of a turntable or the like) that transports the electronic components obtained from the pickup unit to a processing position where the processing units are placed (refer to Patent Literature 1).

[0003] The suction nozzle sucks and picks up the electronic component that ejects onto the front side of the wafer sheet when the back surface of the wafer sheet is pushed by a pin (push-up pin). The position of the electronic component sucked by the suction nozzle with
20 respect to the suction nozzle is influenced by the position of the ejected electronic component with respect to the suction nozzle before being sucked, or the like. In addition, the position of the electronic component sucked by the suction nozzle with respect to the suction nozzle affects the position of the electronic component picked up by the transport unit with respect to the transport unit.

25 [0004] When the position of the electronic component placed at the processing position by the transport unit with respect to the processing unit is not a predetermined position, problems may occur, such as the processing by the processing unit not being performed appropriately. Therefore, the position of the electronic component picked up by the transport unit is adjusted by an alignment unit before being transported to the processing position. The alignment unit
30 picks up the electronic component from the transport unit, adjusts the position, and then returns the electronic component to the transport unit.

[0005] However, adjusting the position of the electronic component by the alignment unit takes longer than processing by the processing unit, resulting in problems such as an inability

to efficiently process the electronic components.

PRIOR ART DOCUMENT

PATENT LITERATURE

5 [0006] Patent Literature 1: JP2012-119494A

SUMMARY OF INVENTION

[0007] The present disclosure relates to an electronic component processing apparatus that can adjust the position and orientation of an electronic component at a processing position
10 with respect to a processing unit to a predetermined position and orientation without using an alignment unit that picks up the electronic component from a transport unit and adjusts the position of the electronic component.

[0008] According to the present disclosure, an electronic component processing apparatus includes: an ejecting mechanism that ejects an electronic component attached to a wafer sheet
15 in a first direction perpendicular to the wafer sheet; a pickup unit having a component support section that picks up the electronic component ejected in the first direction at a pickup position facing the wafer sheet; a transport unit that moves a component holding section together with the electronic component to a processing position by rotation of a rotating body having the component holding section attached thereto, the component holding section
20 picking up the electronic component from the pickup unit at a receiving position; a processing unit that performs predetermined processing on the electronic component placed at the processing position; a first drive mechanism that moves the ejecting mechanism along a first virtual plane parallel to the wafer sheet; a second drive mechanism that moves the pickup unit, which supports the electronic component with the component support section, along a
25 second virtual plane parallel to the wafer sheet; a third drive mechanism that moves the wafer sheet within a third virtual plane including the wafer sheet; a deviation derivation section that detects a deviation of the electronic component picked up by the component support section from a reference position and a reference orientation; and a control section that controls the first drive mechanism, the second drive mechanism, and the third drive mechanism to adjust
30 positions of the component support section placed at the pickup position, the electronic component to be subsequently picked up by the component support section, and the ejecting mechanism. The pickup unit includes a rotating member that rotates 180 degrees around a rotation axis by one or more rotational operations, thereby moving the component support

section placed at the pickup position to a transfer position facing the component holding section placed at the receiving position, and moving the component support section placed at the transfer position to the pickup position, and a drive rotation section that rotates the component support section that has picked up the electronic component around a virtual rotation axis placed in the first direction J in a state where the component support section is placed at the pickup position. The control section controls the second drive mechanism and the drive rotation section based on the deviation detected by the deviation derivation section such that the electronic component is placed at the processing position in a predetermined position and orientation with respect to the processing unit.

[0009] According to the present disclosure, an electronic component processing apparatus includes: an ejecting mechanism that ejects an electronic component attached to a wafer sheet in a first direction perpendicular to the wafer sheet; a pickup unit having a component support section that picks up the electronic component ejected in the first direction at a pickup position facing the wafer sheet; a transport unit that moves a component holding section together with the electronic component to a processing position by rotation of a rotating body having the component holding section attached thereto, the component holding section picking up the electronic component from the pickup unit at a receiving position; a processing unit that performs predetermined processing on the electronic component placed at the processing position; a first drive mechanism that moves the ejecting mechanism along a first virtual plane parallel to the wafer sheet; a second drive mechanism that moves the pickup unit, which supports the electronic component with the component support section, along a second virtual plane parallel to the wafer sheet; a third drive mechanism that moves the wafer sheet within a third virtual plane including the wafer sheet; a deviation derivation section that detects a deviation of the electronic component picked up by the component support section from a reference position and a reference orientation; and a control section that controls the first drive mechanism, the second drive mechanism, and the third drive mechanism to adjust positions of the component support section placed at the pickup position, the electronic component to be subsequently picked up by the component support section, and the ejecting mechanism. The pickup unit includes a rotating member that rotates 180 degrees around a rotation axis by one or more rotational operations, thereby moving the component support section placed at the pickup position to a transfer position facing the component holding section placed at the receiving position, and moving the component support section placed at the transfer position to the pickup position. The transport unit includes a driving rotation

mechanism that rotates the component holding section to adjust an orientation of the electronic component picked up by the component holding section with respect to the transport unit. The control section controls the second drive mechanism and the driving rotation mechanism based on the deviation detected by the deviation derivation section such that the electronic component is placed at the processing position in a predetermined position and orientation with respect to the processing unit.

[0010] According to the present disclosure, an electronic component processing apparatus includes: an ejecting mechanism that ejects an electronic component attached to a wafer sheet in a first direction perpendicular to the wafer sheet; a pickup unit having a component support section that picks up the electronic component ejected in the first direction at a pickup position facing the wafer sheet; a transport unit that moves the component holding section together with the electronic component to a processing position by rotation of a rotating body having a component holding section attached thereto, the component holding section picking up the electronic component from the pickup unit at a receiving position; a processing unit that performs predetermined processing on the electronic component placed at the processing position; a first driver that moves the ejecting mechanism in a second direction G parallel to the wafer sheet or in a direction opposite to the second direction G; a second driver that moves the pickup unit supporting the electronic component with the component support section in the second direction G or in a direction opposite to the second direction G; a third driver that moves the wafer sheet within a third virtual plane Q including the wafer sheet; a fourth driver that moves the processing unit in a third direction K perpendicular to a direction of position adjustment of the electronic component performed by movement of the pickup unit or in a direction opposite to the third direction K, thereby adjusting a position of the processing unit in the third direction K with respect to the electronic component placed at the processing position; a deviation derivation section that detects a deviation of the electronic component picked up by the component support section with respect to a reference position and a reference orientation; and a control section that controls the first driver, the second driver, and the third driver to adjust positions of the component support section placed at the pickup position, the electronic component to be subsequently picked up by the component support section and the ejecting mechanism. The pickup unit includes a drive rotation section that rotates the component support section that has picked up the electronic component around a virtual rotation axis placed in the first direction in a state where the component support section is placed at the pickup position. The control section controls the second driver,

the fourth driver, and the drive rotation section based on the deviation detected by the deviation derivation section such that the electronic component is placed at a predetermined position and orientation with respect to the processing unit at the processing position.

[0011] According to the present disclosure, an electronic component processing apparatus includes: an ejecting mechanism that ejects an electronic component attached to a wafer sheet in a first direction perpendicular to the wafer sheet; a pickup unit having a component support section that picks up the electronic component ejected in the first direction at a pickup position facing the wafer sheet; a transport unit that moves a component holding section together with the electronic component to a processing position by rotation of a rotating body having the component holding section attached thereto, the component holding section picking up the electronic component from the pickup unit at a receiving position; a processing unit that performs predetermined processing on the electronic component placed at the processing position; a first driver that moves the ejecting mechanism in a second direction parallel to the wafer sheet or in a direction opposite to the second direction; a second driver that moves the pickup unit supporting the electronic component with the component support section in the second direction G or in a direction opposite to the second direction G; a third driver that moves the wafer sheet within a third virtual plane Q including the wafer sheet; a fourth driver that moves the processing unit in a third direction K perpendicular to a direction of position adjustment of the electronic component performed by movement of the pickup unit or in a direction opposite to the third direction K, thereby adjusting a position of the processing unit in the third direction K with respect to the electronic component placed at the processing position; a deviation derivation section that detects a deviation of the electronic component picked up by the component support section with respect to a reference position and a reference orientation; and a control section that controls the first driver, the second driver, and the third driver to adjust the positions of the component support section placed at the pickup position, the electronic component to be subsequently picked up by the component support section and the ejecting mechanism. The transport unit includes a driving rotation mechanism that rotates the component holding section to adjust an orientation of the electronic component picked up by the component holding section with respect to the transport unit. The control section controls the second driver, the fourth driver, and the driving rotation mechanism based on the deviation detected by the deviation derivation section such that the electronic component is placed at a predetermined position and orientation with respect to the processing unit at the processing position.

[0012] According to the present disclosure, an electronic component processing apparatus includes: an ejecting mechanism that ejects an electronic component attached to a wafer sheet in a first direction perpendicular to the wafer sheet; a pickup unit having a component support section that picks up the electronic component ejected in the first direction at a pickup position facing the wafer sheet; a transport unit that moves a component holding section together with the electronic component to a processing position by rotation of a rotating body having the component holding section attached thereto, the component holding section picking up the electronic component from the pickup unit at a receiving position; a processing unit that performs predetermined processing on the electronic component placed at the processing position; a first drive mechanism that moves the ejecting mechanism along a first virtual plane parallel to the wafer sheet; a second drive mechanism that moves the pickup unit, which supports the electronic component with the component support section, along a second virtual plane parallel to the wafer sheet; a third drive mechanism that moves the wafer sheet within a third virtual plane including the wafer sheet; a deviation derivation section that detects a deviation of the electronic component picked up by the component support section from a reference position and a reference orientation; and a control section that controls the first drive mechanism, the second drive mechanism, and the third drive mechanism to adjust positions of the component support section placed at the pickup position, the electronic component to be subsequently picked up by the component support section, and the ejecting mechanism. The pickup unit includes a rotating member that moves the component support section placed at the pickup position to a transfer position facing the component holding section placed at the receiving position by one or more rotational operations. The transport unit includes a driving rotation mechanism that rotates the component holding section to adjust an orientation of the electronic component picked up by the component holding section with respect to the transport unit. The control section controls the second drive mechanism and the driving rotation mechanism based on the deviation detected by the deviation derivation section such that the electronic component is placed at the processing position in a predetermined position and orientation with respect to the processing unit.

[0013] According to the present disclosure, an electronic component processing apparatus includes: an ejecting mechanism that ejects an electronic component attached to a wafer sheet in a first direction perpendicular to the wafer sheet; a pickup unit having a component support section that picks up the electronic component ejected in the first direction at a pickup position facing the wafer sheet; a transport unit that moves a component holding section

together with the electronic component to a processing position by rotation of a rotating body having the component holding section attached thereto, the component holding section picking up the electronic component from the pickup unit at a receiving position; a processing unit that performs predetermined processing on the electronic component placed at the processing position; a second driver that moves the pickup unit supporting the electronic component with the component support section in a second direction parallel to the wafer sheet or in a direction opposite to the second direction; a third driver that moves the wafer sheet within a third virtual plane including the wafer sheet; a fourth driver that moves the processing unit in a third direction perpendicular to a direction of position adjustment of the electronic component performed by movement of the pickup unit or in a direction opposite to the third direction, thereby adjusting a position of the processing unit in the third direction with respect to the electronic component placed at the processing position; a deviation derivation section that detects a deviation of the electronic component picked up by the component support section with respect to a reference position and a reference orientation; and a control section that controls the second driver and the third driver to adjust the positions of the component support section placed at the pickup position, and the electronic component to be subsequently picked up by the component support section. The transport unit includes a driving rotation mechanism that rotates the component holding section to adjust an orientation of the electronic component picked up by the component holding section with respect to the transport unit. The control section controls the second driver, the fourth driver, and the driving rotation mechanism based on the deviation detected by the deviation derivation section such that the electronic component is placed at a predetermined position and orientation with respect to the processing unit at the processing position.

[0014] According to the electronic component processing apparatus of the present disclosure, the position and orientation of the electronic component can be adjusted in a state where the electronic component is picked up (supported) by the component support section or the component holding section, and the position and orientation of the electronic component at the processing position with respect to the processing unit can be set to a predetermined position and orientation without using an alignment unit that picks up the electronic component from the transport unit and adjusts the position of the electronic component.

BRIEF DESCRIPTION OF DRAWINGS

[0015] Fig. 1 is an explanatory view of an electronic component processing apparatus

according to a first embodiment.

Fig. 2 is an explanatory view showing the arrangement of a processing unit and a pickup unit with respect to a rotating body.

Fig. 3 is an explanatory view of picking up and delivering an electronic component
5 by the pickup unit.

Fig. 4 is a block diagram showing connections of a control section.

Fig. 5(A) and Fig. 5(B) are an explanatory view showing the position of the pickup unit with respect to an electronic component placed at a transfer position and an explanatory view of an ejecting mechanism, respectively.

10 Fig. 6 is an explanatory view showing the rotation of a component support section of the pickup unit.

Fig. 7 is a flowchart showing a flow of an electronic component pickup process.

Fig. 8 is a flowchart showing a flow of an electronic component delivery process.

Fig. 9 is an explanatory view of an electronic component processing apparatus
15 according to a second embodiment.

Fig. 10 is an explanatory view showing the arrangement of a processing unit and a pickup unit with respect to a rotating body.

Fig. 11 is an explanatory view of picking up and delivering an electronic component
by the pickup unit.

20 Fig. 12 is a block diagram showing connections of a control section.

Fig. 13 is an explanatory view showing a direction in which the pickup unit moves.

Fig. 14 is an explanatory view showing the rotation of the component support section
of the pickup unit.

Fig. 15 is a flowchart showing a flow of an electronic component pickup process.

25 Fig. 16 is a flowchart showing a flow of an electronic component delivery process.

Fig. 17 is a flowchart showing a flow of processing of the electronic component by
the processing unit.

Fig. 18 is an explanatory view of a modified example having a driving rotation
mechanism.

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DESCRIPTION OF EMBODIMENTS

[0016] Next, with reference to the attached drawings, an embodiment of the present invention will be described for understanding of the present invention.

[0017] As shown in Figs. 1, 2, and 3, an electronic component processing apparatus 10 according to a first embodiment includes: an ejecting mechanism 11 that ejects an electronic component W attached to a surface (front surface) of a wafer sheet H from the back surface (rear surface) of the wafer sheet H in a first direction J perpendicular to the wafer sheet H; a pickup unit 13 having a component support section 12 that picks up the electronic component W ejected in the first direction J at a pickup position P1 facing the wafer sheet H; a transport unit 16 that moves a component holding section 14 together with the electronic component W to processing positions P7, P8, P9, P10, and P11 by rotation of a rotating body 15 having the component holding section 14 attached thereto, the component holding section 14 picking up the electronic component W from the pickup unit 13 at a receiving position P2; and processing units 17, 18, 19, 20, and 21 that perform predetermined processing on the electronic components W placed at the processing positions P7, P8, P9, P10, and P11, respectively. Hereinafter, a more detailed description will be given.

[0018] As shown in Figs. 1, 2, and 3, the pickup unit 13 is provided below the rotating body 15 and has a disk-shaped rotating member 23 that rotates together with a rotating shaft 22 rotatably supported by a support body 21a, and a plurality of component support sections 12 that are each provided to be able to move forward and backward in the radial direction with respect to the rotating member 23. There are a plurality of component support sections 12, each of which is cylindrical. Each component support section 12 is provided radially such that the axes thereof coincide with the direction in which the component support sections 12 moves forward and backward, and is placed at equal intervals along the outer edge of a virtual circle centered on the rotating shaft 22. Note that the shape of the component support section 12 is not limited to a cylindrical shape, and may be, for example, a rectangular parallelepiped or cubic shape.

[0019] In the present embodiment, four component support sections 12 are provided at 90° intervals around the rotating member 23, at the 3 o'clock position, 6 o'clock position (180° position), 9 o'clock position, and 12 o'clock position (0° position). As shown in Fig. 3, a coil spring 24 is attached near each component support section 12 to apply a force to the component support section 12 in the direction opposite to the movement direction when the component support section 12 moves toward the center of the rotating member 23. In addition, in Figs. 2 and 5(A), the coil spring 24 of the component support section 12 and the like are omitted.

[0020] In the present embodiment, each component support section 12 is a suction nozzle

that sucks the electronic component W by vacuum pressure (negative pressure) and releases the sucked state of the electronic component W by being opened to the atmosphere or by positive pressure. Each component support section 12 intermittently moves 90 degrees along an arc-shaped path in accordance with the intermittent rotation of the rotating member 23 due to the repeated operation and stopping of a motor 51 (shown in Fig. 4) provided within the support body 21a, and is sequentially placed at the pickup position P1 (6 o'clock position, 180° position) facing the wafer sheet H having multiple (a plurality of) electronic components W attached to the surface thereof.

[0021] In the present embodiment, the wafer sheet H is horizontally placed at a position immediately below the pickup unit 13 and at a distance from the pickup unit 13. The electronic component W is, for example, a diode, a transistor, a capacitor, an inductor, or an integrated circuit (IC). As shown in Figs. 3 and 6, the electronic component W has two parallel surfaces W1 and W2, and is attached to the wafer sheet H in a state where the surface W1 is in a close contact with the surface of the wafer sheet H.

[0022] As shown in Figs. 3 and 5(A), the pickup unit 13 and the support body 21a move in the X-axis direction within a plane parallel (in the present embodiment, horizontal) to the wafer sheet H by the operation of an X-axis drive section 25 attached to the support body 21a, and move (in the present embodiment, move horizontally) together with the X-axis drive section 25 by the operation of a Y-axis drive section 26 attached to the X-axis drive section 25 in the direction (the Y-axis direction within a plane parallel to the wafer sheet H) perpendicular to the direction in which the pickup unit 13 and the support body 21a move by the operation of the X-axis drive section 25. Therefore, a virtual plane parallel to the wafer sheet H and passing through the pickup unit 13 is defined as a second virtual plane F, and in the present embodiment, a second drive mechanism 27 that freely moves the pickup unit 13 along the second virtual plane F (within the second virtual plane F) is configured to have the X-axis drive section 25 and the Y-axis drive section 26.

[0023] In addition, as shown in Fig. 3, the wafer sheet H and a wafer ring 29 on which the wafer sheet H is mounted move in the X-axis direction within a third virtual plane Q (in the present embodiment, horizontally) including the wafer sheet H by the operation of an X-axis drive section 30 that supports the wafer ring 29. Furthermore, the wafer sheet H and the wafer ring 29 move (in the present embodiment, move horizontally) together with the X-axis drive section 30 by the operation of a Y-axis drive section 31 attached to the X-axis drive section 30 within the third virtual plane Q in the Y-axis direction perpendicular to the direction in which

the wafer sheet H and the wafer ring 29 move by the operation of the X-axis drive section 30. In the present embodiment, a third drive mechanism 35 for freely moving the wafer sheet H within the third virtual plane Q is configured to have the X-axis drive section 30 and the Y-axis drive section 31.

5 [0024] A pin 34 which moves forward and backward (in the present embodiment, moves in a vertical direction or in an orientation opposite to the vertical direction) in the direction perpendicular to the wafer sheet H by the operation of a drive source 33, is provided inside a cylindrical member 32 provided immediately below the wafer sheet H. As shown in Figs. 3 and 5(B), an X-axis drive section 46 which moves the cylindrical member 32, the drive source 33, and the pin 34 in the X-axis direction within a plane parallel (in the present embodiment, horizontal) to the wafer sheet H, is attached to the drive source 33. A Y-axis drive section 47 which moves (in the present embodiment, moves horizontally) the cylindrical member 32, the drive source 33, and the pin 34 in the Y-axis direction (parallel to the wafer sheet H) perpendicular to the direction in which the cylindrical member 32, the drive source 33, and the pin 34 move by the operation of the X-axis drive section 46, is attached to the X-axis drive section 46.

[0025] In the present embodiment, the ejecting mechanism 11 is formed with the cylindrical member 32, the drive source 33, and the pin 34. In addition, with a virtual plane parallel to the wafer sheet H and the second virtual plane F and passing through the ejecting mechanism 11, which is defined as a first virtual plane E, a first drive mechanism 49 that moves the ejecting mechanism 11 along the first virtual plane E (within the first virtual plane E) is formed with the X-axis drive section 46 and the Y-axis drive section 47. In addition, in Fig. 3, the wafer sheet H, the wafer ring 29, and the X-axis drive section 30 are shown in a cross-sectional view, and in Figs. 2, 5(A), and 5(B), the electronic components W attached to the wafer sheet H, the wafer ring 29, the X-axis drive section 30, and the like are omitted.

[0026] By the operation of the X-axis drive section 30 and the Y-axis drive section 31, one of the multiple electronic components W attached to the surface of the wafer sheet H is sequentially placed at a position (hereinafter referred to as the "picked-up position") where the electronic component W is picked up by the component support section 12 placed at the pickup position P1. The pin 34 is positioned on the back side (in the present embodiment, the lower side) of the wafer sheet H, and moves (in the present embodiment, rises) in the first direction J toward the front side, thereby moving the electronic component W placed at the picked-up position to the front side of the wafer sheet H and bringing the electronic

component W into contact with the component support section 12 placed at the pickup position P1.

[0027] The component support section 12 placed at the pickup position P1 sucks the surface W2 of the electronic component W that comes into contact with the component support section 12, and the electronic component W is removed from the wafer sheet H by the movement of the pin 34 in the orientation (in the present embodiment, the vertical direction) opposite to the first direction J, thereby picking up the electronic component W from the wafer sheet H.

[0028] Further, an imaging section 28 is provided near the pickup unit 13 to move together with the component support section 12 that has picked up the electronic component W at the pickup position P1 and captures an image of the surface W1 of the electronic component W placed at the 9 o'clock position. Hereinafter, the position where the electronic component W is captured by the imaging section 28 is also referred to as the "imaging position". The imaging section 28 supported by a support member (not shown) captures an image of the surface W1 of the electronic component W placed at the imaging position, and obtains an image of the surface W1 of the electronic component W captured from the front. The imaging section 28 only needs to be capable of capturing an image of the surface W1 of the electronic component W supported by the component support section 12. For example, when the electronic component W temporarily stops at the 7:30 position, the imaging section 28 may be placed to capture an image of the surface W1 of the electronic component W placed at the 7:30 position.

[0029] As shown in Fig. 4, a deviation derivation section 28a that acquires an image captured by the imaging section 28, is connected to the imaging section 28. The deviation derivation section 28a can detect the position and orientation of the electronic component W from the image captured by the imaging section 28. The deviation derivation section 28a stores the positions and orientations of the electronic components W at the imaging positions (hereinafter referred to as the "reference positions and reference orientations of the electronic components W") such that the electronic components W placed at the processing positions P7, P8, P9, P10, and P11 are placed in predetermined positions and orientations with respect to the processing units 17, 18, 19, 20, and 21, respectively.

[0030] Each time the imaging section 28 captures an image of the electronic component W placed at the imaging position, the deviation derivation section 28a detects, from the image captured by the imaging section 28, the position and orientation of the electronic component

W imaged in a state of being picked up (supported) by the component support section 12, compares the detected position and orientation of the electronic component W with the stored reference position and reference orientation of the electronic component W, detects a deviation of the electronic component W from the reference position and reference orientation (the positional deviation of the electronic component W from the reference position and the orientation deviation of the electronic component W from the reference orientation), and stores the deviation in association with the corresponding electronic component W.

[0031] As shown in Fig. 6, the pickup unit 13 has a drive rotation section 56 between the center of the rotating member 23 and the component support section 12. The drive rotation section 56 can rotate the component support section 12 around a virtual rotation axis R passing through the axis of the component support section 12. Since the axis of the component support section 12 is placed in the first direction J when the component support section 12 is placed at the pickup position P1, the drive rotation section 56 rotates the component support section 12 around the virtual rotation axis R placed in the first direction J in a state where the component support section 12 is placed at the pickup position P1.

[0032] As shown in Figs. 1 and 2, the transport unit 16 has a motor 36 fixed to a base table 45, and the rotating body 15 on which the plurality of component holding sections 14 are attached at equal pitch along the outer periphery and which rotates due to the operation of the motor 36. The motor 36 intermittently drives the rotating body 15 to rotate, thereby intermittently moving the plurality of component holding sections 14. With one rotational operation of the rotating body 15, each component holding section 14 moves by an amount equal to the arrangement pitch of the component holding sections 14.

[0033] Each component holding section 14 is long in the vertical direction, and is attached to the rotating body 15 so as to be movable up and down in a state of penetrating the rotating body 15. Each component holding section 14 is a suction nozzle that sucks the electronic component W at the lower end portion, sucks the electronic component W by vacuum pressure (negative pressure), and releases the sucked state of the electronic component W by being opened to the atmosphere or by positive pressure. A coil spring 37 is mounted to each component holding section 14 in an area above the rotating body 15, for applying an upward force to the lowered component holding section 14.

[0034] A disk-shaped plate material 39 which is fixed to a supporting member 38 that penetrates the motor 36 and the rotating body 15, is provided above the rotating body 15. A plurality of holding members 41, each with a motor 40 fixed thereto, are attached to the outer

periphery of the horizontally placed plate material 39, and a vertically placed rod-shaped movable body 42 is mounted to each holding member 41 to be freely movable up and down. A coil spring 43 is provided below each motor 40 to apply an upward force to the lowered movable body 42. As shown in Fig. 4, the motor 40 is connected to a control section 57
 5 together with the X-axis drive sections 25, 30, and 46, the Y-axis drive sections 26, 31, and 47, the imaging section 28, the deviation derivation section 28a, the drive source 33, the motors 36 and 51, and the drive rotation section 56.

[0035] In the present embodiment, an output shaft 44 that moves up and down when driven by the motor 40 is connected to the motor 40, and the movable body 42 is pushed down by the
 10 output shaft 44 being lowered. Each time the motor 36 is driven, the rotating body 15 and the plurality of component holding sections 14 rotate by an angle corresponding to the arrangement pitch of the component holding sections 14. Each movable body 42 is placed above the position where the component holding section 14 is temporarily stopped, and is lowered by operation of the corresponding motor 40 to push down the temporarily stopped
 15 component holding section 14. In Fig. 1, two of each of the component holding section 14, the motor 40, the holding member 41, the movable body 42, the output shaft 44, and the like are shown, but in the present embodiment, three or more of each of these are provided.

[0036] As shown in Figs. 2 and 3, one of the plurality of positions where the component holding section 14 temporarily stops is the receiving position P2 above the pickup unit 13.
 20 The component support section 12 that has picked up the electronic component W from the wafer sheet H at the pickup position P1, intermittently moves together with the electronic component W due to the repeated operation and stopping of the motor 51, and comes to a stop at the transfer position P3 immediately below the receiving position P2.

[0037] In the present embodiment, the transfer position P3 is the 12 o'clock position (0°
 25 position) around the rotating member 23 (rotation axis), and the rotating member 23 rotates 180 degrees around the rotating shaft 22 by two (one example of a plurality of times) 90-degree rotational operations, thereby moving the component support section 12 placed at the pickup position P1 to the transfer position P3 facing the component holding section 14 placed at the receiving position P3, and moving the component support section 12 placed at the
 30 transfer position P3 to the pickup position P1. When there are two component support sections 12, the rotating member 23 can rotate 180 degrees in a single rotational operation, thereby moving the component support section 12 placed at the pickup position P1 to the transfer position P3, and moving the component support section 12 placed at the transfer

position P3 to the pickup position P1.

[0038] The component holding section 14 placed at the receiving position P2 is lowered together with the movable body 42 by the operation of the motor 40, comes into contact with the surface W1 of the electronic component W sucked to the component support section 12 placed at the transfer position P3, and sucks the surface W1 of the electronic component W. The component holding section 14 that has sucked the electronic component W at the receiving position P2 picks up the electronic component W from the component support section 12 that has released the suction of the electronic component W, and rises together with the movable body 42 due to the operation of the motor 40.

[0039] As shown in Fig. 2, the processing units 17, 18, 19, 20, and 21 are provided near the transport unit 16 to perform respective predetermined processing (visual inspection, electrical characteristic inspection, laser marking, and the like) on the electronic components W sucked to the component holding section 14. The electronic component W sucked to the component holding section 14 and the component holding section 14 intermittently move due to the repeated operation and stopping of the motor 36, and is sequentially stopped at the processing position P7 where the processing is performed by the processing unit 17, the processing position P8 where the processing is performed by the processing unit 18, the processing position P9 where the processing is performed by the processing unit 19, the processing position P10 where the processing is performed by the processing unit 20, and the processing position P11 where the processing is performed by the processing unit 21.

[0040] In addition, as shown in Fig. 4, the control section 57 is also connected to an imaging section 58, which captures images of the electronic components W placed at or near the picked-up position in a state of being attached to the wafer sheet H and the surrounding electronic components W, from the front side of the wafer sheet H, and a position detection section 59 which detects the position of the electronic components W placed at or near the picked-up position based on the image captured by the imaging section 58.

[0041] The control section 57 can be configured, for example, by a CPU and a memory, and can control the X-axis drive sections 25, 30, and 47, the Y-axis drive sections 26, 31, and 46, the drive source 33, the motors 36, 40, and 51, the imaging sections 28 and 58, and the drive rotation section 56, as well as acquire electronic data from the deviation derivation section 28a and the position detection section 59.

[0042] Here, the processing unit 17 is designed to perform processing on the electronic component W, on the premise that the electronic component W placed at the processing

position P7 is placed in a predetermined position and orientation with respect to the processing unit 17. Therefore, when the electronic component W placed at the processing position P7 is not placed in a predetermined position and orientation with respect to the processing unit 17, problems such as the processing unit 17 being unable to perform

5 processing on the electronic component W appropriately may occur. The same is true for the electronic component W placed at the processing position P8 and the processing unit 18, the electronic component W placed at the processing position P9 and the processing unit 19, the electronic component W placed at the processing position P10 and the processing unit 20, and the electronic component W placed at the processing position P11 and the processing unit 21.

10 [0043] In the present embodiment, the electronic components W are placed in predetermined positions and orientations with respect to the processing units 17, 18, 19, 20, and 21 at the processing positions P7, P8, P9, P10, and P11, respectively, through the steps described below.

[0044] <Preparation Process>

15 In a state where the pickup unit 13 is placed in a predetermined reference position and none of the component support sections 12 sucks the electronic components W, the motor 51 is intermittently operated to sequentially place the component support sections 12 at the imaging position, and the imaging section 28 captures an image of the component support sections 12 placed at the imaging position. The control section 57 derives and stores, for each
20 component support section 12, the position of the center of the component support section 12 when the component support section 12 is placed at the pickup position P1, based on the image captured by the imaging section 28.

[0045] The reason for conducting such processing is that it has been confirmed that the center positions of the component support sections 12 differ from one another due to
25 manufacturing errors of the component support sections 12 or the like, in each component support section 12. However, since the difference in the center positions of the individual component support sections 12 is extremely small, this preparation process may be omitted depending on the requirements placed on the electronic component processing apparatus 10. Note that the control of the motor 51, the imaging section 28, and the like in the preparation
30 process is performed by the control section 57, and the description thereof is omitted. This point may also be the case in the following description.

[0046] <Electronic Component Pickup Process>

After the preparation process is completed, the pickup unit 13 picks up the electronic

components W from the wafer sheet H in steps S1 to S6 shown in Fig. 7.

[0047] Step S1: As shown in Fig. 7, the control section 57 controls the X-axis drive section 30 and the Y-axis drive section 31 to move the wafer sheet H together with the wafer ring 29 by a predetermined pitch in order to place one electronic component W at a picked-up position facing the component support section 12 placed at the pickup position P1, and captures an image of the electronic component W using the imaging section 58. Incidentally, the image of the electronic component W may be captured by the imaging section 58 before the wafer ring 29 and the wafer sheet H are moved by a predetermined pitch.

[0048] Step S2: Since the positions of the individual electronic components W attached to the wafer sheet H vary to some extent, it is possible that the electronic components W are not placed at the picked-up positions. Therefore, the position detection section 59 detects the position of the electronic component W based on the image captured by the imaging section 58, and determines whether the electronic component W is placed at the picked-up position.

Step S3: When the position detection section 59 determines that the electronic component W is placed at the picked-up position, the electronic component W is not moved.

[0049] Step S4: Meanwhile, when the position detection section 59 determines that the electronic component W is not placed at the picked-up position, the control section 57 controls the X-axis drive section 30 and the Y-axis drive section 31 such that the electronic component W is placed at the picked-up position, and moves the electronic component W together with the wafer ring 29 and the wafer sheet H such that the electronic component W is placed at the picked-up position.

[0050] Step S5: The control section 57 operates the X-axis drive section 25 and the Y-axis drive section 26 based on the center position of the component support section 12 at the pickup position P1, which is stored in association with the component support section 12 moving toward the pickup position P1 (6 o'clock position), and moves the pickup unit 13 placed at the reference position along the second virtual plane F such that when the component support section 12 is placed at the pickup position P1, the center of the component support section 12, the center of the electronic component W placed at the picked-up position, and the center of the pin 34 are placed on a virtual line (in the present embodiment, a virtual line along the first direction J).

[0051] The movement of the pickup unit 13 along the second virtual plane F may be performed in a state where the component support section 12 is placed at the pickup position P1. In the present embodiment, the center of the electronic component W placed at the

picked-up position and the center of the pin 34 are designed to be placed on the virtual line along the first direction J, and thus the ejecting mechanism 11 is not moved in step S5.

However, when the center of the electronic component W and the center of the pin 34 are not placed on the virtual line along the first direction J, the position of the ejecting mechanism 11 is adjusted by the operation of the X-axis drive section 46 and the Y-axis drive section 47 such that the center of the electronic component W and the center of the pin 34 are placed on the virtual line along the first direction J.

[0052] That is, the control section 57 controls the first drive mechanism 48, the second drive mechanism 27, and the third drive mechanism 35 (operates one or more of the first drive mechanism 48, the second drive mechanism 27, and the third drive mechanism 35) to adjust the positions of the component support section 12 placed at the pickup position P1, the electronic component W to be subsequently picked up by the component support section 12 and the ejecting mechanism 11.

[0053] Here, steps S1 to S5 are procedures for adjusting the positions of the component support section 12 placed at the pickup position P1, the electronic component W placed at the picked-up position (that is, the electronic component W to be subsequently picked up by the component support section 12), and the ejecting mechanism 11 based on the center of the electronic component W placed at the picked-up position, but this position adjustment procedure can also be performed based on the center of the component support section 12 placed at the pickup position P1. In that case, steps S2' and S3' described below are conducted instead of steps S2 to S5.

[0054] Step S2': The position detection section 59 detects the position of the electronic component W based on the image of the electronic component W captured by the imaging section 58 in step S1, and stores the position of the center of the electronic component W.

[0055] Step S3': The control section 57 operates the X-axis drive section 30, the Y-axis drive section 31, the X-axis drive section 46, and the Y-axis drive section 47 based on the center position of the component support section 12 at the pickup position P1, which is stored in association with the component support section 12 placed at the pickup position P1, and the center position of the electronic component W to be subsequently obtained by the component support section 12, which is stored in the position detection section 59 such that the center position of the electronic component W to be subsequently obtained by the component support section 12 and the center position of the pin 34 are placed on the virtual line along the first direction J with respect to the center of the component support section 12 placed at the

pickup position P1 in a state where the pickup unit 13 is placed at the reference position.

[0056] Step S6: After the position adjustment of the component support section 12 placed at the pickup position P1, the electronic component W placed at the picked-up position, and the ejecting mechanism 11 is completed, the control section 57 operates the drive source 33 to
 5 move the pin 34 in the first direction J, bringing the electronic component W placed at the picked-up position closer to the component support section 12 placed at the pickup position P1 and sucking the electronic component W, and then causes the component support section 12 to pick up the electronic component W by moving the pin 34 in the orientation opposite to the first direction J. Since the component support section 12 picks up the electronic
 10 component W in a state where the center of the component support section 12, the center of the electronic component W, and the center of the pin 34 are aligned in a straight line, the component support section 12 can pick up the electronic component W stably.

[0057] Step S7: After the component support section 12 placed at the pickup position P1 has completed pickup of the electronic component W, when the pickup unit 13 is not placed at the
 15 reference position, the pickup unit 13 is returned to the reference position by the operation of the X-axis drive section 25 and the Y-axis drive section 26, when the wafer sheet H is not placed at the reference position, the wafer sheet H is returned to the reference position by the operation of the X-axis drive section 30 and the Y-axis drive section 31, and when the ejecting mechanism 11 is not placed at the reference position, the ejecting mechanism 11 is returned to
 20 the reference position by the operation of the X-axis drive section 46 and the Y-axis drive section 47.

[0058] Here, step S1 is performed in a state where the pickup unit 13 and the wafer sheet H are respectively placed at reference positions.

[0059] <Electronic Component Delivery Process>

25 The electronic components W picked up from the wafer sheet H by the component support section 12 placed at the pickup position P1 are delivered from the pickup unit 13 to the transport unit 16 via steps S11 to S16 shown in Fig. 8.

[0060] Step S11: In a state where the pickup unit 13 is placed at the reference position, the imaging section 28 captures an image of the electronic component W that is stationary at the
 30 imaging position, as shown in Fig. 8. Step S12: The deviation derivation section 28a detects the position and orientation of the electronic component W that was captured in a state of being picked up (supported) by the component support section 12 based on the image captured by the imaging section 28, compares the detected position and orientation of the

electronic component W with the stored reference position and reference orientation of the electronic component W, detects a deviation of the electronic component W from the reference position and reference orientation, and stores the detected deviation from the reference position and reference orientation in association with the electronic component W.

5 [0061] Step S13: The control section 57 adjusts the position and orientation of the electronic component W placed at the 12 o'clock position based on the deviation of the electronic component W from the reference position and reference orientation stored by the deviation derivation section 28a in association with the electronic component W. Specifically, the control section 57 operates the X-axis drive section 25 and the Y-axis drive section 26 to
10 move the pickup unit 13, which supports the electronic component W with the component support section 12, along the second virtual plane F, thereby adjusting the position of the electronic component W supported by the component support section 12 and placed at the 12 o'clock position and placing the electronic component W at a predetermined position, and also operates the drive rotation section 56 corresponding to the component support section 12
15 supporting the electronic component W to rotate the electronic component W around the virtual rotation axis R, thereby adjusting the orientation of the electronic component W and disposing the electronic component W in a predetermined orientation.

[0062] The position of the electronic component W placed at the 12 o'clock position after the position adjustment is the transfer position P3. This step S13 may be performed after step
20 S6 or before step S6. When step S13 is performed after step S6, the orientation of the electronic component W can be adjusted by the operation of the drive rotation section 56 before the electronic component W is placed at the 12 o'clock position. When step S13 is performed before step S6, adjustment of the position and orientation of the electronic component W by the operation of the X-axis drive section 25, the Y-axis drive section 26, and
25 the drive rotation section 56 can be performed at a timing when the electronic component W is moving toward the 12 o'clock position.

[0063] Step S14: The control section 57 operates the motor 40 provided above the receiving position P2 to lower the component holding section 14, which has been stationary at the receiving position P2, and brings the component holding section 14 into contact with the
30 surface W1 of the electronic component W supported by the component support section 12, which is stationary at the 12 o'clock position. Step S15: The component holding section 14 sucks the surface W1 of the electronic component W by suction, and the component support section 12 releases the suction of the surface W2 of the electronic component W. After the

component support section 12 releases the suction of the surface W2 of the electronic component W, the pickup unit 13 is returned to the reference position.

[0064] Step S16: The control section 57 operates the motor 40 to raise the component holding section 14, whereby the component holding section 14 picks up the electronic component W from the component support section 12. Accordingly, the delivery of the electronic component W from the pickup unit 13 to the transport unit 16 is completed.

[0065] The component holding section 14, which has picked up the electronic component W from the component support section 12 at the receiving position P2, moves together with the electronic component W to be placed at the processing position P7 by the operation of the motor 36 (in the present embodiment, the motor 36 is operated twice), as shown in Fig. 2. Here, by adjusting the position and orientation of the electronic component W by the operation of the X-axis drive section 25, the Y-axis drive section 26 and the drive rotation section 56 in step S7, the electronic component W placed at the processing position P7 is in a state of being placed in a predetermined position and orientation with respect to the processing unit 17. Therefore, the control section 57 controls the second drive mechanism 27 and the drive rotation section 56 based on the deviation detected by the deviation derivation section 28a such that the electronic component W is placed in a predetermined position and orientation with respect to the processing unit 17 at the processing position P7.

[0066] Thereafter, the processing unit 17 performs predetermined processing on the electronic component W placed at the processing position P7. In principle, the rotation of the rotating body 15 by the operation of the motor 36 is performed at the same timing as the rotation of the rotating member 23.

[0067] The processing by the processing unit 18 for the electronic component W placed at the processing position P8, the processing by the processing unit 19 for the electronic component W placed at the processing position P9, the processing by the processing unit 20 for the electronic component W placed at the processing position P10, and the processing by the processing unit 21 for the electronic component W placed at the processing position P11 are performed at the same timing as the processing by the processing unit 17 for the electronic component W placed at the processing position P7. Some of the processing units 17, 18, 19, 20, and 21 performs processing on the electronic component W in a state where the component holding section 14 supports the electronic component W, and the remaining units pick up the electronic component W from the component holding section 14, perform processing on the electronic component W, and then return the electronic component W to the

component holding section 14.

[0068] Next, an electronic component processing apparatus 70 according to a second embodiment of the present invention will be described with reference to Figs. 9 to 17. In the electronic component processing apparatus 70, the same components as those in the electronic component processing apparatus 10 will be given the same reference numerals, and the detailed description thereof will be omitted. As shown in Figs. 9, 10, and 11, the electronic component processing apparatus 70 includes: an ejecting mechanism 11 that ejects an electronic component W attached to the surface of a wafer sheet H from the back surface of the wafer sheet H in the first direction J perpendicular to the wafer sheet H; a pickup unit 13 having a component support section 12 that picks up the electronic component W ejected in the first direction J at the pickup position P1 facing the wafer sheet H; a transport unit 16 that moves a component holding section 14 together with the electronic component W to the processing positions P7, P8, P9, P10, and P11 by rotation of a rotating body 15 having the component holding section 14 attached thereto, the component holding section 14 picking up the electronic component W from the pickup unit 13 at the receiving position P2; and processing units 17, 18, 19, 20, and 21 that perform predetermined processing on the electronic components W placed at the processing positions P7, P8, P9, P10, and P11, respectively.

[0069] The pickup unit 13 is provided below the rotating body 15 and has the rotating shaft 22 supported by a support body 71 and four (a plurality of) component support sections 12 each of which is provided to be move forward and backward with respect to the rotating member 23. In the present embodiment, the wafer sheet H is placed vertically at approximately the same height position as the pickup unit 13. Each component support section 12 moves 90 degrees in accordance with the intermittent rotation of the rotating member 23 due to the repeated operation and stopping of the motor 51 shown in Fig. 12 provided within the support body 71, and is sequentially placed at the pickup position P1 (3 o'clock position) facing the wafer sheet H. In addition, in Figs. 10 and 13, a coil spring 24 and the like that apply a force to the component support section 12 are omitted.

[0070] As shown in Figs. 9 and 11, the support body 71 is movably attached to guide rails 73 and 74 that are provided in parallel on a base table 72. As shown in Figs. 10 and 13, a drive source 76 is installed near the support body 71. When operated, the drive source 76 applies a force to the support body 71 via a power transmission section 75, thereby moving the pickup unit 13 horizontally along the guide rails 73 and 74.

[0071] In the present embodiment, the pickup unit 13 moves in a second direction G parallel to the wafer sheet H or in the direction opposite to the second direction G. In planar view (viewed along the rotation axis of the rotating body 15), the second direction G is perpendicular to a second virtual line N passing through the rotation center of the rotating body 15 and the receiving position P2, as shown in Fig. 13. A drive mechanism 77, which is an example of a second driver that moves the pickup unit 13 in the second direction G or in the direction opposite to the second direction G, is configured to have the guide rails 73 and 74, the power transmission section 75, and the drive source 76.

[0072] Furthermore, as shown in Fig. 11, the wafer sheet H and the wafer ring 29 on which the wafer sheet H is mounted are moved in the positive and negative vertical directions by the operation of a vertical drive section 78 that supports the wafer ring 29. Furthermore, the wafer sheet H and the wafer ring 29 are moved horizontally together with the vertical drive section 78 by the operation of a horizontal drive section 79 attached to the vertical drive section 78. The pin 34 that moves horizontally forward and backward by the operation of the drive source 33 is provided inside the cylindrical member 32 attached to the vertical drive section 78. In the present embodiment, a drive mechanism 80 (an example of a third driver) that freely moves the wafer sheet H within the third virtual plane Q including the wafer sheet H is configured to have the vertical drive section 78 and the horizontal drive section 79.

[0073] In addition, in Fig. 11, the wafer sheet H, the wafer ring 29, and the vertical drive section 78 are shown in cross section. By the operation of the vertical drive section 78 and the horizontal drive section 79, one of the multiple electronic components W attached to the surface of the wafer sheet H is sequentially placed at the picked-up position where the electronic component W is picked up by the component support section 12 placed at the pickup position P1.

[0074] The pin 34 is provided on the inside of the cylindrical member 32 provided near the wafer sheet H, which moves forward and backward (move in the first direction J or in the orientation opposite to the first direction J) in the direction perpendicular to the wafer sheet H (horizontal direction) by the operation of the drive source 33. The pin 34 is positioned on the back side of the wafer sheet H, and moves forward (moves in the first direction J), and accordingly, the pin 34 moves the electronic component W placed at the pickup position to the front side of the wafer sheet H (protruding in the first direction J) and brings the electronic component W into contact with the component support section 12 placed at the pickup position P1.

[0075] As shown in Figs. 11 and 13, a horizontal drive section 81 (an example of the first driver) that moves the ejecting mechanism 11, which is formed having the cylindrical member 32, the drive source 33, and the pin 34, in the second direction G parallel to the wafer sheet H or in the direction opposite to the second direction G is attached to the drive source 33.

5 [0076] Further, an imaging section 82 is provided near the pickup unit 13 to move together with the component support section 12 that has picked up the electronic component W at the pickup position P1 and captures an image of the surface W1 of the electronic component W placed at the 6 o'clock position. Hereinafter, the "6 o'clock position" will also be referred to as the "imaging position". The imaging section 82 captures an image of the surface W1 of the
10 electronic component W placed at an imaging position through a prism 83, and obtains an image of the surface W1 of the electronic component W captured from the front. The imaging section 82 only needs to be able to capture an image of the surface W1 of the electronic component W supported by the component support section 12, and the imaging section 82 may be placed to capture an image of, for example, the surface W1 of the electronic
15 component W placed at the 9 o'clock position.

[0077] As shown in Fig. 12, a deviation derivation section 84 that picks up an image captured by the imaging section 82, is connected to the imaging section 82. The deviation derivation section 84 can detect the position and orientation of the electronic component W from the image captured by the imaging section 82. The deviation derivation section 84 stores
20 the reference position and reference orientation of the electronic component W. The deviation derivation section 84 compares the position and orientation of the electronic component W detected for the captured electronic component W with the stored reference position and reference orientation of the electronic component W each time the imaging section 82 captures an image of the electronic component W placed at the imaging position, detects the
25 deviation from the reference position and reference orientation of the electronic component W, and stores the detected deviation from the reference position and reference orientation in association with the electronic component W.

[0078] As shown in Fig. 14, the drive rotation section 56 can rotate the component support section 12 around the virtual rotation axis R placed in the first direction J in a state where the
30 component support section 12 is placed at the pickup position P1. In the present embodiment, as shown in Figs. 11 and 14, the transfer position P3 is the 12 o'clock position around the rotating member 23 (rotating shaft 22), and the rotating member 23 rotates 270 degrees through three 90-degree rotational operations, whereby the component support section 12 that

was placed at the pickup position P1 is placed at the transfer position P3.

[0079] In addition, as shown in Fig. 10, in planar view (viewed along the rotation axis of the rotating body 15), the virtual line passing through the center of the rotating body 15 and the processing position P7 is defined as a first virtual line M, the direction from the processing position P7 toward the center of the rotating body 15 along the first virtual line M is defined as a third direction K (that is, the third direction K is a direction along the first virtual line M), and a drive mechanism 87 (an example of a fourth driver) that moves the processing unit 17 in the third direction K or in the direction opposite to the third direction K is connected to the processing unit 17.

[0080] Similarly, a horizontal virtual line passing through the center of the rotating body 15 and the processing position P8 in planar view is defined as a first virtual line M, a direction from the processing position P8 toward the center of the rotating body 15 along the first virtual line M is defined as a third direction K, a horizontal virtual line passing through the center of the rotating body 15 and the processing position P9 in planar view is defined as a first virtual line M, a direction from the processing position P9 toward the center of the rotating body 15 along the first virtual line M is defined as a third direction K, a horizontal virtual line passing through the center of the rotating body 15 and the processing position P10 in planar view is defined as a first virtual line M, the direction from the processing position P10 toward the center of the rotating body 15 along the first virtual line M is defined as a third direction K, a horizontal virtual line passing through the center of the rotating body 15 and the processing position P11 in planar view is defined as a first virtual line M, the direction from processing position P11 toward the center of the rotating body 15 along the first virtual line M is defined as a third direction K, and the drive mechanisms 88, 89, 90, and 91 (each an example of a fourth driver) that move the processing unit in the third direction K or in the direction opposite to the third direction K are connected to the processing units 18, 19, 20, and 21, respectively. In addition, in Fig. 10, the first virtual lines M other than the first virtual line M corresponding to the processing unit 17 and the processing position P7 are omitted.

[0081] As shown in Fig. 12, the drive mechanisms 87, 88, 89, 90, and 91 are connected to a control section 57a together with the drive source 76, the vertical drive section 78, the horizontal drive section 79, the drive source 33, the motors 36, 40, and 51, the imaging sections 58 and 82, the position detection section 59, the deviation derivation section 84, and the drive rotation section 56. The control section 57a can control the drive sources 33 and 76, the motors 36, 40, and 51, the drive rotation section 56, the imaging sections 58 and 82, the

vertical drive section 78, the horizontal drive sections 79 and 81, and the drive mechanisms 87, 88, 89, 90, and 91, and can acquire electronic data from the position detection section 59 and the deviation derivation section 84.

[0082] In the present embodiment, after performing a preparation process similar to the preparation process performed in the electronic component processing apparatus 10, the electronic components W are placed in predetermined positions and orientations with respect to the processing units 17, 18, 19, 20, and 21 at processing positions P7, P8, P9, P10, and P11, respectively, by the processing described below.

[0083] <Electronic Component Pickup Process>

After the preparation process is completed, the pickup unit 13 picks up the electronic components W from the wafer sheet H in steps S21 to S27 shown in Fig. 15.

[0084] Step S21: As shown in Fig. 15, the control section 57a controls the vertical drive section 78 and the horizontal drive section 79 to move the wafer sheet H together with the wafer ring 29 by a predetermined pitch in order to place one electronic component W at a picked-up position facing the component support section 12 placed at the pickup position P1, and captures an image of the electronic component W using the imaging section 58.

Incidentally, the image of the electronic component W may be captured by the imaging section 58 before the wafer ring 29 and the wafer sheet H are moved by a predetermined pitch.

[0085] Step S22: the position detection section 59 detects the position of the electronic component W based on the image captured by the imaging section 58, and determines whether the electronic component W is placed at the picked-up position. Step S23: When the position detection section 59 determines that the electronic component W is placed at the picked-up position, the electronic component W is not moved.

[0086] Step S24: Meanwhile, when the position detection section 59 determines that the electronic component W is not placed at the picked-up position, the control section 57a controls the vertical drive section 78 and the horizontal drive section 79 such that the electronic component W is placed at the picked-up position, and moves the electronic component W together with the wafer ring 29 and the wafer sheet H such that the electronic component W is placed at the picked-up position.

[0087] Step S25: The control section 57a operates the drive source 76 based on the center position of the component support section 12 at the pickup position P1, which is stored in association with the component support section 12 moving toward the pickup position P1 (3

o'clock position), and moves the pickup unit 13 placed at the reference position in the second direction G or in the direction opposite to the second direction G such that when the component support section 12 is placed at the pickup position P1, the center of the component support section 12, the center of the electronic component W placed at the picked-up position, and the center of the pin 34 are placed on a virtual line (in the present embodiment, a virtual line along the first direction J).

[0088] The movement of the pickup unit 13 in the second direction G or in the direction opposite to the second direction G may be performed in a state where the component support section 12 is placed at the pickup position P1. In the present embodiment, the center of the electronic component W placed at the picked-up position and the center of the pin 34 are designed to be placed on the virtual line along the first direction J, and thus the ejecting mechanism 11 is not moved in step S25. However, when the center of the electronic component W and the center of the pin 34 are not placed on the virtual line along the first direction J, the position of the ejecting mechanism 11 is adjusted by the operation of the horizontal drive section 81 such that the center of the electronic component W and the center of the pin 34 are placed on a virtual line along the first direction J.

[0089] That is, the control section 57a controls the first driver, the second driver, and the third driver (operates one or more of the first driver, the second driver, and the third driver) to adjust the positions of the component support section 12 placed at the pickup position P1, the electronic component W to be subsequently picked up by the component support section 12 and the ejecting mechanism 11.

[0090] Here, steps S21 to S25 are procedures for adjusting the positions of the component support section 12 placed at the pickup position P1, the electronic component W placed at the picked-up position (that is, the electronic component W to be subsequently picked up by the component support section 12), and the ejecting mechanism 11 based on the center of the electronic component W placed at the picked-up position, but this position adjustment procedure can also be performed based on the center of the component support section 12 placed at the pickup position P1. In that case, steps S22' and S23' described below are conducted instead of steps S22 to S25.

[0091] Step S22': The position detection section 59 detects the position of the electronic component W based on the image of the electronic component W captured by the imaging section 58 in step S21, and stores the position of the center of the electronic component W.

[0092] Step S23': The control section 57a operates the horizontal drive sections 79 and 81

based on the center position of the component support section 12 at the pickup position P1, which is stored in association with the component support section 12 placed at the pickup position P1, and the center position of the electronic component W to be subsequently obtained by the component support section 12, which is stored in the position detection
 5 section 59 such that the center position of the electronic component W to be subsequently obtained by the component support section 12 and the center position of the pin 34 are placed on the virtual line along the first direction J with respect to the center of the component support section 12 placed at the pickup position P1 in a state where the pickup unit 13 is placed at the reference position.

10 [0093] Step S26: After the position adjustment of the component support section 12 placed at the pickup position P1, the electronic component W placed at the picked-up position, and the ejecting mechanism 11 is completed, the control section 57a operates the drive source 33 to move the pin 34 in the first direction J, bringing the electronic component W placed at the picked-up position closer to the component support section 12 placed at the pickup position
 15 P1 and sucking the electronic component W, and then causes the component support section 12 to pick up the electronic component W by moving the pin 34 in the orientation opposite to the first direction J.

[0094] Step S27: After the component support section 12 placed at the pickup position P1 has completed pickup of the electronic component W, when the pickup unit 13 is not placed at
 20 the reference position, the pickup unit 13 is returned to the reference position by the operation of the drive source 76, when the wafer sheet H is not placed at the reference position, the wafer sheet H is returned to the reference position by the operation of the horizontal drive section 79, and when the ejecting mechanism 11 is not placed at the reference position, the ejecting mechanism 11 is returned to the reference position by the operation of the horizontal
 25 drive section 81.

[0095] Here, step S21 is performed in a state where the pickup unit 13 and the wafer sheet H are respectively placed at reference positions.

[0096] <Electronic Component Delivery Process>

The electronic components W picked up from the wafer sheet H by the component
 30 support section 12 placed at the pickup position P1 are delivered from the pickup unit 13 to the transport unit 16 through steps S31 to S36 shown in Fig. 16.

[0097] Step S31: In a state where the pickup unit 13 is placed at the reference position, the imaging section 82 captures an image of the electronic component W that is stationary at the

imaging position, as shown in Fig. 16. Step S32: The deviation derivation section 84 detects the position and orientation of the electronic component W that was captured in a state of being picked up (supported) by the component support section 12 based on the image captured by the imaging section 82, compares the detected position and orientation of the electronic component W with the stored reference position and reference orientation of the electronic component W, detects a deviation of the electronic component W from the reference position and reference orientation, and stores the deviation in association with the electronic component W.

[0098] Step S33: The control section 57a adjusts the position and orientation of the electronic component W placed at the 12 o'clock position based on the deviation of the electronic component W from the reference position and reference orientation stored by the deviation derivation section 84 in association with the electronic component W. Specifically, the control section 57a operates the drive source 76 to move the pickup unit 13, which supports the electronic component W with the component support section 12, in the second direction G or in the direction opposite to the second direction G, thereby supporting the pickup unit 13 with the component support section 12, adjusting the position of the electronic component W placed at the 12 o'clock position in the second direction G, and placing the electronic component W at the predetermined position, and also operates the drive rotation section 56 corresponding to the component support section 12 supporting the electronic component W to rotate the electronic component W around the virtual rotation axis R, thereby adjusting the orientation of the electronic component W and disposing the electronic component W in a predetermined orientation.

[0099] The position of the electronic component W placed at the 12 o'clock position after the position adjustment is the transfer position P3. This step S33 may be performed after step S26 or before step S26. When step S33 is performed after step S26, the orientation of the electronic component W can be adjusted by the operation of the drive rotation section 56 before the electronic component W is placed at the 12 o'clock position. When step S33 is performed before step S26, adjustment of the position and orientation of the electronic component W by the operation of the drive source 76 and the drive rotation section 56 can be performed at a timing when the electronic component W is moving toward the 12 o'clock position.

[0100] The electronic component W, of which the position and orientation have been adjusted at the 12 o'clock position, is subjected to processing similar to the processing of the

electronic component W performed by the electronic component processing apparatus 10, and is then delivered from the component support section 12 of the pickup unit 13 to the component holding section 14 of the transport unit 16. The electronic component W supported by the component holding section 14 of the transport unit 16 is then subjected to
 5 predetermined processing by the processing units 17, 18, 19, 20, and 21 in accordance with the steps described below.

[0101] <Processing by Processing Unit>

The component holding section 14 that has picked up the electronic component W from the component support section 12 at the receiving position P2 moves together with the
 10 electronic component W by the operation of the motor 36 and is placed in a stopping area one upstream of the processing position P7. Thereafter, the radial positions of the electronic component W and the rotating body 15 of the processing unit 17 are adjusted by steps S41 and S42 shown in Fig. 17. In principle, the rotation of the rotating body 15 and the movement of the component holding section 14 due to the operation of the motor 36 are performed at the
 15 same timing as the rotation of the rotating member 23 and the movement of the component support section 12.

[0102] Step S41: The control section 57a operates the motor 36 to move the electronic component W and the component holding section 14 to the processing position P7, determines whether to move the processing unit 17 in the third direction K or in the direction opposite to
 20 the third direction K, and the distance of movement, based on the deviation from the reference position and reference orientation that the deviation derivation section 84 stored in association with the electronic component W in step S26, and then operates the drive mechanism 87.

[0103] By the operation of the drive mechanism 87, the processing unit 17 moves in the third direction K or in the direction opposite to the third direction K, such that the processing
 25 unit 17 is placed at a predetermined position with respect to the electronic component W placed at the processing position P7 at a position in the direction of the first virtual line M. Therefore, the drive mechanism 87 moves in the third direction K perpendicular to the direction of the position adjustment of the electronic component W performed by the movement of the pickup unit 13 or in the direction opposite to the third direction K, thereby
 30 adjusting the position of the processing unit 17 in the third direction K with respect to the electronic component W placed at the processing position P7.

[0104] As a result, the electronic component W placed at the processing position P7 is placed in a predetermined position and orientation with respect to the processing unit 17.

Therefore, the control section 57a controls the drive mechanisms 77 and 87 and the drive rotation section 56 based on the deviation detected by the deviation derivation section 84 such that the electronic component W is placed in a predetermined position and orientation with respect to the processing unit 17 at the processing position P7. In the present embodiment, the movement of the processing unit 17 in the third direction K or in the direction opposite to the third direction K is completed before the electronic component W is placed at the processing position P7, but the movement of the processing unit 17 in the third direction K or in the direction opposite to the third direction K may also be completed after the electronic component W is placed at the processing position P7.

[0105] Here, at the timing when the position of the processing unit 17 is adjusted for the electronic component W placed at the processing position P7, the position of the processing unit 18 is adjusted for the electronic component W placed at the processing position P8, the position of the processing unit 19 is adjusted for the electronic component W placed at the processing position P9, the position of the processing unit 20 is adjusted for the electronic component W placed at the processing position P10, and the position of the processing unit 21 is adjusted for the electronic component W placed at the processing position P11.

[0106] Furthermore, in the present embodiment, at the same timing, the position adjustment of the electronic component W in the second direction G and the orientation adjustment of the electronic component W around the virtual rotation axis R are performed by moving the pickup unit 13 in step S27. Therefore, each processing performed to place the processing unit 17 in a predetermined position and orientation with respect to the electronic component W placed at the processing position P7 can be performed effectively, and as a result, it is possible to increase the number of electronic components W processed per unit time by the electronic component processing apparatus 70.

[0107] Furthermore, when viewed in planar view, there is not enough free area between each of the processing units 17, 18, 19, 20, and 21, which are placed around the motor 36, and thus moving each of the processing units 17, 18, 19, 20, and 21 in the direction perpendicular to the third direction K would be a space problem. However, in the present embodiment, the processing units 17, 18, 19, 20, and 21 are each moved only in the third direction K, thereby avoiding this problem.

[0108] Step S42: After the radial movement of the rotating body 15 is completed, the processing unit 17 performs predetermined processing on the electronic component W placed and stationary at the processing position P7. In the present embodiment, the processing units

18, 19, 20, and 21 each perform predetermined processing on each of the electronic components W placed at the processing positions P8, P9, P10, and P11 at approximately the same timing.

[0109] Although the embodiment of the present invention has been described above, the present invention is not limited to the above-mentioned embodiment, and all changes in conditions that do not depart from the gist of the present invention are within the scope of application of the present invention. For example, the wafer sheet need not be placed vertically or horizontally.

[0110] In addition, instead of the pickup unit having a drive rotation section, as in the modified example shown in Fig. 18, a transport unit 100 may have a driving rotation mechanism 102 that rotates the component holding section 101, thereby adjusting the orientation of the electronic component W. As shown in Fig. 18, the driving rotation mechanism 102 rotates the component holding section 101 which has picked up the electronic component W before the component holding section 101 is placed at the processing position, thereby adjusting the orientation of the electronic component W picked up by the component holding section 101 (supported by the component support section 12) with respect to the transport unit.

[0111] In this case, the control section controls the second drive mechanism and the driving rotation mechanism 102 (or the second driver, the fourth driver, and the driving rotation mechanism 102) based on the deviation detected by the deviation derivation section such that the electronic component W is placed in a predetermined position and orientation with respect to the processing unit at the processing position. When the driving rotation mechanism 102 is adopted, it is not necessary to provide the pickup unit 103 with a drive rotation section.

[0112] Here, when the most upstream processing position along the rotation direction of the rotating body corresponds to a processing unit that does not require precise adjustment of the orientation of the electronic component (for example, a processing unit that performs visual inspection of the electronic component using an imaging section), and the second processing position from the upstream side corresponds to a processing unit that requires precise adjustment of the orientation of the electronic component (for example, a processing unit that performs electrical characteristic inspection of the electronic component), the adjustment of the orientation of the electronic component W by the driving rotation mechanism 102 may be performed before the electronic component W is placed at the second processing position from the upstream side (for example, at the timing when the component holding section 101 is

moving from the most upstream processing position to the second processing position), or may be performed in a state where the electronic component W is placed at the second processing position from the upstream side. The driving rotation mechanism 102 can be configured to have, for example, a motor. In the modified example shown in Fig. 18, the same components as those in the electronic component processing apparatuses 10 and 70 will be given the same reference numerals, and the detailed description thereof will be omitted.

[0113] Furthermore, the first drive mechanism only needs to have two drive sections that move the ejecting mechanism in different directions, and does not require an X-axis drive section and a Y-axis drive section that are perpendicular to the direction in which the ejecting mechanism moves. This also applies to the second drive mechanism that moves the pickup unit, the third drive mechanism that moves the wafer sheet, and the third driver that moves the wafer sheet.

[0114] The rotating body of the transport unit does not need to rotate around a vertical rotation axis. For example, the rotating body of the transport unit may rotate around a horizontal rotation axis. When the rotating body of the transport unit rotates around a horizontal rotation axis, the first virtual line M passing through the center of the rotating body and the processing position when viewed along the rotation axis of the rotating body is placed on a virtual vertical plane in which the processing position is placed.

[0115] Furthermore, a relay unit may be provided between the pickup unit and the transport unit to pick up the electronic components from the pickup unit and provide the electronic components to the transport unit. Furthermore, the detection of the position and orientation of the electronic component picked up by the component support section does not need to be performed based on the image captured by the imaging section. For example, the detection may be performed based on the measurement values of a laser sensor.

[0116] This application is based on a Japanese patent application (Patent Application No. 2022-119662) filed on July 27, 2022 and a Japanese patent application (Patent Application No. 2022-169188) filed on October 21, 2022, the contents of which are incorporated by reference into this application.

REFERENCE SIGNS LIST

- [0117] 10: Electronic component processing apparatus
- 11: Ejecting mechanism
- 12: Component support section

	13: Pickup unit
	14: Component holding section
	15: Rotating body
	16: Transport unit
5	17, 18, 19, 20, 21: Processing unit
	21a: Support body
	22: Rotating shaft
	23: Rotating member
	24: Coil spring
10	25: X-axis drive section
	26: Y-axis drive section
	27: Second drive mechanism
	28: Imaging section
	28a: Deviation derivation section
15	29: Wafer ring
	30: X-axis drive section
	31: Y-axis drive section
	32: Cylindrical member
	33: Drive source
20	34: Pin
	35: Third drive mechanism
	36: Motor
	37: Coil spring
	38: Supporting member
25	39: Plate material
	40: Motor
	41: Holding member
	42: Movable body
	43: Coil spring
30	44: Output shaft
	45: Base table
	46: X-axis drive section
	47: Y-axis drive section

	49: First drive mechanism
	51: Motor
	56: Drive rotation section
	57, 57a: Control section
5	58: Imaging section
	59: Position detection section
	70: Electronic component processing apparatus
	71: Support body
	72: Base table
10	73, 74: Guide rail
	75: Power transmission section
	76: Drive source
	77: Drive mechanism
	78: Vertical drive section
15	79: Horizontal drive section
	80: Drive mechanism
	81: Horizontal drive section
	82: Imaging section
	83: Prism
20	84: Deviation derivation section
	87, 88, 89, 90, 91: Drive mechanism
	100: Transport unit
	101: component holding section
	102: Driving rotation mechanism
25	103: Pickup unit
	H: Wafer sheet
	M, N: Virtual line
	P1: Pickup position
	P2: Receiving position
30	P3: Transfer position
	P7, P8, P9, P10, P11: Processing positions
	R: Virtual rotation axis
	W: Electronic component

W1, W2: Surface

CLAIMS

1. An electronic component processing apparatus (10) comprising:
 - an ejecting mechanism (11) that ejects an electronic component (W) affixed to a
5 wafer sheet (H) in a first direction (J) perpendicular to the wafer sheet (H);
 - a pickup unit (13) having a component support section (12) that picks up the
electronic component (W) ejected in the first direction (J) at a pickup position (P1) facing the
wafer sheet (H);
 - a transport unit (16) that moves a component holding section (14) together with the
10 electronic component (W) to a processing position (P7, P8, P9, P10, P11) by rotation of a
rotating body (15) having the component holding section (14) attached thereto, the component
holding section (14) picking up the electronic component (W) from the pickup unit (13) at a
receiving position (P2);
 - a processing unit (17, 18, 19, 20, 21) that performs predetermined processing on the
15 electronic component (W) placed at the processing position (P7, P8, P9, P10, P11);
 - a first drive mechanism (49) that moves the ejecting mechanism (11) along a first
virtual plane parallel to the wafer sheet (H);
 - a second drive mechanism (27) that moves the pickup unit (13), which supports the
electronic component (W) with the component support section (12), along a second virtual
20 plane parallel to the wafer sheet (H);
 - a third drive mechanism (35) that moves the wafer sheet (H) within a third virtual
plane including the wafer sheet (H);
 - a deviation derivation section (28a) that detects a deviation of the electronic
component (W) picked up by the component support section (12) from a reference position
25 and a reference orientation; and
 - a control section (57) that controls the first drive mechanism (49), the second drive
mechanism (27), and the third drive mechanism (35) to adjust positions of the component
support section (12) placed at the pickup position (P1), the electronic component (W) to be
subsequently picked up by the component support section (12), and the ejecting mechanism
30 (11), wherein
 - the pickup unit (13) includes
 - a rotating member (23) that rotates 180 degrees around a rotation axis (22)
by one or more rotational operations, thereby moving the component support section (12)

placed at the pickup position (P1) to a transfer position (P3) facing the component holding section (14) placed at the receiving position (P2), and moving the component support section (12) placed at the transfer position (P3) to the pickup position (P1), and

5 a drive rotation section (56) that rotates the component support section (12) that has picked up the electronic component (W) around a virtual rotation axis (R) placed in the first direction (J) in a state where the component support section (12) is placed at the pickup position (P1), and

the control section (57) controls the second drive mechanism (27) and the drive rotation section (56) based on the deviation detected by the deviation derivation section (28a) such that the electronic component (W) is placed at the processing position (P7, P8, P9, P10, P11) in a predetermined position and orientation with respect to the processing unit (17, 18, 19, 20, 21).

2. The electronic component processing apparatus (10) according to claim 1, further comprising:

an imaging section (28) that captures an image of the electronic component (W) picked up by the component support section (12), wherein

the deviation derivation section (28a) detects the deviation based on the image captured by the imaging section (28).

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3. An electronic component processing apparatus (10) comprising:

an ejecting mechanism (11) that ejects an electronic component (W) affixed to a wafer sheet (H) in a first direction (J) perpendicular to the wafer sheet (H);

a pickup unit (103) having a component support section (12) that picks up the electronic component (W) ejected in the first direction (J) at a pickup position (P1) facing the wafer sheet (H);

a transport unit (100) that moves a component holding section (101) together with the electronic component (W) to a processing position (P7, P8, P9, P10, P11) by rotation of a rotating body (15) having the component holding section (101) attached thereto, the component holding section (101) picking up the electronic component (W) from the pickup unit (13) at a receiving position (P2);

a processing unit (17, 18, 19, 20, 21) that performs predetermined processing on the electronic component (W) placed at the processing position (P7, P8, P9, P10, P11);

a first drive mechanism (49) that moves the ejecting mechanism (11) along a first virtual plane E parallel to the wafer sheet (H);

a second drive mechanism (27) that moves the pickup unit (103), which supports the electronic component (W) with the component support section (12), along a second virtual plane parallel to the wafer sheet (H);

a third drive mechanism (35) that moves the wafer sheet (H) within a third virtual plane including the wafer sheet (H);

a deviation derivation section (28a) that detects a deviation of the electronic component (W) picked up by the component support section (12) from a reference position and a reference orientation; and

a control section (57) that controls the first drive mechanism (49), the second drive mechanism (27), and the third drive mechanism (35) to adjust positions of the component support section (12) placed at the pickup position (P1), the electronic component (W) to be subsequently picked up by the component support section (12), and the ejecting mechanism (11), wherein

the pickup unit (103) includes a rotating member (23) that rotates 180 degrees around a rotation axis (22) by one or more rotational operations, thereby moving the component support section (12) placed at the pickup position (P1) to a transfer position (P3) facing the component holding section (101) placed at the receiving position (P2), and moving the component support section (12) placed at the transfer position (P3) to the pickup position (P1),

the transport unit (100) includes a driving rotation mechanism (102) that rotates the component holding section (101) to adjust an orientation of the electronic component (W) picked up by the component holding section (101) with respect to the transport unit (100), and

the control section (57) controls the second drive mechanism (27) and the driving rotation mechanism (102) based on the deviation detected by the deviation derivation section (28a) such that the electronic component (W) is placed at the processing position (P7, P8, P9, P10, P11) in a predetermined position and orientation with respect to the processing unit (17, 18, 19, 20, 21).

4. The electronic component processing apparatus (10) according to claim 3, further comprising:

an imaging section (28) that captures an image of the electronic component (W)

picked up by the component support section (12), wherein

the deviation derivation section (28a) detects the deviation based on the image captured by the imaging section (28).

- 5 5. An electronic component processing apparatus (70) comprising:
 - an ejecting mechanism (11) that ejects an electronic component (W) affixed to a wafer sheet (H) in a first direction (J) perpendicular to the wafer sheet (H);
 - a pickup unit (13) having a component support section (12) that picks up the electronic component (W) ejected in the first direction (J) at a pickup position (P1) facing the
 - 10 wafer sheet (H);
 - a transport unit (16) that moves a component holding section (14) together with the electronic component (W) to a processing position (P7, P8, P9, P10, P11) by rotation of a rotating body (15) having the component holding section (14) attached thereto, the component holding section (14) picking up the electronic component (W) from the pickup unit (13) at a
 - 15 receiving position (P2);
 - a processing unit (17, 18, 19, 20, 21) that performs predetermined processing on the electronic component (W) placed at the processing position (P7, P8, P9, P10, P11);
 - a first driver (81) that moves the ejecting mechanism (11) in a second direction parallel to the wafer sheet (H) or in a direction opposite to the second direction;
 - 20 a second driver (77) that moves the pickup unit (13) supporting the electronic component (W) with the component support section (12) in the second direction or in the direction opposite to the second direction;
 - a third driver (80) that moves the wafer sheet (H) within a third virtual plane including the wafer sheet (H);
 - 25 a fourth driver (87, 88, 89, 90, 91) that moves the processing unit (17, 18, 19, 20, 21) in a third direction (K) perpendicular to a direction of position adjustment of the electronic component (W) performed by movement of the pickup unit (13) or in a direction opposite to the third direction (K), thereby adjusting a position of the processing unit (17, 18, 19, 20, 21) in the third direction (K) with respect to the electronic component (W) placed at the
 - 30 processing position (P7, P8, P9, P10, P11);
 - a deviation derivation section (28a) that detects a deviation of the electronic component (W) picked up by the component support section (12) with respect to a reference position and a reference orientation; and

a control section (57) that controls the first driver (81), the second driver (77), and the third driver (80) to adjust the positions of the component support section (12) placed at the pickup position (P1), the electronic component (W) to be subsequently picked up by the component support section (12) and the ejecting mechanism (11), wherein

5 the pickup unit (13) includes a drive rotation section (56) that rotates the component support section (12) that has picked up the electronic component (W) around a virtual rotation axis (R) placed in the first direction (J) in a state where the component support section (12) is placed at the pickup position (P1), and

 the control section (57) controls the second driver (77), the fourth driver (87, 88, 89,
10 90, 91), and the drive rotation section (56) based on the deviation detected by the deviation derivation section (28a) such that the electronic component (W) is placed at a predetermined position and orientation with respect to the processing unit (17, 18, 19, 20, 21) at the processing position (P7, P8, P9, P10, P11).

15 6. The electronic component processing apparatus (70) according to claim 5, wherein when viewed along a rotation axis of the rotating body (15), the second direction is perpendicular to a second virtual line passing through a rotation center of the rotating body (15) and the receiving position (P2), and the third direction (K) is a direction along a first virtual line (M) passing through the rotation center of the rotating body (15) and the
20 processing position (P7, P8, P9, P10, P11).

7. The electronic component processing apparatus (70) according to claim 5, further comprising:

 an imaging section (28) that captures an image of the electronic component (W)
25 picked up by the component support section (12), wherein
 the deviation derivation section (28a) detects the deviation based on the image captured by the imaging section (28).

8. An electronic component processing apparatus (70) comprising:
30 an ejecting mechanism (11) that ejects an electronic component (W) affixed to a wafer sheet (H) in a first direction (J) perpendicular to the wafer sheet (H);
 a pickup unit (103) having a component support section (12) that picks up the electronic component (W) ejected in the first direction (J) at a pickup position (P1) facing the

wafer sheet (H);

a transport unit (100) that moves a component holding section (101) together with the electronic component (W) to a processing position (P7, P8, P9, P10, P11) by rotation of a rotating body (15) having the component holding section (101) attached thereto, the component holding section (101) picking up the electronic component (W) from the pickup unit at a receiving position (P2);

a processing unit (17, 18, 19, 20, 21) that performs predetermined processing on the electronic component (W) placed at the processing position (P7, P8, P9, P10, P11);

a first driver (81) that moves the ejecting mechanism (11) in a second direction parallel to the wafer sheet (H) or in a direction opposite to the second direction;

a second driver (77) that moves the pickup unit (103) supporting the electronic component (W) with the component support section (12) in the second direction or in a direction opposite to the second direction;

a third driver (80) that moves the wafer sheet (H) within a third virtual plane including the wafer sheet (H);

a fourth driver (87, 88, 89, 90, 91) that moves the processing unit (17, 18, 19, 20, 21) in a third direction (K) perpendicular to a direction of position adjustment of the electronic component (W) performed by movement of the pickup unit (103) or in a direction opposite to the third direction (K), thereby adjusting a position of the processing unit (17, 18, 19, 20, 21) in the third direction (K) with respect to the electronic component (W) placed at the processing position (P7, P8, P9, P10, P11);

a deviation derivation section (28a) that detects a deviation of the electronic component (W) picked up by the component support section (12) with respect to a reference position and a reference orientation; and

a control section (57) that controls the first driver (81), the second driver (77), and the third driver (80) to adjust the positions of the component support section (12) placed at the pickup position (P1), the electronic component (W) to be subsequently picked up by the component support section (12) and the ejecting mechanism (11), wherein

the transport unit (100) includes a driving rotation mechanism (102) that rotates the component holding section (12) to adjust an orientation of the electronic component (W) picked up by the component holding section (101) with respect to the transport unit (100), and

the control section (57) controls the second driver (77), the fourth driver (87, 88, 89, 90, 91), and the driving rotation mechanism (102) based on the deviation detected by the

deviation derivation section (28a) such that the electronic component (W) is placed at a predetermined position and orientation with respect to the processing unit (17, 18, 19, 20, 21) at the processing position (P7, P8, P9, P10, P11).

5 9. The electronic component processing apparatus (70) according to claim 8, wherein
 when viewed along a rotation axis of the rotating body (15), the second direction is
 perpendicular to a second virtual line passing through a rotation center of the rotating body
 (15) and the receiving position (P2), and the third direction (K) is a direction along a first
 virtual line (M) passing through the rotation center of the rotating body (15) and the
 10 processing position (P7, P8, P9, P10, P11).

10. The electronic component processing apparatus (70) according to claim 8, further
 comprising:
 an imaging section (28) that captures an image of the electronic component (W)
 15 picked up by the component support section (12), wherein
 the deviation derivation section (28a) detects the deviation based on the image
 captured by the imaging section (28).

11. An electronic component processing apparatus (10) comprising:
 20 an ejecting mechanism (11) that ejects an electronic component (W) affixed to a
 wafer sheet (H) in a first direction (J) perpendicular to the wafer sheet (H);
 a pickup unit (103) having a component support section (12) that picks up the
 electronic component (W) ejected in the first direction (J) at a pickup position (P1) facing the
 wafer sheet (H);
 25 a transport unit (100) that moves a component holding section (101) together with
 the electronic component (W) to a processing position (P7, P8, P9, P10, P11) by rotation of a
 rotating body (15) having the component holding section (101) attached thereto, the
 component holding section (101) picking up the electronic component (W) from the pickup
 unit (103) at a receiving position (P2);
 30 a processing unit (17, 18, 19, 20, 21) that performs predetermined processing on the
 electronic component (W) placed at the processing position (P7, P8, P9, P10, P11);
 a first drive mechanism (49) that moves the ejecting mechanism (11) along a first
 virtual plane parallel to the wafer sheet (H);

a second drive mechanism (27) that moves the pickup unit (103), which supports the electronic component (W) with the component support section (12), along a second virtual plane parallel to the wafer sheet (H);

5 a third drive mechanism (35) that moves the wafer sheet (H) within a third virtual plane including the wafer sheet (H);

a deviation derivation section (28a) that detects a deviation of the electronic component (W) picked up by the component support section (12) from a reference position and a reference orientation; and

10 a control section (57) that controls the first drive mechanism (49), the second drive mechanism (27), and the third drive mechanism (35) to adjust positions of the component support section (12) placed at the pickup position (P1), the electronic component (W) to be subsequently picked up by the component support section (12), and the ejecting mechanism (11), wherein

15 the pickup unit (103) includes a rotating member (23) that moves the component support section (12) placed at the pickup position (P1) to a transfer position (13) facing the component holding section (101) placed at the receiving position (P2) by one or more rotational operations,

20 the transport unit (100) includes a driving rotation mechanism (102) that rotates the component holding section (101) to adjust an orientation of the electronic component (W) picked up by the component holding section (101) with respect to the transport unit (100), and

25 the control section (57) controls the second drive mechanism (27) and the driving rotation mechanism (102) based on the deviation detected by the deviation derivation section (28a) such that the electronic component (W) is placed at the processing position (P7, P8, P9, P10, P11) in a predetermined position and orientation with respect to the processing unit (17, 18, 19, 20, 21).

12. The electronic component processing apparatus (10) according to claim 11, further comprising:

30 an imaging section (28) that captures an image of the electronic component (W) picked up by the component support section (12), wherein

the deviation derivation section (28a) detects the deviation based on the image captured by the imaging section (28).

13. An electronic component processing apparatus (70) comprising:

an ejecting mechanism (11) that ejects an electronic component (W) affixed to a wafer sheet (H) in a first direction (J) perpendicular to the wafer sheet (H);

a pickup unit (103) having a component support section (12) that picks up the electronic component (W) ejected in the first direction (J) at a pickup position facing the wafer sheet (H);

a transport unit (100) that moves a component holding section (101) together with the electronic component (W) to a processing position (P7, P8, P9, P10, P11) by rotation of a rotating body (15) having the component holding section (101) attached thereto, the component holding section (101) picking up the electronic component (W) from the pickup unit (103) at a receiving position (P2);

a processing unit (17, 18, 19, 20, 21) that performs predetermined processing on the electronic component (W) placed at the processing position (P7, P8, P9, P10, P11);

a pickup unit driver (77) that moves the pickup unit (103) supporting the electronic component (W) with the component support section (12) in a second direction parallel to the wafer sheet (H) or in a direction opposite to the second direction;

a wafer sheet driver (80) that moves the wafer sheet (H) within a third virtual plane including the wafer sheet (H);

a processing unit driver (87, 88, 89, 90, 91) that moves the processing unit (17, 18, 19, 20, 21) in a third direction (K) perpendicular to a direction of position adjustment of the electronic component (W) performed by movement of the pickup unit (103) or in a direction opposite to the third direction (K), thereby adjusting a position of the processing unit (17, 18, 19, 20, 21) in the third direction (K) with respect to the electronic component (W) placed at the processing position (P7, P8, P9, P10, P11);

a deviation derivation section (28a) that detects a deviation of the electronic component (W) picked up by the component support section (12) with respect to a reference position and a reference orientation; and

a control section (57) that controls the pickup unit driver (77) and the wafer sheet driver (80) to adjust the position of the component support section (12) placed at the pickup position (P1), and the electronic component (W) to be subsequently picked up by the component support section (12), wherein

the transport unit (100) includes a driving rotation mechanism (102) that rotates the component holding section (101) to adjust an orientation of the electronic component (W)

picked up by the component holding section (101) with respect to the transport unit (100), and the control section (57) controls the pickup unit driver (77), the processing unit driver (87, 88, 89, 90, 91), and the driving rotation mechanism (102) based on the deviation detected by the deviation derivation section (28a) such that the electronic component (W) is placed at a predetermined position and orientation with respect to the processing unit (17, 18, 19, 20, 21) at the processing position (P7, P8, P9, P10, P11).

14. The electronic component processing apparatus (70) according to claim 13, wherein when viewed along a rotation axis of the rotating body (15), the second direction is perpendicular to a second virtual line passing through a rotation center of the rotating body (15) and the receiving position (P2), and the third direction (K) is a direction along a first virtual line (M) passing through the rotation center of the rotating body (15) and the processing position (P7, P8, P9, P10, P11).

15. The electronic component processing apparatus (70) according to claim 13, further comprising:

an imaging section (28) that captures an image of the electronic component (W) picked up by the component support section (12), wherein the deviation derivation section (28a) detects the deviation based on an image captured by the imaging section (28).