

## DESCRIPTION

TITLE OF INVENTION: INVERSION UNIT

## 5 TECHNICAL FIELD

[0001] The present invention relates to an inversion unit for inverting an electronic component.

## BACKGROUND ART

10 [0002] In system for transferring electronic components, it is often necessary to invert the electronic components according to a structure of a mechanism for supplying the electronic components and a process (for example, visual inspection) to be performed on the electronic components. As inversion units for inverting the electronic components, those described, for example, in Patent Literatures 1 and 2 can be adopted.

15 [0003] However, in the inversion unit described in Patent Literature 1, it is necessary to match a groove formed in a rotation nozzle with a size of the electronic component. In the inversion unit described in Patent Literature 2, it is necessary to match lengths of a pair suction arms capable of suctioning respective electronic components, with thicknesses of the electronic components. Therefore, when electronic components to be inverted are changed  
20 to electric components of different sizes and thicknesses, since the inversion unit of Patent Literature 1 requires replacement of the rotation nozzle and the inversion unit of Patent Literature 2 requires replacement of the suction arms, switching work of the electronic components may be complicated.

## 25 CITATION LIST

## PATENT LITERATURE

[0004] Patent Literature 1: JP06115687A

Patent Literature 2: JP10129832A

## 30 SUMMARY OF INVENTION

[0005] The present disclosure relates to an inversion unit capable of inverting electronic components of different sizes without replacing a member.

According to an embodiment, in an inversion unit configured to receive an

electronic component having surfaces P, Q parallel to each other, invert the electronic component, and transfer the inverted electronic component to an external component transfer apparatus, the inversion unit includes: a component transfer unit L having a suction holding member J configured to suction the surface Q of the electronic component whose surface P is suctioned by the component transfer apparatus so as to receive the electronic component from the component transfer apparatus, and a moving mechanism K configured to move the suction holding member J that received the electronic component to a first position; and a component transfer unit T having: a suction holding member R configured to be arranged to face the suction holding member J arranged at the first position, suction the surface P of the electronic component suctioned by the suction holding member J, and a moving mechanism S configured to move the suction holding member R that receives the electronic component to a second position where the inverted electronic component is to be transferred to the component transfer apparatus, and the moving mechanism K is configured to move the suction holding member J to approach the suction holding member R that is arranged to face the suction holding member J arranged at the first position and bring the surface P into contact with the suction holding member R.

[0006] According to the inversion unit, the moving mechanism K moves the suction holding member J to approach the suction holding member R arranged to face the suction holding member J arranged at the first position so as to bring the surface P into contact with the suction holding member R. Therefore, the electronic component is inverted in a state where the suction holding members J, R sandwich the electronic component from a surface Q side and a surface P side, and a moving distance of the suction holding member J can be designed to be changeable by setting the moving mechanism K.

Therefore, the electronic components of different sizes (including thicknesses) can be inverted without exchanging the member or the like.

[0007] According to an embodiment, an inversion unit configured to receive an electronic component having surfaces P, Q parallel to each other, invert the electronic component, and transfer the inverted electronic component to an external component transfer apparatus, includes: a component transfer unit L including: a suction holding member J configured to suction the surface Q of the electronic component whose surface P is suctioned by the component transfer apparatus so as to receive the electronic component from the component transfer apparatus, and a moving mechanism K configured to move the suction holding member J that receives the electronic component to a first position; and a component transfer

unit T including: a suction holding member R configured to be arranged to face the suction holding member J arranged at the first position, suction the surface P of the electronic component suctioned by the suction holding member J, and a moving mechanism S configured to move the suction holding member R that receives the electronic component to a second position where the inverted electronic component is to be transferred to the component transfer apparatus, and the moving mechanism S is configured to move the suction holding member R, that is arranged to face the suction holding member J arranged at the first position, to approach the suction holding member J so as to bring the suction holding member R into contact with the surface P.

[0008] According to the inversion unit, the moving mechanism S moves the suction holding member R, arranged to face the suction holding member J that is arranged at the first position, to approach the suction holding member J so as to bring the suction holding member R into contact with the surface P. Therefore, the electronic component is inverted in a state where the suction holding members J, R sandwich the electronic component from a surface Q side and a surface P side, and a moving distance of the suction holding member R can be designed to be changeable by setting the moving mechanism S.

Therefore, the electronic components of different sizes (including thicknesses) can be inverted without exchanging the member or the like.

## BRIEF DESCRIPTION OF DRAWINGS

[Fig. 1] Fig. 1 is diagram illustrating an inversion unit according to a first embodiment.

[Fig. 2] Fig. 2 is a diagram illustrating an arrangement of the inversion unit and a component transfer apparatus according to the first embodiment.

[Fig. 3] Fig. 3 is a diagram illustrating a rotation mechanism.

[Fig. 4] Figs. 4(A) and 4(B) are diagrams illustrating a state where the inversion unit according to the first embodiment inverts an electronic component.

[Fig. 5] Figs. 5(A) and 5(B) are diagrams illustrating a state where the inversion unit according to the first embodiment inverts the electronic component.

[Fig. 6] Fig. 6 is a diagram illustrating an inversion unit according to a second embodiment.

[Fig. 7] Fig. 7 is a diagram illustrating a modification in which a rotation angle of the rotation mechanism is an angle other than 90 degrees.

[Fig. 8] Fig. 8 is a diagram illustrating a modification in which each rotation mechanism includes a plurality of nozzles.

## DESCRIPTION OF EMBODIMENTS

5 [0010] Embodiments will be described with reference to the accompanying drawings.

As shown in Figs. 1 and 2, an inversion unit 10 according to a first embodiment is a device that receives an electronic component W having surfaces P, Q arranged in parallel, inverts the electronic component W, and transfers the inverted electronic component W to an external component transfer apparatus 11. The details will be described below.

10 [0011] In the present embodiment, the electronic component W has a rectangular plate shape, and the surfaces P, Q are respectively a front surface and a back surface.

As shown in Figs. 1 and 2, the component transfer apparatus 11 includes a motor 13 fixed to a horizontally arranged base plate 12, a disk-shaped rotor 15 rotatable around a rotation shaft 14 connected to the motor 13, and a plurality of nozzle mechanisms 16 provided  
15 at equal intervals on an outer peripheral portion of the rotor 15.

[0012] In the present embodiment, eight nozzle mechanisms 16 are attached to the outer peripheral portion of the horizontally arranged rotor 15 at intervals of 45 degrees so as to be vertically movable. Each nozzle mechanism 16 is long in a vertical direction, and can suction one of the surface P and the surface Q of the electronic component W at a lower end  
20 thereof by suction, and releases the electronic component W suctioned by stopping the suction or blowing out air.

[0013] The motor 13 repeats operation and stop, and due to one operation, the rotation shaft 14 and the rotor 15 are rotated by 45 degrees and each nozzle mechanism 16 is moved. Therefore, eight temporary stop positions (hereinafter also referred to as "nozzle stop  
25 positions") of the nozzle mechanisms 16 are present on an outer periphery of the rotor 15.

A drive mechanism 17 for lowering the nozzle mechanism 16 is fixed to an upper side of each nozzle stop position by a support member (not shown). The drive mechanism 17 includes a motor 18 and a lifting body 19 that is lowered by an operation of the motor 18 to push down the nozzle mechanism 16. A coil spring (not shown) that applies an upward  
30 force to the nozzle mechanism 16 is connected to each nozzle mechanism 16. The lowered nozzle mechanism 16 is moved upward by a force from the coil spring as the lifting body 19 moves up.

[0014] While being transferred by the component transfer apparatus 11, the electronic

component W is subjected to predetermined processing such as visual inspection. In order to perform predetermined processing on the electronic component W, the electronic component W needs to be inverted upside down from a state where the surface P is suctioned by the nozzle mechanism 16 to a state where the surface Q is suctioned by the nozzle mechanism 16.

5 In the present embodiment, the inversion unit 10 is used to invert the electronic component W. [0015] As shown in Figs. 1 and 2, the inversion unit 10 includes a pedestal 21 which is fixed on the base plate 12 and to which a rail 20 is attached from above, a plate-shaped base block 23 which is fixed to the pedestal 21 and to which a support body 22 is attached, and long rotation mechanisms 24, 25 which are supported by the support body 22. The rotation  
10 mechanism 24 is disposed below one nozzle stop position, and the rotation mechanism 25 is disposed below another nozzle stop position adjacent to the above nozzle stop position. In Fig. 2, the rotation mechanisms 24, 25 and the like are omitted. The rotation mechanisms 24, 25 are respectively provided below adjacent nozzle stop position, but the arrangement is not necessary and for example, the two rotation mechanisms may be arranged such that one  
15 nozzle stop position exists between a nozzle stop position provided above one rotation mechanism and a nozzle stop position provided above the other rotation mechanism.

[0016] The rail 20 has a linear shape, and is positioned such that the rotation shaft 14 is positioned on an extension line of the rail 20 in a plan view.

A groove 26 into which the rail 20 is fitted is formed in the base block 23. In a  
20 state where the base block 23 is not fixed to the pedestal 21, the base block 23 is movable back and forth along the rail 20 together with the support body 22 and the rotation mechanisms 24, 25. The base block 23 is fixed to the pedestal 21 by a lock mechanism (for example, a draw latch, a nut and a bolt) that is not shown.

[0017] In the present embodiment, as shown in Fig. 1, the support body 22 is a T-shaped  
25 metal plate, is vertically arranged, and a lower portion thereof is connected to the base block 23. As shown in Figs. 1 and 2, motors 27, 28 are respectively attached to an upper left side and an upper right side on a back surface (one surface) of the support body 22. The motors 27, 28 are connected to a rotation shaft 29 that is rotationally driven by an operation of the motor 27 and a rotation shaft 30 that is rotationally driven by an operation of the motor 28,  
30 respectively. The rotating shafts 29, 30 are provided at the same height, penetrate the support body 22 horizontally, and are respectively connected to the rotation mechanisms 24, 25.

[0018] The rotation mechanism 24 provided on a front surface (the other surface) of the

support body 22 has a bracket (an example of a holding member support body) 31 to which the rotation shaft 29 is connected, a long slide member 32 movably mounted on the bracket 31, and a nozzle J1 (an example of a first suction holding member J) fixed to one end portion of the slide member 32.

5           The rotation mechanism 24 rotates clockwise or counterclockwise by 90 degrees around the rotation shaft 29 by one operation of the motor 27. The slide member 32 is inserted through the bracket 31. The slide member 32 is provided with a coil spring 34 (an example of an elastic body) whose both ends are respectively in contact with the bracket 31 and the other end of the slide member 32 that is enlarged in diameter. The slide member 32  
10 is movably supported by the bracket 31, and thus the nozzle J1 attached to the slide member 32 is movable.

[0019] A movable member 36 is movably mounted on a horizontally arranged guide rail 35 on an upper right side of the front surface of the support body 22. The movable member 36 includes a protruding portion 37 protruding leftward at the same height as the rotation shaft  
15 29, and a leftward force is applied from the motor 38, attached to the support body 22, via a known cam, a cam follower or the like, and a rightward force is applied from a coil spring (not shown). The movable member 36 moves leftward or rightward by two forces having different directions.

[0020] As shown in Figs. 1 and 3, the rotation mechanism 25 provided on a front surface  
20 side of the support body 22 includes a long guide member 39 to which the rotation shaft 30 is connected, a nozzle R1 (an example of a second suction holding member R) movably attached to the guide member 39, and a coil spring 41 that couples the nozzle R1 and the guide member 39. The rotation mechanism 25 rotates clockwise or counterclockwise by 90 degrees around the rotation shaft 30 by one operation of the motor 28.

25           The nozzles J1, R1 can suction the electronic component W by suction, and release the suctioned electronic component W by stopping the suction or blowing out air.

[0021] In the present embodiment, a moving mechanism K1 (an example of a first moving mechanism K) for moving the nozzle J1 includes the motors 27, 38, the rotation shaft 29, the bracket 31, the slide member 32, the guide rail 35, and the movable member 36. A  
30 component transfer unit L1 (an example of a first component transfer unit L) includes the nozzle J1 and the moving mechanism K1. A moving mechanism S1 (an example of a second moving mechanism S) for moving the nozzle R1 includes the motor 28, the rotation shaft 30, and the guide member 39. A component transfer unit T1 (an example of a second

component transfer unit T) includes the nozzle R1 and the moving mechanism S1.

[0022] Next, an operation of the inversion unit 10 in which the electronic component W in a condition where the surface P is suctioned by the nozzle mechanism 16 is inverted to a condition where the surface Q is suctioned by the nozzle mechanism 16 will be described.

5 As shown in Fig. 1, the nozzle J1 is arranged on an upper side of the vertically arranged slide member 32 and directly below the electronic component W whose surface P is suctioned by the nozzle mechanism 16. In a state of suctioning the surface P of the electronic component W, the nozzle R1 is arranged on an upper side of the guide member 39 arranged in the vertical direction, and is arranged directly below the nozzle mechanism 16  
10 which does not suction the electronic component W.

[0023] As shown in Fig. 4(A), the nozzle mechanism 16 arranged above the rotation mechanism 24 is lowered, and thus the nozzle J1 receives the electronic component W from the nozzle mechanism 16 by suctioning, from below, the surface Q of the electronic component W that is suctioned by the nozzle mechanism 16. At this time, the nozzle  
15 mechanism 16 above the rotation mechanism 25 suction, from above, the surface Q of the electronic component W suctioned by the nozzle R1 so as to receive the electronic component W from the nozzle R1. Since the nozzle mechanism 16 and the nozzle J1 transfer the electronic component W in a state of sandwiching the electronic component W from above and below, the electronic component W can be transferred in a state where the electronic  
20 component W is kept at a predetermined position with respect to the nozzle mechanism 16 and the nozzle J1.

[0024] Thereafter, as shown in Fig. 4(B), the rotation mechanism 24 rotates counterclockwise by 90 degrees by the operation of the motor 27, and the rotation mechanism 25 rotates clockwise by 90 degrees by the operation of the motor 28. As a result, the nozzles  
25 J1, R1 are moved, the nozzle R1 is disposed to face the nozzle J1, and one end portion (right end portion) of the slide member 32 is disposed on a left side of the protruding portion 37 and at the same height as the protruding portion 37. In the present embodiment, a position of the nozzle J1 at this time is referred to as a first position. Therefore, the motor 27 (that is, the moving mechanism K1) moves the nozzle J1, which has received the electronic component W,  
30 to the first position.

[0025] Then, as shown in Fig. 5(A), the motor 38 moves the movable member 36 leftward by the operation thereof, and brings the protruding portion 37 into contact with one end portion of the slide member 32 so as to move the slide member 32 and the nozzle J1 leftward.

The slide member 32 and the nozzle J1 move leftward until the surface P of the electronic component W whose surface Q is suctioned by the nozzle J1 is in contact with the nozzle R1 and the electronic component W is sandwiched by the nozzles R1, J1 from the left and right. Therefore, the motor 38 (that is, the moving mechanism K1) moves the nozzle J1 to approach the nozzle R1 disposed facing the nozzle J1 that is disposed at the first position and brings the surface P into contact with the nozzle R1.

[0026] When the electronic component W comes into contact with the nozzle R1 due to the movement of the nozzle J1, a load is generated in the electronic component W, but the load is relieved by the coil spring 41. Since a moving distance of the nozzle J1 in the left direction can be adjusted by a rotation angle of the motor 38, the electronic components W of different thicknesses can be transferred between the nozzles J1, R1 by adjusting the rotation angle of the motor 38. Further, since the rotation mechanisms 24, 25 are rotatably attached to the support body 22 (that is, one member), a relative positional relationship between the rotation mechanisms 24, 25 can be kept in a predetermined relationship with high accuracy, as compared with a case where the rotation mechanisms 24, 25 are rotatably attached to separate members.

[0027] Next, the nozzle R1 in contact with the surface P of the electronic component W starts to suction the surface P of the electronic component W, and then the nozzle J1 stops the suction. As a result, the electronic component W is transferred from the nozzle J1 to the nozzle R1. Since the nozzle J1 and the nozzle R1 transfer the electronic component W in a state of sandwiching the electronic component W from the left and right, the electronic component W can be transferred in a state where the electronic component W is kept at a predetermined position with respect to the nozzle J1 and the nozzle R1.

Then, the motor 38 operates, the movable member 36 moves to rightward by the elastic force of a coil spring (not shown), the slide member 32 and the nozzle J1 move rightward by the elastic force of the coil spring 34, the nozzle J1 separates from the electronic component W, and the protruding portion 37 of the movable member 36 is separated from the slide member 32.

[0028] In the present embodiment, as shown in Figs. 5(A) and 5(B), the nozzle mechanism 16 disposed above the rotation mechanism 24 moves to above the rotation mechanism 25 due to the rotation of the rotor 15 caused by the operation of the motor 13 during a period from when the slide member 32 starts to move leftward to when the rightward movement of the nozzle J1 and the movable member 36 ends.

[0029] Thereafter, due to the operation of the motors 27, 28, the rotation mechanism 24 is rotated by 90 degrees clockwise, the nozzle J1 is arranged directly below a nozzle mechanism 16 that suctions the surface P of the electronic component W, the rotation mechanism 25 is rotated by 90 degrees counterclockwise, and the nozzle R1 that suctions the surface P of the electronic component W is arranged directly below a nozzle mechanism 16 that does not suction the electronic component W (the nozzle mechanism 16 that is moved from above the rotation mechanism 24 to above the rotation mechanism 25). Next, the nozzle mechanism 16 disposed above the nozzle R1 is lowered to suction the surface Q of the electronic component W whose surface P is suctioned by the nozzle R1, and receives the electronic component W from the nozzle R1. Thus, the inverting of the electronic component W is completed.

[0030] Since the nozzle mechanism 16 and the nozzle R1 transfer the electronic component W in a state of sandwiching the electronic component W from above and below, the electronic component W can be transferred in a state where the electronic component W is kept at a predetermined position with respect to the nozzle mechanism 16 and the nozzle R1.

In the present embodiment, a position directly below the nozzle mechanism 16 disposed above the rotation mechanism 25, that is, a position where the electronic component W inverted by the rotation mechanisms 24, 25 is transferred to the nozzle mechanism 16 (the component transfer apparatus 11) is set as a second position. Therefore, the motor 28, the rotation shaft 30, and the guide member 39, that is, the moving mechanism S1, move the nozzle R1 that has received the electronic component W to the second position.

[0031] In the present embodiment, only the rotation mechanism 24 is rotated together with the rotation shaft 29 by the operation of the motor 27, but the present invention is not limited thereto. A rotation body to which the rotation shaft 29 is connected may be rotatably attached to the support body 22, the rotation mechanism 24, the motor 38, the movable member 36, and the guide rail 35 may be attached to the rotation body, and the rotation body, the rotation mechanism 24, the motor 38, the movable member 36, and the guide rail 35 may be integrally rotated together with the rotation shaft 29 by the operation of the motor 27. In this case, the nozzle J1 can be raised by the operation of the motor 38 from a position directly below the electronic component W suctioned by the nozzle mechanism 16, so as to receive the electronic component W from the nozzle mechanism 16.

[0032] The positional relationship between the inversion unit 10 and the component transfer apparatus 11 is important for stably transferring the electronic component W between

the nozzle mechanism 16 and the nozzle J1 or the nozzle R1, but in this point, the present embodiment is designed such that the rotation shaft 14 is located on the extension line of the rail 20 in the plan view, and the support body 22 to which the rotation mechanisms 24, 25 are attached can be moved and positioned along the rail 20, so that the inversion unit 10 and the component transfer apparatus 11 can be easily aligned in position. It is not necessary to use the rail 20 and the base block 23 in which the groove 26 is formed, and for example, a groove may be provided on the pedestal, and a rail to be fitted into the groove may be attached to the base block to facilitate the position alignment of the inversion unit 10 and the component transfer apparatus 11.

[0033] In the inversion unit 10 described above, the nozzle J1 (suction holding member J) that has received the electronic component W from the component transfer apparatus 11 approaches the nozzle R1 (suction holding member R), and the electronic component W is transferred from the nozzle J1 to the nozzle R1, but the present invention is not limited thereto.

Hereinafter, an inversion unit 50 according to a second embodiment in which the suction holding member R approaches the suction holding member J to transfer the electronic component W will be described with reference to Fig. 6. In the inversion unit 50, the same elements as those of the inversion unit 10 are denoted by the same reference numerals, and detailed description thereof will be omitted.

[0034] As shown in Fig. 6, the inversion unit 50 includes, on an upper left side of the support body 22, a long rotation mechanism 52 that is rotatably supported by a rotation shaft 51, a motor 53 that rotates the rotation mechanism 52 clockwise or counterclockwise together with the rotation shaft 51, and a movable member 55 that is guided by a guide rail 54 to moves horizontally by rotation of the motor 53. Further, on an upper right side of the support body 22, a long rotation mechanism 57 rotatably supported by a rotation shaft 56, and a motor 58 that rotates the rotation mechanism 57 clockwise or counterclockwise together with the rotation shaft 56 are provided.

[0035] The rotation mechanism 52 includes a bracket (an example of a holding member support body) 59 connected to the rotation shaft 51, a long slide member 60 movably mounted on the bracket 59, and a nozzle R2 (an example of the suction holding member R) fixed to one end portion of the slide member 60. Similarly to the rotation mechanism 25, the rotation mechanism 57 includes a long guide member 62, a nozzle J2 (an example of the suction holding member J) movably attached to the guide member 62, and a coil spring (an

example of the elastic body) that is not shown and connects the nozzle J2 and the guide member 62.

[0036] The inversion unit 50 inverts the electronic component W as follows.

In a state where the rotation mechanism 57 is vertically arranged, the nozzle J2  
 5 suctions the surface Q of the electronic component W whose surface P is suctioned by the  
 nozzle mechanism 16 so as to receive the electronic component W from the component  
 transfer apparatus 11, and the nozzle J2 moves to the first position due to that the rotation  
 mechanism 57 is rotated counterclockwise by 90 degrees. The rotation mechanism 52  
 rotates clockwise by 90 degrees from the vertical state according to the movement of the  
 10 nozzle J2, and the nozzle R2 is brought into a state corresponding to the nozzle J2 disposed at  
 the first position.

[0037] Next, the movable member 55 moves rightward by an operation of a motor 64  
 provided below the motor 53, thus a protruding portion 65 of the movable member 55 is  
 brought into contact with the slide member 60, the nozzle R2 and the slide member 60 are  
 15 moved rightward, and the nozzle R2 comes into contact with and suctions the surface P of the  
 electronic component W whose surface Q is suctioned by the nozzle J2 so as to receive the  
 electronic component W from the nozzle J2. A load generated in the electronic component  
 W when the nozzle R2 contacts the electronic component W is absorbed by a coil spring that  
 couples the nozzle J2 and the guide member 62.

[0038] Then, as the movable member 55 moves leftward by the operation of the motor 64,  
 the nozzle R2 moves leftward by an elastic force of a coil spring 66 whose both ends are  
 respectively in contact with the bracket 59 and the other end of the slide member 60 that is  
 enlarged in diameter. Thereafter, the rotation mechanism 52 is rotated counterclockwise by  
 90 degrees by the operation of the motor 53, and thus the nozzle R2 moves to the second  
 25 position where the inverted electronic component W is transferred to the nozzle mechanism  
 16. The surface Q of the electronic component W whose surface P is suctioned by the  
 nozzle R2 is suctioned by the descended nozzle mechanism 16, and the electronic component  
 W is transferred from the nozzle R2 to the nozzle mechanism 16 by suction stop of the nozzle  
 R2.

[0039] In the present embodiment, a moving mechanism K2 (an example of the first  
 moving mechanism K) that moves the nozzle J2 that receives the electronic component W  
 from the component transfer apparatus 11 to the first position includes the rotation shaft 56,  
 the motor 58, and the guide member 62, and a component transfer unit L2 (an example of the

first component transfer unit L) includes the nozzle J2 and the moving mechanism K2. Further, a moving mechanism S2 (an example of the second moving mechanism S), that moves the nozzle R2 that has received the electronic component W, to the second position includes the rotation shaft 51, the motors 53, 64, the bracket 59, the slide member 60, the guide rail 54, and the movable member 55, and a component transfer unit T2 (an example of the second component transfer unit T) includes the nozzle R2 and the moving mechanism S2.

[0040] Therefore, the moving mechanism S2 moves the nozzle R2 arranged facing the nozzle J2 disposed at the first position to approach the nozzle J2 so as to bring the nozzle R2 into contact with the surface P.

In the present embodiment, the bracket 59 is a member that movably supports the nozzle R2, and the moving mechanism S2 rotates the bracket 59 by a predetermined angle around the rotation shaft 51 so as to move the nozzle R2 to the second position.

[0041] Although embodiments has been described, the present invention is not limited to the above-described embodiments, and modifications in conditions and the like without departing from the gist are all within the scope of the present invention.

For example, an elastic body that relieves the load generated in the electronic component may not be provided. In a case where the elastic body is provided, the elastic body is not limited to the coil spring (for example, a cylinder, urethane, or the like can be adopted as the elastic body), and the elastic body can be provided only on one of the first component transfer unit L and the second component transfer unit T, or on both the first component transfer unit L and the second component transfer unit T.

Further, the first suction holding member J or the second suction holding member R may be directly movably attached to the holding member support body.

[0042] Further, the rotation mechanism having the first suction holding member J and the rotation mechanism having the second suction holding member R do not necessarily have to rotate 90 degrees in order to invert the electronic component. For example, as shown in Fig. 7, in a component transfer apparatus 75 in which eight nozzle mechanisms 72 are provided at an equal pitch on an outer peripheral portion of a disk-shaped rotation body 71 that rotates around a rotation shaft 70, when a longitudinal direction (suction direction) of each nozzle mechanism 72 is arranged to be a radial direction of the rotation body 71, the rotation mechanism 73 having the first suction holding member J and the rotation mechanism 74 having the second suction holding member R each perform a rotation operation of 67.5 degrees to invert the electronic component.

[0043] Then, the inversion unit may be designed such that the first suction holding member J arranged at the first position and the second suction holding member R disposed facing the first suction holding member J approaches each other, and the first suction holding member J and the second suction holding member R are brought into contact with the surfaces P, Q of the electronic component W, respectively.

Further, the component transfer apparatus is not necessarily to be a rotation transfer type in which the nozzle mechanism moves by rotation of the rotor, and may be, for example, a horizontal transfer type in which the nozzle mechanism horizontally moves in one direction in order.

[0044] As shown in Fig. 8, the electronic component W may be inverted by an inversion unit 80 in which a rotation mechanism 81 in a pair of rotation mechanisms 81, 82 is provided with a plurality of (four in the example in Fig. 8) nozzles J3 (an example of the first suction holding member J), and the rotation mechanism 82 is provided with a plurality of (four in the example in Fig. 8) nozzles R3. In the inversion unit 80, the same components as those of the inversion unit 10 are denoted by the same reference numerals, and detailed description thereof will be omitted.

[0045] The rotation mechanism 81 in which the nozzles J3 are radially arranged and the rotation mechanism 82 in which the nozzles R3 are radially arranged are rotatably attached to the right side and the left side of the support body 22, respectively. The rotation mechanism 81 includes a holding member support body 87 coupled to a rotation shaft 86 that is rotationally driven by an operation of a motor 85, and the nozzles J3 are movably supported by a plurality of arm portions provided on the holding member support body 87 respectively. The rotation mechanism 82 includes a holding member support body 90 coupled to a rotation shaft 89 that is rotationally driven by an operation of a motor 88, and the nozzles R3 are movably supported by a plurality of arm portions provided on the holding member support body 90 respectively.

[0046] The rotation mechanism 81 rotates counterclockwise by a predetermined angle (90 degrees in the example of Fig. 8) by one operation of the motor 85, and the rotation mechanism 82 rotates counterclockwise by a predetermined angle (90 degrees in the example of Fig. 8) by one operation of the motor 88. A drive unit 91 for applying a force to the nozzle J3 disposed at the first position so as to horizontally move the nozzle J3 is attached to the support body 22.

[0047] After one nozzle J3 receives the electronic component W in a state of suctioning the

surface Q from the nozzle mechanism 16 temporarily stopped at the nozzle stop position above the rotation mechanism 81, the rotation mechanism 81 rotates counterclockwise by a predetermined angle by the operation of the motor 85 so as to move the nozzle J3 that has received the electronic component W from the nozzle mechanism 16 to the first position.

One nozzle R3 is disposed to face the nozzle J3 disposed at the first position, and the nozzle J3 suctioning the surface Q of the electronic component W approaches the nozzle R3 due to an operation of the drive unit 91 so as to bring the surface P into contact with the nozzle R3. The nozzle R3 suctions the surface P and receives the electronic component W from the nozzle J3 that is disposed facing the nozzle R3.

[0048] At a timing when the nozzle R3 receives the electronic component W from the nozzle J3, another nozzle J3 receives the electronic component W from the nozzle mechanism 16 temporarily stopped at the nozzle stop position. After the nozzle R3 receives the electronic component W from the nozzle J3, the motors 85, 88 are operated to rotate the rotation mechanisms 81, 82 counterclockwise by a predetermined angle, and the nozzle R3 that has received the electronic component W from the nozzle J3 is arranged at the second position below the nozzle mechanism 16 that is temporarily stopped at the nozzle stop position above the rotation mechanism 82. The nozzle mechanism 16 disposed above the nozzle R3 moves downward until coming into contact with the surface Q of the electronic component W suctioned by the nozzle R3, suctions the surface Q, and receives the electronic component W from the nozzle R3.

[0049] At a timing when the electronic component W is transferred from the nozzle R3 to the nozzle mechanism 16, another nozzle R3 receives the electronic component W from the nozzle J3. In the inversion unit 80, since the transfer of the electronic component W from the component transfer apparatus 11 to the rotation mechanism 81, the transfer of the electronic component W from the rotation mechanism 81 to the rotation mechanism 82, and the transfer of the electronic component W from the rotation mechanism 82 to the component transfer apparatus 11 can be performed at the same time, the electronic component W can be inverted efficiently. That is, when one nozzle J3 is arranged at a position where the electronic component W is received from the nozzle mechanism 16, another nozzle J3 is arranged at the first position, one nozzle R3 is arranged to face the nozzle J3 disposed at the first position, and another nozzle R3 is disposed at the second position.

[0050] In the inversion unit 80, a moving mechanism K3 (an example of the first moving mechanism K) mainly includes the motor 85, the rotation shaft 86, and the holding member

support body 87, and a component transfer unit L3 (an example of the first component transfer unit L) mainly includes the plurality of nozzles J3 and the moving mechanism K3. Further, a moving mechanism S3 (an example of the second moving mechanism S) includes the motor 88, the rotation shaft 89, and the holding member support body 90, and a  
5 component transfer unit T3 (an example of the second component transfer unit T) mainly includes the plurality of nozzles R3 (an example of the second suction holding member R) and the moving mechanism S3.

Therefore, it is possible to design the inversion unit such that the two rotation mechanisms rotate in the same direction, and the first component transfer unit L and the  
10 second component transfer unit T respectively include a plurality of first suction holding members and a plurality of second suction holding members.

[0051] Further, when the electronic component W comes into contact with the nozzle R3 due to the approach of the nozzle J3 to the nozzle R3, a load is generated in the electronic component W, but the load is relieved by an elastic body (not shown) attached to the rotation  
15 mechanism 82.

Instead of providing the drive unit 91 for horizontally moving the nozzle J3, a drive unit may be adopted that moves the nozzle R3 to approach the nozzle J3 that is at the first position and suctions the surface Q of the electronic component W, so as to bring the nozzle R3 into contact with the surface P of the electronic component W. In addition to the drive  
20 unit 91, a drive unit that moves the nozzle R3 to approach the nozzle J3 may be provided, and in this case, the nozzles J3, R3 can approach each other and the nozzle R3 comes into contact with the surface P of the electronic component W.

Further, a drive unit that moves the nozzle J3 disposed below the nozzle mechanism 16 to approach the nozzle mechanism 16 or a drive unit that moves the nozzle R3 disposed  
25 below the nozzle mechanism 16 to approach the nozzle mechanism 16 may be provided.

[0052] Although the present invention has been described in detail with reference to particular embodiments, it will be apparent to those skilled in the art that various changes and modifications can be made without departing from the spirit and scope of the invention.

The present application is based on a Japanese Patent Application No. 2018-195083,  
30 filed on Oct 16, 2018, the contents of which are incorporated herein by reference.

## REFERENCE SIGNS LIST

[0053]

|    |        |                              |
|----|--------|------------------------------|
|    | 10     | Inversion unit               |
|    | 11     | Component transfer apparatus |
|    | 12     | Base plate                   |
|    | 13     | Motor                        |
| 5  | 14     | Rotation shaft               |
|    | 15     | Rotor                        |
|    | 16     | Nozzle mechanism             |
|    | 17     | Drive mechanism              |
|    | 18     | Motor                        |
| 10 | 19     | Lifting body                 |
|    | 20     | Rail                         |
|    | 21     | Pedestal                     |
|    | 22     | Support body                 |
|    | 23     | Base block                   |
| 15 | 24, 25 | Rotation mechanism           |
|    | 26     | Groove                       |
|    | 27, 28 | Motor                        |
|    | 29, 30 | Rotation shaft               |
|    | 31     | Bracket                      |
| 20 | 32     | Slide member                 |
|    | 34     | Coil spring                  |
|    | 35     | Guide rail                   |
|    | 36     | Movable member               |
|    | 37     | Protruding portion           |
| 25 | 38     | Motor                        |
|    | 39     | Guide member                 |
|    | 41     | Coil spring                  |
|    | 50     | Inversion unit               |
|    | 51     | Rotation shaft               |
| 30 | 52     | Rotation mechanism           |
|    | 53     | Motor                        |
|    | 54     | Guide rail                   |
|    | 55     | Movable member               |

|    |                   |                              |
|----|-------------------|------------------------------|
|    | 56                | Rotation shaft               |
|    | 57                | Rotation mechanism           |
|    | 58                | Motor                        |
|    | 59                | Bracket                      |
| 5  | 60                | Slide member                 |
|    | 62                | Guide member                 |
|    | 64                | Motor                        |
|    | 65                | Protruding portion           |
|    | 66                | Coil spring                  |
| 10 | 70                | Rotation shaft               |
|    | 71                | Rotation body                |
|    | 72                | Nozzle mechanism             |
|    | 73, 74            | Rotation mechanism           |
|    | 75                | Component transfer apparatus |
| 15 | 80                | Inversion unit               |
|    | 81, 82            | Rotation mechanism           |
|    | 85                | Motor                        |
|    | 86                | Rotation shaft               |
|    | 87                | Holding member support body  |
| 20 | 88                | Motor                        |
|    | 89                | Rotation shaft               |
|    | 90                | Holding member support body  |
|    | 91                | Drive unit                   |
|    | J1, J2, J3 Nozzle |                              |
| 25 | K1, K2, K3        | Moving mechanism             |
|    | L1, L2, L3        | Component transfer unit      |
|    | P, Q              | Surface                      |
|    | R1, R2, R3        | Nozzle                       |
|    | S1, S2, S3        | Moving mechanism             |
| 30 | T1, T2, T3        | Component transfer unit      |
|    | W                 | Electronic component         |

## CLAIMS

1. An electronic component transfer system comprising: a component transfer apparatus; and an inversion unit that receives an electronic component having surfaces (P, Q) parallel to each other, inverts the electronic component, and transfers the inverted electronic component to the component transfer apparatus,

wherein the component transfer apparatus includes: a plurality of nozzle mechanisms that suction the electronic component; and a rotor to which the nozzle mechanisms are mounted and which is rotated by an operation of a motor so as to move the nozzle mechanisms,

wherein the inversion unit includes:

a component transfer unit (L) having: a suction holding member (J) that suctions the surface (Q) of the electronic component whose surface (P) is suctioned by a nozzle mechanism so as to receive the electronic component from the nozzle mechanism; and a moving mechanism (K) that moves the suction holding member (J) that received the electronic component to a first position; and

a component transfer unit (T) having: a suction holding member (R) that is to be arranged to face the suction holding member (J) arranged at the first position, suctions the surface (P) of the electronic component suctioned by the suction holding member (J), and receives the electronic components; and a moving mechanism (S) that moves the suction holding member (R) that receives the electronic component to a second position where the inverted electronic component is to be transferred to the nozzle mechanism,

wherein the moving mechanism (K) is configured to move the suction holding

member (J) to approach the suction holding member (R) that is arranged to face the suction holding member (J) arranged at the first position and bring the surface (P) into contact with the suction holding member (R), and

wherein the nozzle mechanism is moved by a rotation of the rotor from a position where the nozzle mechanism can transfer the electronic component to the suction holding member (J) to a position where the nozzle mechanism can receive the electronic component from the suction holding member (R).

2. The electronic component transfer system according to claim 1, wherein the component transfer unit (L) includes a holding member support body that movably supports the suction holding member (J), and the component transfer unit (L) is configured to rotate the holding member support body around a rotation shaft, that is coupled to the holding member support body, by a predetermined angle so as to move the suction holding member (J) to the first position.

3. The electronic component transfer system according to claim 1 or 2, wherein an elastic body configured to relieve a load generated in the electronic component caused by the surface (P) coming into contact with the suction holding member (R) is provided on at least one of the component transfer unit (L) and the component transfer unit (T).

4. The electronic component transfer system according to any one of claims 1 to 3, wherein a plurality of suction holding members (J) and a plurality of suction holding members (R) are provided, and

wherein, when one suction holding member (J) is arranged at a position where the electronic component is to be received from the nozzle mechanism, another suction holding member (J) is arranged at the first position, one suction holding member (R) is arranged to face the suction holding member (J) that is arranged at the first position, and another suction holding member (R) is arranged at the second position.

5. An electronic component transfer system comprising: an electronic component transfer apparatus; and an inversion unit that receives an electronic component having surfaces (P, Q) parallel to each other, inverts the electronic component, and transfers the inverted electronic component to the component transfer apparatus,

wherein the component transfer apparatus includes: a plurality of nozzle mechanisms that suction the electronic component; and a rotor to which the nozzle mechanisms are mounted and which is rotated by an operation of a motor so as to move the nozzle mechanisms,

wherein the inversion unit includes:

a component transfer unit (L) having: a suction holding member (J) that suctions the surface (Q) of the electronic component whose surface (P) is suctioned by a nozzle mechanism so as to receive the electronic component from the nozzle mechanism; and a moving mechanism (K) that moves the suction holding member (J) that received the electronic component to a first position; and

a component transfer unit (T) having: a suction holding member (R) that is to be arranged to face the suction holding member (J) arranged at the first position, suctions the surface (P) of the electronic component suctioned by the suction holding member (J), and a moving mechanism (S) that moves the suction holding

member (R) that received the electronic component to a second position where the inverted electronic component is to be transferred to the nozzle mechanism,

wherein the moving mechanism (S) is configured to move the suction holding member (R), that is arranged to face the suction holding member (J) arranged at the first position, to approach the suction holding member (J) so as to bring the suction holding member (R) into contact with the surface (P), and

wherein the nozzle mechanism is moved by a rotation of the rotor from a position where the nozzle mechanism can transfer the electronic component to the suction holding member (J) to a position where the nozzle mechanism can receive the electronic component from the suction holding member (R).