

## DESCRIPTION

TITLE OF INVENTION: PROCESSING DEVICE OF ELECTRONIC COMPONENT

### 5 TECHNICAL FIELD

[0001] The present disclosure relates to a processing device of an electronic component.

### BACKGROUND ART

10 [0002] Patent Document 1 discloses an electronic component inspection device including a turntable and an electronic component holding device attached to an outer peripheral end of the turntable. The electronic component inspection device includes a suction nozzle capable of moving up and down with respect to a placement position of an electronic component. The suction nozzle is lowered to the placement position, the electronic component is detached from the placement position, or the electronic component is acquired from the placement  
15 position.

### PRIOR ART DOCUMENT

#### PATENT DOCUMENT

[0003] Patent Literature 1: WO 2012/073282

### 20 SUMMARY OF INVENTION

#### TECHNICAL PROBLEM

[0004] The present disclosure provides a processing device of an electronic component that is effective in improving positioning accuracy of an electronic component.

#### SOLUTION TO PROBLEM

25 [0005] A processing device of an electronic component according to an aspect of the present disclosure includes: a turning portion that is turnable around a central axis of a circular transfer track passing through a predetermined arrangement region; an electronic component holding portion that is provided on the turning portion so as to be positioned in the circular transfer track; a holding position changing portion that enables displacement of the  
30 electronic component holding portion with respect to the turning portion in a predetermined displacement direction; a turning drive portion that is configured to turn the turning portion around the central axis so that the electronic component holding portion holding the electronic component is arranged in the arrangement region; and a displacement drive portion that is

provided in the arrangement region so as to move the electronic component holding portion arranged in the arrangement region to one side in the displacement direction. The holding position changing portion includes a plurality of parallel leaf springs that intersect the displacement direction and connect the electronic component holding portion and the turning portion.

#### ADVANTAGEOUS EFFECTS OF INVENTION

[0006] According to the present disclosure, there is provided the processing device of an electronic component that is effective in improving the positioning accuracy of an electronic component.

#### BRIEF DESCRIPTION OF DRAWINGS

[0007] [Fig. 1] Fig. 1 is a plan view schematically illustrating an example of a processing device.

[Fig. 2] Fig. 2 is a side view schematically illustrating the processing device illustrated in Fig. 1.

[Fig. 3] Fig. 3 is an enlarged side view illustrating a part of the processing device.

[Fig. 4] Fig. 4 is a plan view schematically illustrating a part of the processing device.

[Fig. 5] Fig. 5(a) and Fig. 5(b) are schematic views illustrating displacement of an electronic component holding portion.

#### DESCRIPTION OF EMBODIMENTS

[0008] Hereinafter, an embodiment will be described in detail with reference to the drawings. In the description, the same elements or elements having the same function are denoted by the same reference numerals, and a redundant description thereof will be omitted.

[0009] A processing device 1 of an electronic component according to the present embodiment is a so-called die sorter, and is a device that transfers an electronic component W formed in a previous process such as dicing, performs processing such as visual inspection, electrical characteristic inspection, or marking, and then packs the electronic component W in a storage member such as a tape, a container tube, or a tray. The processing device 1 illustrated below is a device that performs various processing such as inspection on the electronic component W received from a component supply part and packs the electronic component W in the storage member without bonding the electronic component W to a

substrate or the like.

[0010] As illustrated in Figs. 1 and 2, the processing device 1 includes a rotary transfer unit 10 and a controller 100. The rotary transfer unit 10 moves the electronic component W along a circular track CR (circular transfer track). The electronic component W to be transferred may have two main surfaces Wa, Wb parallel to each other and an outer peripheral surface Wc surrounding the main surfaces Wa, Wb (see Fig. 3). The rotary transfer unit 10 includes a turning portion 20, a plurality of electronic component holding portions 50, a plurality of holding position changing portions 70, a turning drive portion 60, and a displacement drive portion 80.

[0011] The turning portion 20 is turnable around a central axis Ax of the circular track CR passing through a plurality of arrangement regions ARs. The turning portion 20 includes a turntable 22 provided so as to be turnable around the central axis Ax, and a plurality of connection parts 24. An outer periphery of the turntable 22 is positioned inside the circular track CR. For example, the circular track CR is a horizontal circular track, and the central axis Ax thereof is vertical.

[0012] The plurality of arrangement regions ARs may be set at equal intervals along the circular track CR. The plurality of arrangement regions ARs are regions that do not move even when the turning portion 20 turns. For example, in at least a part of the plurality of arrangement regions ARs through which the circular track CR passes, the electronic components W is transferred from the turning portion 20 to processing portions 16. Specific examples of the processing portion 16 include a component supply part that supplies the electronic component W, a collection part that collects the electronic component W and packages the electronic component W in a storage member, and an intermediate processing portion that performs predetermined processing on the electronic component W between the component supply part and the collection part. Examples of the intermediate processing portion include an inspection part that inspects an appearance of the electronic component W, an inspection part that inspects electrical characteristics of the electronic component W, and a marking part that performs marking on the electronic component W. The plurality of connection parts 24 are arranged at equal intervals along the outer periphery of the turntable 22 and protrude from the turntable 22 to an outer peripheral side.

[0013] The plurality of electronic component holding portions 50 are provided in the turning portion 20 so as to be positioned in the circular track CR. For example, the plurality of electronic component holding portions 50 are arranged at equal intervals along the circular

track CR, and are attached to the plurality of connection parts 24, respectively. In the present description, the term "attached" includes not only a case of being directly attached, but also a case of being attached via another member. As an example, the number of the plurality of electronic component holding portions 50 and the number of the plurality of arrangement regions ARs may be the same. A pitch angle at which the plurality of electronic component holding portions 50 are arranged along the circular track CR (an angle between the adjacent electronic component holding portions 50) and a pitch angle at which the plurality of arrangement regions ARs are arranged along the circular track CR may be the same.

[0014] Each of the plurality of electronic component holding portions 50 holds the electronic component W. The electronic component holding portion 50 may hold the electronic component W by any method. Specific examples of a method of holding the electronic component W include negative pressure (vacuum) suction, electrostatic adsorption, gripping, or the like. For example, the electronic component holding portion 50 sucks one of the main surfaces Wa, Wb from one side in a direction (Z-axis direction illustrated in the drawing) orthogonal to the turntable 22 by a negative pressure.

[0015] As illustrated in Fig. 2, the holding position changing portion 70 connects the turning portion 20 and the electronic component holding portion 50, and enables displacement of the electronic component holding portion 50 with respect to the turning portion 20 in a predetermined direction. Hereinafter, a direction in which the electronic component holding portion 50 can be displaced by the holding position changing portion 70 is referred to as a "displacement direction". For example, the holding position changing portion 70 enables displacement of the electronic component holding portion 50 in a direction (Z-axis direction illustrated in the drawing) perpendicular to the turntable 22. As an example, the holding position changing portion 70 enables the displacement of the electronic component holding portion 50 between a transfer position and a placement position.

[0016] The transfer position is a position at which the electronic component holding portion 50 is arranged when the turning portion 20 turns. For example, the transfer position is set at the same height position as the turntable 22. The placement position is a position at which the electronic component W is transferred to the processing portion 16, and is set at a position below the transfer position (in a Z-axis negative direction).

[0017] The turning drive portion 60 turns the turning portion 20 around the central axis Ax. For example, the turning drive portion 60 uses an electric motor as a power source, and

rotates the turntable 22 around the central axis Ax by a direct drive without a gear. Since the plurality of electronic component holding portions 50 are attached to the turntable 22, the plurality of electronic component holding portions 50 move along the circular track CR (rotate around the central axis Ax) in accordance with a rotation of the turntable 22. The turning drive portion 60 turns the turning portion 20 such that each of the plurality of electronic component holding portions 50 is sequentially arranged in the one arrangement region AR. For example, the turning drive portion 60 intermittently turns the turning portion 20 such that the plurality of electronic component holding portions 50 respectively stop temporarily in the plurality of arrangement regions ARs. As a result, one of the plurality of electronic component holding portions 50 may be sequentially temporarily stopped in the one arrangement region AR.

[0018] As illustrated in Fig. 3, the electronic component holding portion 50 may include a suction nozzle 52, a nozzle holder 54, and a connection block 55.

[0019] The suction nozzle 52 is positioned in the circular track CR. The suction nozzle 52 is open downward, and sucks one of the main surfaces Wa, Wb of the electronic component W from above by a negative pressure. For example, the suction nozzle 52 extends vertically with respect to the turntable 22, and a lower end portion of the suction nozzle 52 is open downward. The electronic component holding portion 50 further includes a valve (not illustrated) for switching turning-on and turning-off of the negative pressure suction by the suction nozzle 52 in response to an input of a control signal. Specific examples of the valve include an electromagnetic valve.

[0020] The nozzle holder 54 holds the suction nozzle 52. The suction nozzle 52 protrudes downward from the nozzle holder 54. The connection block 55 is adjacent to the nozzle holder 54 on a turntable 22 side, and faces the connection part 24. Hereinafter, a surface of an outer surface of the connection block 55 that faces the connection part 24 is referred to as an "inner surface 55a", and a surface of an outer surface of the connection part 24 that faces the connection block 55 is referred to as an "outer surface 24a".

[0021] The holding position changing portion 70 includes a plurality of parallel leaf springs. The holding position changing portion 70 includes, for example, two parallel leaf springs. Hereinafter, one of the two leaf springs is referred to as a "leaf spring 72a", and the other one is referred to as a "leaf spring 72b".

[0022] The leaf springs 72a, 72b connect the electronic component holding portion 50 and the turning portion 20 so that the leaf springs 72a, 72b intersect with the displacement

direction of the electronic component holding portion 50. For example, the leaf springs 72a, 72b are arranged vertically while being separated apart from each other, and the leaf springs 72a, 72b respectively extend horizontally to connect the inner surface 55a of the connection block 55 and the outer surface 24a of the connection part 24. A distance between the leaf spring 72a and the leaf spring 72b may be larger than a thickness of the turntable 22. The two parallel leaf springs 72a, 72b connect the electronic component holding portion 50 and the turning portion 20, so that the direction in which the electronic component holding portion 50 is displaced with respect to the turning portion 20 (a movement operation of the electronic component holding portion 50) is restricted. That is, the leaf springs 72a, 72b have a function of guiding the movement of the electronic component holding portion 50 with respect to the turning portion 20.

[0023] The leaf spring 72a and the leaf spring 72b may be formed to have the same spring characteristic. For example, the leaf spring 72a and the leaf spring 72b are made of the same material. In addition, for example, the leaf spring 72a and the leaf spring 72b have the same shape. Incidentally, the same shape includes not only a case where the leaf spring 72a completely coincides with the leaf spring 72b but also a case where the leaf spring 72a substantially coincides with the leaf spring 72b.

[0024] The displacement drive portion 80 moves the electronic component holding portion 50 arranged in the arrangement region AR to one side in the displacement direction. For example, the displacement drive portion 80 moves the electronic component holding portion 50 downward in a vertical direction. The rotary transfer unit 10 may include a plurality of displacement drive portions 80. The plurality of displacement drive portions 80 are provided in the plurality of arrangement regions ARs, respectively. The plurality of displacement drive portions 80 are respectively fixed to the plurality of arrangement regions ARs, and do not move even when the turning portion 20 turns. In the arrangement region AR where it is not necessary to displace the electronic component holding portion 50, the displacement drive portion 80 may not be provided. One displacement drive portion 80 moves the electronic component holding portion 50, which is sequentially arranged in the arrangement region AR where the displacement drive portion 80 is fixed, to one side in the displacement direction.

[0025] Returning to Fig. 2, the rotary transfer unit 10 may further include a fixing plate 90 that fixes (holds) the plurality of displacement drive portions 80. The fixing plate 90 is, for example, a plate-shaped member arranged above the turntable 22 of the turning portion 20. The fixing plate 90 is configured not to turn together with the turntable 22. The plurality of

displacement drive portions 80 are fixed to the fixing plate 90 in a state in which the plurality of displacement drive portions 80 are positioned in the plurality of arrangement regions ARs, respectively. Therefore, the plurality of displacement drive portions 80 do not move even when the turning portion 20 turns.

5 [0026] The displacement drive portion 80 includes, for example, a main body part 81, a pusher 82, and a drive part 84. The main body part 81 is fixed to the arrangement region AR so as not to turn together with the turntable 22 (turning portion 20). For example, the main body part 81 is fixed to a portion of an outer edge portion of the fixing plate 90 corresponding to the arrangement region AR. The pusher 82 is provided on the main body part 81 so as to  
10 be displaceable along the displacement direction with respect to the main body part 81. For example, the pusher 82 is held by the main body part 81 so as to be movable along an upper-lower direction. The pusher 82 is positioned above the electronic component holding portion 50 in a state in which the electronic component holding portion 50 is positioned in the arrangement region AR. The drive part 84 moves the pusher 82 downward by using an  
15 electric motor, an air cylinder, or the like as a power source. As a result, the electronic component holding portion 50 is pushed downward by the pusher 82. A position of an action point of a force from the displacement drive portion 80 to the electronic component holding portion 50 (hereinafter, referred to as an "action point P1") and a position of the suction nozzle 52 may be different from each other in a direction orthogonal to the  
20 displacement direction.

[0027] As illustrated in Fig. 3, the pusher 82 is positioned above the connection block 55 in a state in which the electronic component holding portion 50 is positioned in the arrangement region AR, and comes into contact with an upper surface 55b of the connection block 55 when the electronic component holding portion 50 is pushed downward. That is, the action  
25 point P1 of the force from the displacement drive portion 80 to the electronic component holding portion 50 is positioned on the upper surface 55b of the connection block 55. When the displacement drive portion 80 releases the state in which a downward force is applied to the upper surface 55b of the connection block 55, the electronic component holding portion 50 returns to a position before the displacement due to reaction forces of the leaf springs 72a,  
30 72b.

[0028] The holding position changing portion 70 may further include an auxiliary spring 78. The auxiliary spring 78 pushes the electronic component holding portion 50 toward the other side in the displacement direction. For example, the auxiliary spring 78 pushes the

electronic component holding portion 50 in a direction opposite to the direction in which the displacement drive portion 80 pushes the electronic component holding portion 50. A position of an action point of a force from the auxiliary spring 78 to the electronic component holding portion 50 (hereinafter, referred to as an "action point P2") and the position of the action point P1 of the force acting from the displacement drive portion 80 to the electronic component holding portion 50 may be different from each other in the direction orthogonal to the displacement direction (X-axis direction in the drawing).

[0029] As an example, the electronic component holding portion 50 further includes an extension part 56 (first extension part), the connection part 24 further includes an extension part 28 (second extension part), and the auxiliary spring 78 is provided between the extension part 56 and the extension part 28. The extension part 56 protrudes from the inner surface 55a of the connection block 55 toward the outer surface 24a of the connection part 24. The extension part 28 protrudes from the outer surface 24a of the connection part 24 toward the inner surface 55a of the connection block 55. The extension part 28 is positioned below the extension part 56, and an upper surface 28a of the extension part 28 faces a lower surface 56b of the extension part 56.

[0030] The auxiliary spring 78 is, for example, a coil spring (compression coil spring). The auxiliary spring 78 is arranged between the extension part 28 and the extension part 56 with its central axis along the displacement direction. A lower end of the auxiliary spring 78 comes into contact with the upper surface 28a of the extension part 28, and an upper end of the auxiliary spring 78 comes into contact with the lower surface 56b of the extension part 56. The auxiliary spring 78 applies a force to the electronic component holding portion 50 in a direction from the placement position to the transfer position when the electronic component holding portion 50 is displaced from the transfer position to the placement position.

[0031] At least one of the connection part 24 and the electronic component holding portion 50 may include a guide pin 32 that guides a deformation direction of the auxiliary spring 78 so as to follow the displacement direction. For example, the connection part 24 further includes the guide pin 32, and the electronic component holding portion 50 further includes a guide hole 58. The guide pin 32 protrudes from the extension part 28 toward the extension part 56. The guide pin 32 is formed in a columnar shape, for example. The guide hole 58 penetrates the extension part 56 at a position corresponding to the guide pin 32. For example, the guide hole 58 penetrates the extension part 56 in the vertical direction (the Z-axis direction in the drawing).

[0032] An end portion of the guide pin 32 is passed through the guide hole 58. An inner diameter of the guide hole 58 is larger than an outer diameter of the end portion of the guide pin 32. Therefore, a gap is provided between an outer peripheral surface of the guide pin 32 and an inner peripheral surface of the guide hole 58. The gap is set to be larger than a displacement amount of the electronic component holding portion 50 in the direction perpendicular to the displacement direction. Incidentally, the displacement of the electronic component holding portion 50 in the direction perpendicular to the displacement direction is a displacement caused by deflection of the leaf springs 72a, 72b in the displacement direction. The auxiliary spring 78 is arranged so as to surround the guide pin 32. Thereby, the deformation direction of the auxiliary spring 78 is restricted in a direction along the guide pin 32.

[0033] The extension part 28 may be arranged so as to sandwich at least one of the leaf springs 72a, 72b between the extension part 56 and the extension part 28, and the auxiliary spring 78 may penetrate the leaf spring, among the leaf springs 72a, 72b, which is positioned between the extension part 56 and the extension part 28 and come into contact with the extension part 56 and the extension part 28. One of the extension part 56 and the extension part 28 may be positioned between the leaf springs 72a, 72b, and the other of the extension part 56 and the extension part 28 may be positioned outside between the leaf springs 72a, 72b.

[0034] As an example, the extension part 28 is positioned between the leaf springs 72a, 72b, and the extension part 56 is positioned outside between the leaf springs 72a, 72b. More specifically, the extension part 56 is positioned above the leaf spring 72a. That is, the extension part 28 is arranged so as to sandwich the leaf spring 72a between the extension part 56 and the extension part 28. For example, the extension part 56 is positioned close to an upper end of the connection block 55, and the upper surface 55b of the connection block 55 and an upper surface 56a of the extension part 56 are flush with each other. The extension part 56 may be positioned above the turntable 22.

[0035] The leaf spring 72a includes an opening 76a through which the guide pin 32 penetrates. The opening 76a vertically penetrates the leaf spring 72a. The leaf spring 72b through which the guide pin 32 does not penetrate may include an opening 76b similar to the opening 76a. A position, shape, and size of the opening 76b in the leaf spring 72b may be the same as a position, shape, and size of the opening 76a in the leaf spring 72a. Accordingly, even when the guide pin 32 penetrates the leaf spring 72a and does not penetrate the leaf spring 72b, the spring characteristic of the leaf spring 72b can be substantially the

same as the spring characteristic of the leaf spring 72a. The sizes of the openings 76a, 76b may be at least larger than the guide pin 32 and further larger than the guide hole 58.

[0036] An arrangement relationship between the extension parts 28, 56 and the leaf springs 72a, 72b is not limited to the above-described example. The extension part 28, the leaf spring 72b, the extension part 56, and the leaf spring 72a may be arranged from below in this order. That is, the extension part 56 may be positioned between the leaf springs 72a, 72b, and the extension part 28 may be positioned outside the leaf springs 72a, 72b (below the leaf spring 72b). In this way, the extension part 56 may be arranged at a position where the leaf spring 72b is sandwiched between the extension part 56 and the extension part 28. In this example, the leaf spring 72a may not be positioned between the extension part 28 and the extension part 56 (may be positioned above the extension part 56), and the leaf spring 72b may be positioned between the extension part 28 and the extension part 56. In this case, the guide pin 32 and the auxiliary spring 78 may do not penetrate through the opening 76a of the leaf spring 72a, and the guide pin 32 and the auxiliary spring 78 may penetrate through the opening 76b of the leaf spring 72b.

[0037] The extension part 28 and the extension part 56 may be positioned between the leaf springs 72a, 72b. In this case, the guide pin 32 and the auxiliary spring 78 may penetrate through the openings 76a, 76b of the leaf springs 72a, 72b. The extension part 28 and the extension part 56 may be positioned outside the leaf springs 72a, 72b. That is, the extension part 28 and the extension part 56 may be positioned above the leaf spring 72a or below the leaf spring 72b. In this case, the leaf springs 72a, 72b may not be provided with the openings 76a, 76b.

[0038] The holding position changing portion 70 may include at least one other leaf spring in addition to the leaf springs 72a, 72b. In the example illustrated in Fig. 3, at least one other leaf spring may be provided below the extension part 28, or may be provided between the extension part 28 and the extension part 56. In addition, one or more other leaf springs may be provided below the extension part 28, and one or more other leaf springs may be provided between the extension part 28 and the extension part 56. The other leaf springs may be formed in the same shape by the same material as the leaf springs 72a, 72b. The other leaf spring may also be provided with the same opening as the opening 76a (opening 76b). Even when the extension part 56 is positioned between the leaf springs 72a, 72b and the extension part 28 is positioned outside the leaf springs 72a, 72b, at least one other leaf spring may be similarly provided.

[0039] In the example illustrated in Figs. 3 and 4, the auxiliary spring 78 is provided at a position overlapping the leaf springs 72a, 72b when viewed from above, but the auxiliary spring 78 may be provided at a position not overlapping with the leaf springs 72a, 72b. In this case, the leaf springs 72a, 72b may not be provided with the openings 76a, 76b, and the extension parts 28, 56 may not overlap the leaf springs 72a, 72b when viewed from above. The holding position changing portion 70 may not include the auxiliary spring 78. In this case, the extension part 28, the guide pin 32, and the extension part 56 may not be provided.

[0040] The turning portion 20 may further include a restriction part 34 that restricts movement of the electronic component holding portion 50 in a direction in which the auxiliary spring 78 pushes the electronic component holding portion 50 (for example, upward). For example, the turning portion 20 further includes the restriction part 34 provided at an upper end of the guide pin 32. The restriction part 34 is formed in a shape and size that cannot pass through the guide hole 58 (interfere with a peripheral edge portion of the guide hole 58). As an example, as illustrated in Fig. 4, the shape of the restriction part 34 is a polygon whose maximum width is larger than a diameter of the guide hole 58 when viewed from above.

[0041] The restriction part 34 is arranged at a height in contact with the upper surface 56a of the extension part 56 when the electronic component holding portion 50 is positioned at the transfer position. As a result, even if the electronic component holding portion 50 attempts to move above the transfer position, the electronic component holding portion 50 comes into contact with the restriction part 34 so as to hinder the movement thereof. The auxiliary spring 78 may be configured to press the extension part 56 against the restriction part 34 in a state in which the extension part 56 is in contact with the restriction part 34. For example, a natural length of the auxiliary spring 78 may be longer than a distance between the extension part 56 and the extension part 28 in a state in which the extension part 56 is in contact with the restriction part 34.

[0042] A reaction force generated by the auxiliary spring 78 with respect to the displacement of the electronic component holding portion 50 by the displacement drive portion 80 may be larger than the total of the reaction forces generated by the leaf springs 72a, 72b with respect to the displacement. For example, a spring constant of the auxiliary spring 78 with respect to the displacement may be 2 to 20 times, 5 to 15 times, or 8 to 12 times spring constants of the leaf springs 72a, 72b.

[0043] The controller 100 is a computer that controls the rotary transfer unit 10 according

to a preset control procedure. In this control, the controller 100 is configured to at least control the turning drive portion 60 such that the electronic component holding portion 50 is moved to any one of the arrangement regions ARs in a state in which the electronic component W is held by the electronic component holding portion 50, and control the displacement drive portion 80 so as to displace the electronic component holding portion 50 moved to the arrangement region AR from the transfer position to the placement position in the vertical direction.

[0044] In a period in which the turning drive portion 60 turns the turning portion 20, the electronic component holding portion 50 is arranged at the transfer position. When the electronic component holding portion 50 is at the transfer position, the extension part 56 is pressed against the restriction part 34 by the auxiliary spring 78. Therefore, a vibration of the electronic component holding portion 50 due to the movement of the turning portion 20 is suppressed. When the electronic component holding portion 50 arranged in the arrangement region AR is displaced to the placement position, the displacement drive portion 80 positioned in the arrangement region AR lowers the pusher 82. When the pusher 82 is lowered by a predetermined amount from an initial position, as illustrated in Fig. 5(a), the pusher 82 comes into contact with the connection block 55.

[0045] When the displacement drive portion 80 further applies a force to the action point P1 by the pusher 82, the force with which the pusher 82 pushes the electronic component holding portion 50 exceeds the reaction forces of the leaf springs 72a, 72b and the auxiliary spring 78, and the electronic component holding portion 50 moves downward. At this time, as illustrated in Fig. 5(b), since the leaf springs 72a, 72b are deformed while maintaining a substantially parallel state, a posture of the electronic component holding portion 50 is kept substantially constant. That is, the electronic component holding portion 50 is displaced downward while substantially maintaining a state in which the suction nozzle 52 faces vertically downward.

[0046] When the electronic component holding portion 50 is displaced downward, the leaf springs 72a, 72b, which are horizontal before the displacement, are bent between the inner surface 55a of the connection block 55 and the outer surface 24a of the connection part 24. Therefore, a distance between the inner surface 55a and the outer surface 24a is shorter than the total length of the leaf springs 72a, 72b. Accordingly, the electronic component holding portion 50 is also displaced in a horizontal direction toward the central axis Ax of the turning portion 20. As long as a downward displacement of the electronic component holding

portion 50 is smaller than the total length of the leaf springs 72a, 72b, the displacement of the electronic component holding portion 50 in the horizontal direction is very small. As described above, if the gap between the guide hole 58 and the guide pin 32 is set to be larger than the displacement amount of the electronic component holding portion 50 in the direction perpendicular to the displacement direction (X-axis direction in the drawing), contact and rubbing between the electronic component holding portion 50 and the guide pin 32 due to the displacement of the electronic component holding portion 50 in the horizontal direction are suppressed.

[0047] In a state in which the displacement drive portion 80 applies a force to the action point P1 by the pusher 82 (a state in which the electronic component holding portion 50 is positioned at the placement position), the electronic component W is transferred between the electronic component holding portion 50 and the processing portion 16. For example, the suction of the electronic component W held by the suction nozzle 52 is released, and the electronic component W is transferred from the electronic component holding portion 50 to the processing portion 16. Then, the displacement drive portion 80 reduces the force applied to the action point P1. When the force applied to the action point P1 decreases, the reaction forces of the leaf springs 72a, 72b and the auxiliary spring 78 exceed the force with which the pusher 82 pushes the electronic component holding portion 50, and the electronic component holding portion 50 is displaced upward.

[0048] Thereafter, the electronic component holding portion 50 (the extension part 56) abuts against the restriction part 34, raising of the electronic component holding portion 50 is stopped, and the pusher 82 is separated from the electronic component holding portion 50. As a result, the electronic component holding portion 50 is returned to a state in which the electronic component holding portion 50 can turn (transport) again. When the electronic component holding portion 50 that does not hold the electronic component W receives the electronic component W from the processing portion 16, the electronic component holding portion 50 may be lowered and raised in the same manner.

[0049] As described above, the processing device 1 according to one aspect of the present disclosure includes the turning portion 20 that is turnable around the central axis Ax of the circular track CR passing through the predetermined arrangement region AR, the electronic component holding portion 50 that is provided on the turning portion 20 so as to be positioned in the circular track CR, the holding position changing portion 70 that enables the displacement of the electronic component holding portion 50 with respect to the turning

portion 20 in the predetermined displacement direction, the turning drive portion 60 that turns the turning portion 20 around the central axis Ax so that the electronic component holding portion 50 holding the electronic component W is arranged in the arrangement region AR, and the displacement drive portion 80 that is provided in the arrangement region AR so as to move the electronic component holding portion 50 arranged in the arrangement region AR to the one side in the displacement direction. The holding position changing portion 70 includes the two parallel leaf springs 72a, 72b that intersect the displacement direction and connect the electronic component holding portion 50 and the turning portion 20.

[0050] Examples of a mechanism for guiding the displacement of the electronic component holding portion 50 in the predetermined displacement direction include a slide guide for guiding the movement of the electronic component holding portion 50 along the displacement direction. However, a structural clearance is indispensable for the slide guide, and the movement of the electronic component holding portion in the direction perpendicular to the displacement direction cannot be completely restricted. In addition, it is also conceivable that the clearance increases over time due to wear or the like. On the other hand, according to the holding position changing portion 70 including two parallel leaf springs 72a, 72b that intersect the displacement direction and connect the electronic component holding portion 50 and the turning portion 20, it is possible to permit the movement of the electronic component holding portion 50 in the direction perpendicular to the leaf springs 72a, 72b while restricting the movement of the electronic component holding portion 50 in the direction along the leaf springs 72a, 72b without clearance.

[0051] According to the mechanism for enabling displacement of the electronic component holding portion 50 by deformation of the leaf springs 72a, 72b, a displacement of the electronic component holding portion 50 in a direction perpendicular to the displacement direction (hereinafter referred to as "vertical displacement") also occurs. With respect to this displacement, by setting the length of the leaf springs 72a, 72b sufficiently larger than the displacement amount in the displacement direction, it is possible to suppress the vertical displacement to a very small extent. Further, since a size of the vertical displacement is less likely to change over time in comparison with a size of the structural clearance of the slide guide, positioning accuracy can be improved by setting a position at which the vertical displacement is expected to be a target position, and the positioning accuracy can be maintained for a long period of time. Therefore, it is effective in improving the positioning accuracy of the electronic component W.

[0052] The displacement drive portion 80 may include the main body part 81 that is fixed to the arrangement region AR so as not to turn together with the turning portion 20, the pusher 82 that is provided on the main body part 81 so as to be displaceable along the displacement direction and pushes the electronic component holding portion 50 toward the one side in the displacement direction, and the drive part 84 that moves the pusher 82 along the displacement direction. Since the displacement drive portion 80 is provided in the arrangement region AR without turning together with the turning portion 20, the mechanism for displacing the electronic component holding portion 50 in the arrangement region AR is simplified.

[0053] The processing device 1 may include the plurality of electronic component holding portions 50 and the plurality of holding position changing portions 70. The plurality of holding position changing portions 70 can respectively displace the plurality of electronic component holding portions 50 with respect to the turning portion 20. The turning drive portion 60 turns the turning portion 20 such that each of the plurality of electronic component holding portions 50 is sequentially arranged in the arrangement region AR. In this case, the plurality of electronic components W can be simultaneously transferred by the plurality of electronic component holding portions 50. Therefore, it is effective for efficient processing of the electronic component W.

[0054] The displacement drive portion 80 may be configured to push the electronic component holding portion 50 toward one side in the displacement direction. The holding position changing portion 70 may further include the auxiliary spring 78 that pushes the electronic component holding portion 50 toward the other side in the displacement direction. According to the leaf springs 72a, 72b, the movement direction of the electronic component holding portion 50 can be restricted without clearance, while the reaction forces by the leaf springs 72a, 72b are likely to vary according to the variation in the thickness of the leaf springs 72a, 72b, respectively. Meanwhile, a spring that can easily adjust the strength of the reaction force can be used for the auxiliary spring 78 without considering a function of restricting the moving direction of the electronic component holding portion 50. Therefore, according to the above-described configuration in which the holding position changing portion 70 further includes the auxiliary spring 78, the holding position changing portion 70 can adjust the reaction force applied to the electronic component holding portion 50 with higher accuracy.

[0055] The turning portion 20 may further include the restriction part 34 that restricts the movement of the electronic component holding portion 50 in the direction in which the

auxiliary spring 78 pushes the electronic component holding portion 50. In this case, by pressing the electronic component holding portion 50 against the restriction part 34, a rigidity of the connection part between the electronic component holding portion 50 and the turning portion 20 is increased. In addition, the strength of the rigidity can be appropriately adjusted according to the strength of the reaction force by the auxiliary spring 78. Accordingly, it is possible to suppress the vibration of the electronic component holding portion 50 according to the rotation and the stopping of the turning portion 20, and therefore it is easy to increase a rotational speed of the turning portion 20. Increasing the rotational speed of the turning portion 20 is effective in further improving the processing efficiency of the electronic component W.

[0056] The action point P2 of the force from the auxiliary spring 78 to the electronic component holding portion 50 and the action point P1 of the force from the displacement drive portion 80 to the electronic component holding portion 50 may be different from each other in the direction orthogonal to the displacement direction. In this case, space saving can be achieved by using a function of holding the posture of the electronic component holding portion 50 by the two leaf springs 72a, 72b.

[0057] The electronic component holding portion 50 may include the extension part 56 protruding toward the turning portion 20. The turning portion 20 may include the extension part 28 protruding toward the electronic component holding portion 50 at a position where at least two leaf springs 72a, 72b are sandwiched between the turning portion 20 and the extension part 56. The auxiliary spring 78 may penetrate through the leaf spring, among the two leaf springs 72a, 72b, which is positioned between the extension part 56 and the extension part 28 and come into contact with the extension part 56 and the extension part 28. In this case, space saving can be further achieved by using a part of the space between the two leaf springs 72a, 72b as an arrangement space for the auxiliary spring 78.

[0058] One of the extension part 56 and the extension part 28 may be positioned between the two leaf springs 72a, 72b, and the other of the extension part 56 and the extension part 28 may be positioned outside the two leaf springs 72a, 72b. In this case, space saving can be further achieved by using the space between the two leaf springs 72a, 72b as the arrangement space of the extension part 56 or the extension part 28.

[0059] The leaf spring, among the two leaf springs 72a, 72b, which is positioned between the extension part 28 and the extension part 56 may include an opening through which the auxiliary spring 78 penetrates, and the leaf spring that is not positioned between the extension

part 28 and the extension part 56 may also include the same opening as the above opening. In this case, the same opening as the opening provided in the leaf spring through which the auxiliary spring penetrates is also provided in the leaf spring through which the auxiliary spring 78 does not penetrate, so that it is possible to more reliably achieve both the space saving and the positioning accuracy.

[0060] The electronic component holding portion 50 may include the guide hole 58 that penetrates the extension part 56. The turning portion 20 may include the guide pin 32 that protrudes from the extension part 28 toward the extension part 56 and guides the auxiliary spring 78 through the guide hole 58. The gap between the guide hole 58 and the guide pin 32 may be set to be larger than the displacement amount of the electronic component holding portion 50 in the direction perpendicular to the displacement direction. In this case, the auxiliary spring 78 can be guided without hindering the displacement of the electronic component holding portion 50 according to the deformation of the two leaf springs 72a, 72b due to the contact between the guide hole 58 and the guide pin 32. As a result, the reaction force applied to the electronic component holding portion 50 by the holding position changing portion 70 can be adjusted with higher accuracy.

[0061] The reaction force generated by the auxiliary spring 78 with respect to the displacement of the electronic component holding portion 50 by the displacement drive portion 80 may be larger than the total of the reaction forces generated by the two leaf springs 72a, 72b with respect to the displacement. In this case, the reaction force applied to the electronic component holding portion by the holding position changing portion can be adjusted with higher accuracy.

[0062] Although the embodiment has been described above, the present invention is not necessarily limited to the embodiment described above, and various modifications can be made without departing from the spirit thereof.

[0063] The present application is based on a Japanese Patent Application No. 2019-171910 filed on September 20, 2019, and the contents of which are incorporated herein by reference.

#### REFERENCE SIGNS LIST

[0064] 1 processing device  
20 turning portion  
28 extension part  
32 guide pin

|    |                                      |
|----|--------------------------------------|
|    | 34 restriction part                  |
|    | 56 extension part                    |
|    | 60 turning drive portion             |
|    | 70 holding position changing portion |
| 5  | 72a, 72b leaf spring                 |
|    | 78 auxiliary spring                  |
|    | 80 displacement drive portion        |
|    | 90 fixing plate                      |
|    | AR arrangement region                |
| 10 | CR circular track                    |
|    | Ax central axis                      |

## CLAIMS

1. A processing device of an electronic component comprising:

a turning portion that is turnable around a central axis of a circular transfer track  
5 passing through a predetermined arrangement region;

an electronic component holding portion that is provided on the turning portion so  
as to be positioned in the circular transfer track;

a holding position changing portion that enables displacement of the electronic  
component holding portion with respect to the turning portion in a predetermined  
10 displacement direction;

a turning drive portion that is configured to turn the turning portion around the  
central axis so that the electronic component holding portion holding the electronic  
component is arranged in the arrangement region; and

a displacement drive portion that is provided in the arrangement region so as to  
15 move the electronic component holding portion arranged in the arrangement region to one  
side in the displacement direction,

wherein the displacement drive portion is configured to push the electronic  
component holding portion toward the one side in the displacement direction, wherein the  
holding position changing portion includes a plurality of leaf springs and an auxiliary spring,

20 wherein the plurality of leaf springs respectively extend along a direction  
intersecting the displacement direction and connect the electronic component holding portion  
and the turning portion, and

wherein the auxiliary spring is configured to push the electronic component holding  
portion, that is displaced toward the one side in the displacement direction by being pushed by  
25 the displacement drive portion, toward another side in the displacement direction.

2. The processing device of an electronic component according to claim 1, wherein the  
displacement drive portion includes:

a main body part fixed to the arrangement region so as not to turn together with the  
30 turning portion;

a pusher provided in the main body part so as to be displaceable along the  
displacement direction and configured to push the electronic component holding portion  
toward said one side in the displacement direction; and

a drive part configured to move the pusher along the displacement direction.

3. The processing device of an electronic component according to claim 1 or 2, further comprising:

5 a plurality of electronic component holding portions including the electronic component holding portion; and

a plurality of holding position changing portions including the holding position changing portion,

10 wherein the plurality of holding position changing portions respectively enable to displace the plurality of electronic component holding portions with respect to the turning portion, and

wherein the turning drive portion turns the turning portion so that the plurality of electronic component holding portions are sequentially arranged in the arrangement region.

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4. The processing device of an electronic component according to any one of claims 1 to 3, wherein the turning portion further includes a restriction part configured to restrict movement of the electronic component holding portion in a direction in which the auxiliary spring pushes the electronic component holding portion.

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5. The processing device of an electronic component according to any one of claims 1 to 4, wherein an action point of a force from the auxiliary spring to the electronic component holding portion and an action point of a force from the displacement drive portion to the electronic component holding portion are different from each other in a direction orthogonal to the displacement direction.

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