

DESCRIPTION

TITLE OF INVENTION

ELECTRONIC COMPONENT PROCESSING DEVICE

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TECHNICAL FIELD

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

BACKGROUND ART

10 [0002] Patent Literature 1 discloses a device for transferring a chip from a wafer to a lead frame. The device disclosed in Patent Literature 1 includes a transfer head that transfers the chip from a pick-up position to a bonding position. Patent Literature 2 discloses a collet for picking up an electronic component. The collet is mounted on an arm member with a spring means that is slightly movable in an upper-lower direction interposed therebetween. The
15 spring means includes two leaf springs that are parallel to and separated from each other in the upper-lower direction.

CITATION LIST

PATENT LITERATURE

20 [0003] Patent Literature 1: JP2006-513565A
Patent Literature 2: JPH08-306713A

SUMMARY OF INVENTION

TECHNICAL PROBLEM

25 [0004] The present disclosure is to provide an electronic component processing device useful for suppressing a damage to an electronic component.

SOLUTION TO PROBLEM

[0005] An electronic component processing device according to an aspect of the present
30 disclosure includes: a turning portion configured to turn around a central axis of a conveyance track passing through a predetermined arrangement region; a movable portion provided on the turning portion in a displaceable manner along a predetermined displacement direction; a component holding portion configured to hold an electronic component and attached to the

movable portion so as to be positioned in the conveyance track; a turning drive portion configured to turn the turning portion around the central axis so as to dispose the component holding portion in the arrangement region; a displacement drive portion configured to displace the movable portion to one side in the displacement direction such that the component holding portion moves to the one side in the displacement direction in the arrangement region; and a plurality of leaf springs parallel to each other that intersect with the displacement direction and connect the component holding portion and the movable portion so that the component holding portion is displaceable along the displacement direction with respect to the movable portion.

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ADVANTAGEOUS EFFECTS OF INVENTION

[0006] According to the present disclosure, an electronic component processing device useful for suppressing a damage to an electronic component is provided.

15 BRIEF DESCRIPTION OF DRAWINGS

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

[Fig. 2] Fig. 2 is a side view schematically showing the example of the processing device.

20 [Fig. 3] Fig. 3 is an enlarged side view showing a part of the processing device shown in Fig. 2.

[Fig. 4] Fig. 4 is a side view illustrating an example of a positional relationship between a center of gravity of a component holding portion and a leaf spring.

25 [Fig. 5] Fig. 5(a) is a schematic view illustrating an example of a delivery operation in a normal state. Fig. 5(b) is a schematic view illustrating an example of a delivery operation in an abnormal state.

[Fig. 6] Fig. 6(a) and Fig. 6(b) are schematic views illustrating an example of a component holding portion according to a modification.

30 DESCRIPTION OF EMBODIMENTS

[0008] Hereinafter, embodiments will be described with reference to the drawings. In the description, the same elements or elements having the same functions are denoted by the same reference numerals, and a repetitive description thereof will be omitted. In the drawings,

an XYZ orthogonal coordinate system is shown as necessary. For example, an X-axis and a Y-axis correspond to a horizontal direction, and a Z-axis corresponds to a vertical direction.

[0009] [Electronic Component Processing Device]

An electronic component processing device 1 according to the present embodiment
 5 is a so-called die sorter, and is a device that performs processing such as visual inspection, electrical characteristic inspection, and marking while conveying an electronic component W, and then packs the electronic component W in a storage member such as a tape, a container tube, or a tray. The electronic component W to be processed is, for example, a component formed in a pre-process of a semiconductor manufacturing process and separated into
 10 individual pieces by dicing or the like. The processing device 1 shown below is a device that performs various processing such as inspection on the electronic component W received from a component supply portion and packs the electronic component W in the storage member without bonding the electronic component W to a substrate or the like. As shown in Figs. 1 and 2, the processing device 1 includes, for example, a rotation conveyance portion 10 and a
 15 controller 100.

[0010] (Rotation Conveyance Portion)

The rotation conveyance portion 10 moves the electronic component W along a conveyance track CR. The electronic component W to be conveyed has two main surfaces Wa and Wb parallel to each other (opposite to each other) (see also Fig. 3). The rotation
 20 conveyance portion 10 includes, for example, a turning portion 20, a plurality of movable portions 30, a plurality of component holding portions 40, a turning drive portion 60, and a displacement drive portion 70. In Fig. 1, an illustration of the displacement drive portion 70 is omitted.

[0011] The turning portion 20 turns around a central axis Ax of the conveyance track CR passing through a plurality of arrangement regions ARs. In one example, the conveyance
 25 track CR is a horizontal circular track, and the central axis Ax is vertical. The turning portion 20 includes, for example, a turntable 22 and connection portions 24. The turntable 22 is turnable around the central axis Ax and disposed horizontally. An outer edge of the turntable 22 is positioned at an inner side (near the central axis Ax) with respect to the conveyance
 30 track CR. The plurality of connection portions 24 are aligned at equal intervals along an outer periphery of the turntable 22 and protrude from the turntable 22 to an outer peripheral side.

[0012] The plurality of arrangement regions ARs may be set at equal intervals along the conveyance track CR. The plurality of arrangement regions ARs are regions that do not move

even when the turning portion 20 turns. The processing device 1 further includes a plurality of processing portions 12 arranged in at least a part of the plurality of arrangement regions ARs. In any one of the plurality of arrangement regions ARs, the electronic component W is transferred from the processing portion 12 to the rotation conveyance portion 10, and in any one of the plurality of arrangement regions ARs, the electronic component W is transferred from the rotation conveyance portion 10 to the processing portion 12.

[0013] Specific examples of the processing portion 12 include a component supply portion 12A that supplies the electronic component W to the rotation conveyance portion 10, a collection portion 12B that collects the electronic component W from the rotation conveyance portion 10 and packs the electronic component W in the storage member, and an intermediate processing portion 12C that performs predetermined processing on the electronic component W between the component supply portion 12A and the collection portion 12B. Examples of the intermediate processing portion 12C include an inspection portion that inspects a visual of the electronic component W, an inspection portion that inspects electrical characteristics of the electronic component W, and a marking portion that performs marking on the electronic component W.

[0014] The plurality of movable portions 30 are provided on the turning portion 20 in a displaceable manner along a predetermined direction. Hereinafter, a direction in which the movable portions 30 are displaceable with respect to the turning portion 20 is referred to as a "displacement direction". For example, the plurality of movable portions 30 correspond to the plurality of connection portions 24 of the turning portion 20, respectively, and each movable portion 30 is attached to the corresponding connection portion 24 in a displaceable manner along the displacement direction. In one example, the displacement direction is set to a direction perpendicular to the turntable 22 (a plane including the conveyance track CR). In the present disclosure, the term "attached" includes not only a case of being directly attached but also a case of being attached via another member. The movable portion 30 includes, for example, a slide portion 32, a receiving portion 34, a first connection portion 36, and a second connection portion 38, as shown in Fig. 3.

[0015] The slide portion 32 extends along the displacement direction, and is displaceably provided in the corresponding connection portion 24. At least a part of the slide portion 32 protrudes upward from the connection portion 24. The receiving portion 34 is connected to an upper end of the slide portion 32 and is a portion that receives a pressing force for displacing the slide portion 32 (the movable portion 30). In a plan view (viewed from above), the

receiving portion 34 covers the slide portion 32, and a size of the receiving portion 34 is smaller than a size of the slide portion 32.

[0016] The first connection portion 36 is connected to a lower end of the slide portion 32 and extends along the horizontal direction (for example, the X-axis direction in the drawing).

5 In the movable portion 30 shown in Fig. 3, the first connection portion 36 extends along a radial direction of the conveyance track CR. More specifically, one end of the first connection portion 36 is connected to the lower end of the slide portion 32, and the first connection portion 36 extends toward an inner side (the central axis Ax) of the conveyance track CR from a connection portion with the slide portion 32 as a starting point. The other end of the first
10 connection portion 36 (an end near the central axis Ax) is connected with the second connection portion 38.

[0017] The second connection portion 38 extends along a direction perpendicular to the turntable 22. More specifically, an upper end of the second connection portion 38 is connected to the end portion of the first connection portion 36, and the second connection portion 38
15 extends vertically downward from a connection portion with the first connection portion 36 as a starting point. In this case, the second connection portion 38 is disposed on an inner side (a tip end portion of the connection portion 24) with respect to the conveyance track CR or the slide portion 32. That is, a distance between the central axis Ax and the second connection portion 38 is shorter than a distance between the central axis Ax and the conveyance track CR
20 or the slide portion 32. In the movable portion 30 described above, when a pressing force directed toward one side of the displacement direction is applied to the receiving portion 34, the slide portion 32, the receiving portion 34, the first connection portion 36, and the second connection portion 38 (the entire movable portion 30) are displaced along the displacement direction. The first connection portion 36 and the second connection portion 38 constitute a
25 connection portion between the movable portion 30 and the component holding portion 40.

[0018] Returning to Fig. 1, the plurality of component holding portions 40 correspond to the plurality of movable portions 30, respectively. Each of the plurality of component holding portions 40 is attached to the corresponding movable portion 30 so as to be positioned in the conveyance track CR. For example, the plurality of component holding portions 40 are
30 arranged at equal intervals along the conveyance track CR. The number of the plurality of component holding portions 40 is the same as the number of the plurality of arrangement regions ARs. A pitch angle (an angle between component holding portions 40 adjacent to each other) at which the plurality of component holding portions 40 are arranged along the

conveyance track CR and a pitch angle at which the plurality of arrangement regions ARs are arranged along the conveyance track CR may be the same.

[0019] Each of the plurality of component holding portions 40 holds the electronic component W. The component holding portion 40 may hold the electronic component W by any method. Specific examples of a method for holding the electronic component W include negative pressure (vacuum) suction, electrostatic suction (holding using Coulomb force), and gripping. For example, the component holding portion 40 suctions any one of the main surfaces Wa and Wb of the electronic component W from one side in a direction (the Z-axis direction in the drawing) perpendicular to the turntable 22 with a negative pressure.

[0020] As shown in Fig. 3, the component holding portion 40 is aligned with the first connection portion 36 of the movable portion 30 along the displacement direction. For example, the component holding portion 40 is disposed vertically below the slide portion 32 (the connection portion of the first connection portion 36 with the slide portion 32). The component holding portion 40 is aligned with the second connection portion 38 of the movable portion 30 along a direction intersecting with the displacement direction (hereinafter referred to as an "intersecting direction"). For example, the central axis Ax, the second connection portion 38, and the component holding portion 40 are arranged in this order along the radial direction of the conveyance track CR.

[0021] The component holding portion 40 includes, for example, a nozzle holder 42 and a suction nozzle 44. The nozzle holder 42 holds the suction nozzle 44. The nozzle holder 42 faces the first connection portion 36 in the displacement direction and faces the second connection portion 38 in the above intersecting direction. For example, a lower end surface of the first connection portion 36 faces an upper end surface of the nozzle holder 42 in the displacement direction, and a side surface of the second connection portion 38 (a side surface facing an outside of the conveyance track CR) opposite to a side surface facing the central axis Ax faces a side surface of the nozzle holder 42 facing the central axis Ax in the above intersecting direction.

[0022] The suction nozzle 44 is positioned in the conveyance track CR. The suction nozzle 44 is, for example, open downward, and suctions any one of the main surfaces Wa and Wb (for example, the main surface Wa) of the electronic component W from above with a negative pressure. In one example, the suction nozzle 44 extends perpendicularly to the turntable 22, and a lower end portion of the suction nozzle 44 is open downward. The rotation conveyance portion 10 further includes a valve (not shown) for switching turning-on and

turning-off of the negative pressure suction by the suction nozzle 44 in response to an input of a control signal. Specific examples of the valve include an electromagnetic valve. In the movable portion 30 and the component holding portion 40 shown in Fig. 3, the suction nozzle 44, the nozzle holder 42, the connection portion of the first connection portion 36 with the slide portion 32, the slide portion 32, and the receiving portion 34 are aligned along a line L1 parallel to the displacement direction.

[0023] The component holding portion 40 is attached to the movable portion 30 in a displaceable manner along the displacement direction with respect to the movable portion 30. Specifically, a plurality of leaf springs parallel to each other are provided between the movable portion 30 and the component holding portion 40 to enable the component holding portion 40 to be displaced along the displacement direction with respect to the movable portion 30. The plurality of leaf springs intersect with the displacement direction and connect the movable portion 30 and the component holding portion 40. (All of) the plurality of leaf springs are arranged parallel to each other. In one example, the rotation conveyance portion 10 includes two parallel leaf springs connecting the movable portion 30 and the component holding portion 40. Hereinafter, one of the two parallel leaf springs is referred to as a "leaf spring 50a", and the other one is referred to as a "leaf spring 50b".

[0024] Each of the leaf springs 50a and 50b extends along the intersecting direction (for example, the horizontal direction) intersecting with the displacement direction. In one example, (a main surface of) each of the leaf springs 50a and 50b is horizontally disposed. The leaf springs 50a and 50b are arranged such that the main surface of the leaf spring 50a and the main surface of the leaf spring 50b are parallel to each other. The leaf springs 50a and 50b are separated from each other and aligned in an upper-lower direction (aligned along the displacement direction), and the leaf spring 50a is disposed above the leaf spring 50b. An interval between the leaf spring 50a and the leaf spring 50b may be approximately the same as a thickness of the turntable 22. The leaf spring 50a and the leaf spring 50b may have the same spring characteristic. For example, the leaf spring 50a and the leaf spring 50b are made of the same material. The leaf spring 50a and the leaf spring 50b have the same shape. The same shape includes not only a case where the leaf spring 50a completely coincides with the leaf spring 50b but also a case where the leaf spring 50a substantially coincides with the leaf spring 50b.

[0025] In the example shown in Fig. 3, the leaf springs 50a and 50b connect the nozzle holder 42 of the component holding portion 40 and the second connection portion 38 of the

movable portion 30. More specifically, one end of each of the leaf springs 50a and 50b is connected to the side surface of the nozzle holder 42 facing the central axis Ax, and the other end of each of the leaf springs 50a and 50b is connected to the side surface of the second connection portion 38 facing the outside of the conveyance track CR. The leaf springs 50a and 50b are arranged vertically below the first connection portion 36 (a substantially central portion of the first connection portion 36).

[0026] As described above, the leaf springs 50a and 50b connect the movable portion 30 and the component holding portion 40. Therefore, unless an external force is applied to the component holding portion 40, the component holding portion 40 moves in the displacement direction along with the displacement of the movable portion 30 while a relative position of the component holding portion 40 with respect to the movable portion 30 is kept substantially constant. When the external force is applied to the component holding portion 40, the leaf springs 50a and 50b are deformed, so that the component holding portion 40 is displaced with respect to the movable portion 30. At this time, the leaf springs 50a and 50b regulate a direction in which the component holding portion 40 is displaced with respect to the movable portion 30 (a movement operation of the component holding portion 40). That is, the leaf springs 50a and 50b have a function of guiding the movement of the component holding portion 40 with respect to the movable portion 30.

[0027] Here, an example of a positional relationship between a center of gravity CG of the component holding portion 40 and the plurality of leaf springs (the plurality of leaf springs parallel to each other) will be described with reference to Fig. 4. The center of gravity CG of the component holding portion 40 may be positioned between the plurality of leaf springs in the displacement direction. In the example shown in Fig. 4, the center of gravity CG of the component holding portion 40 (a center of gravity of an object constituted by the nozzle holder 42 and the suction nozzle 44) is positioned between the leaf spring 50a and the leaf spring 50b in the vertical direction. More specifically, the center of gravity CG of the component holding portion 40 is positioned below an upper end of the leaf spring 50a and above a lower end of the leaf spring 50b.

[0028] The center of gravity CG of the component holding portion 40 may be positioned in the vicinity of an intermediate position between the leaf spring 50a and the leaf spring 50b in the vertical direction. For example, a height position of the center of gravity CG may be lower than a height position below a lower end of the leaf spring 50a by 1/4 of a shortest distance (hereinafter, referred to as a "distance Ds") between the leaf spring 50a and the leaf spring

50b, and higher than a height position above an upper end of the leaf spring 50b by $1/4$ of the distance D_s . Alternatively, the height position of the center of gravity CG may be lower than a height position below the lower end of the leaf spring 50a by $1/3$ of the distance D_s , and higher than a height position above the upper end of the leaf spring 50b by $1/3$ of the distance D_s . Alternatively, the height position of the center of gravity CG may substantially coincide with the intermediate position between the leaf spring 50a and the leaf spring 50b in the vertical direction.

[0029] As shown in Fig. 2, the turning drive portion 60 rotates the turning portion 20 around the central axis Ax. The turning drive portion 60 includes, for example, a power source such as an electric motor, and rotates the turntable 22 around the central axis Ax by a direct drive without a gear. Each of the plurality of component holding portions 40 is connected to the turntable 22 via the leaf springs 50a and 50b, the movable portion 30, and the connection portion 24, and thus the plurality of component holding portions 40 move along the conveyance track CR (turn around the central axis Ax) in accordance with the rotation of the turntable 22. The turning drive portion 60 turns the turning portion 20 such that each of the plurality of component holding portions 40 is sequentially disposed in one arrangement region AR. For example, the turning drive portion 60 intermittently turns the turning portion 20 such that the plurality of component holding portions 40 are temporarily stopped in the plurality of arrangement regions ARs, respectively. Accordingly, any one of the plurality of component holding portions 40 (the electronic component W held by any one of the component holding portions 40) is sequentially temporarily stopped in one arrangement region AR.

[0030] The displacement drive portion 70 displaces the movable portion 30 to the one side in the displacement direction such that the component holding portion 40 moves to the one side in the displacement direction in the arrangement region AR. For example, the displacement drive portion 70 displaces the movable portion 30 vertically downward such that the component holding portion 40 moves vertically downward in the arrangement region AR. The rotation conveyance portion 10 may include a plurality of displacement drive portions 70. The plurality of displacement drive portions 70 are provided, for example, in the plurality of arrangement regions ARs, respectively. The displacement drive portion 70 may not be provided in the arrangement region AR where the component holding portion 40 does not need to be moved (displaced). The plurality of displacement drive portions 70 are fixed to the plurality of arrangement regions ARs, respectively, and do not move even when the turning

portion 20 turns. One displacement drive portion 70 moves, to the one side in the displacement direction, the movable portion 30 corresponding to the component holding portion 40 sequentially disposed in the arrangement region AR in which the displacement drive portion 70 is positioned.

5 [0031] The rotation conveyance portion 10 may further include a fixing portion 78 that fixes (holds) the plurality of displacement drive portions 70 at predetermined positions. The fixing portion 78 is, for example, a plate-shaped member disposed above the turntable 22 of the turning portion 20. The fixing portion 78 is configured not to turn together with the turntable 22. The plurality of displacement drive portions 70 are fixed to the fixing portion 78 in a manner of being positioned in the plurality of arrangement regions ARs, respectively. Therefore, the plurality of displacement drive portions 70 do not move even when the turning portion 20 turns.

[0032] The displacement drive portion 70 includes, for example, a main body portion 72, a pusher 74, and a drive portion 76. The main body portion 72 is fixed to the arrangement region AR so as not to turn together with the turntable 22 (the turning portion 20). For example, the main body portion 72 is fixed to a portion of an outer edge portion of the fixing portion 78 that corresponds to the arrangement region AR. The pusher 74 is provided on the main body portion 72 in a displaceable manner along the displacement direction with respect to the main body portion 72. For example, the pusher 74 is held by the main body portion 72 in a movable manner along the vertical direction. The pusher 74 is disposed vertically above a portion (the receiving portion 34) of the movable portion 30 corresponding to the component holding portion 40 in a state where the component holding portion 40 is positioned in the arrangement region AR. In the example shown in Fig. 3, the pusher 74 is positioned vertically above the component holding portion 40 in the arrangement region AR.

25 [0033] The drive portion 76 moves the pusher 74 downward by using a power source such as an electric motor or an air cylinder. Accordingly, the movable portion 30 is pressed downward by the pusher 74, and as a result, the movable portion 30 is displaced downward. That is, the pusher 74 is configured to press the movable portion 30 toward the one side in the displacement direction. In a state where the pusher 74 presses the movable portion 30 downward, a lower end of the pusher 74 is in contact with an upper end surface of the receiving portion 34 of the movable portion 30. That is, an action point of the force from the displacement drive portion 70 (the pusher 74) to the movable portion 30 is positioned at the upper end surface of the receiving portion 34.

[0034] As shown in Fig. 3, the rotation conveyance portion 10 may further include a reaction spring 80. The reaction spring 80 is configured to press the movable portion 30 toward the other side in the displacement direction. More specifically, the reaction spring 80 is configured to press the movable portion 30 in a direction opposite to a direction in which the displacement drive portion 70 (the pusher 74) presses the movable portion 30. The reaction spring 80 is provided between the receiving portion 34 of the movable portion 30 and the connection portion 24. The reaction spring 80 is, for example, a coil spring (a compression coil spring). The reaction spring 80 is disposed between the receiving portion 34 and the connection portion 24 in a state where a central axis thereof is along the displacement direction.

[0035] An upper end of the reaction spring 80 is in contact with a lower end surface of the receiving portion 34, and a lower end of the reaction spring 80 is in contact with an upper end surface of the connection portion 24. The reaction spring 80 applies a reaction force to the receiving portion 34 in a vertically upward direction when the movable portion 30 is displaced vertically downward. That is, an action point of the force from the reaction spring 80 to the movable portion 30 is positioned at the lower end surface of the receiving portion 34. When the displacement drive portion 70 (the pusher 74) releases a state where a downward force is applied to the upper end surface of the receiving portion 34, the movable portion 30 returns to a position before the displacement by the reaction force of the reaction spring 80, and accordingly, the component holding portion 40 also returns to a position before the movement.

[0036] In the example shown in Fig. 3, when the component holding portion 40 is disposed in the arrangement region AR, the pusher 74, the reaction spring 80, and the component holding portion 40 are aligned along the line L1 extending in the displacement direction in the arrangement region AR. In this case, the action point of the force from the pusher 74 to the movable portion 30, the action point of the reaction force from the reaction spring 80 to the movable portion 30, and a holding position of the electronic component W by the component holding portion 40 (for example, a suction position of the electronic component W by the suction nozzle 44) are aligned along the line L1.

[0037] The rotation conveyance portion 10 may further include an auxiliary spring 88. The auxiliary spring 88 can extend and contract along the displacement direction, and generates a reaction force according to extension and contraction. The auxiliary spring 88 is, for example, a coil spring. The auxiliary spring 88 connects the first connection portion 36 of the movable

portion 30 and the component holding portion 40 (the nozzle holder 42). The auxiliary spring 88 is provided in a state where a central axis thereof is along the displacement direction. An upper end of the auxiliary spring 88 is connected (fixed) to the lower end surface of the first connection portion 36, and a lower end of the auxiliary spring 88 is connected (fixed) to the upper end surface of the nozzle holder 42.

[0038] The auxiliary spring 88 may be configured to support the component holding portion 40 in a state where the component holding portion 40 is not displaced with respect to the movable portion 30. For example, the auxiliary spring 88 is configured to extend slightly longer than a natural length thereof and generate a force (the reaction force) to support the component holding portion 40 in the state where the component holding portion 40 is not displaced. Accordingly, a force with which the leaf springs 50a and 50b support the component holding portion 40 can be reduced as compared with a case where the auxiliary spring 88 is not provided, and a spring constant of the leaf springs 50a and 50b can be reduced. In one example, the auxiliary spring 88 is configured such that the force with which the auxiliary spring 88 supports the component holding portion 40 and a weight of the component holding portion 40 are substantially equal in the state where the component holding portion 40 is not displaced. Accordingly, the force with which the leaf springs 50a and 50b support the component holding portion 40 can be brought close to zero, and the spring constant of the leaf springs 50a and 50b can be further reduced.

[0039] The auxiliary spring 88 may be configured to apply, in a state where the component holding portion 40 is displaced with respect to the movable portion 30, a pressing force (the reaction force) to the component holding portion 40 in a direction opposite to the direction in which the component holding portion 40 is displaced. More specifically, the auxiliary spring 88 may be configured to generate a force that presses the component holding portion 40 in the above opposite direction (for example, a negative direction of the Z-axis in the drawing) when the component holding portion 40 is displaced to such an extent that the auxiliary spring 88 is shorter than the natural length (compressed).

[0040] The processing portion 12 (the collection portion 12B) that collects the electronic component W from the rotation conveyance portion 10 stores the electronic component W received from the component holding portion 40 in a storage member 90 so as to collect the electronic component W from the component holding portion 40 (the suction nozzle 44) disposed in the arrangement region AR. The storage member 90 is, for example, a storage tray or a carrier tape, and includes a plurality of pockets 92 for storing the electronic component

W. The pocket 92 has a shape corresponding to the electronic component W. The collection portion 12B moves the storage member 90 such that the empty pocket 92 is disposed vertically below the component holding portion 40 each time the component holding portion 40 is disposed in the arrangement region AR where the collection portion 12B is positioned.

5 For example, in a state where the component holding portion 40 is moved vertically downward together with the movable portion 30 by the displacement drive portion 70, the component holding portion 40 delivers the electronic component W to the empty pocket 92 by releasing the suction of the electronic component W suctioned by the suction nozzle 44.

[0041] (Controller)

10 The controller 100 is a computer that controls the rotation conveyance portion 10 and the plurality of processing portions 12 according to a predetermined control procedure. In this control procedure, the controller 100 is configured to at least control the turning drive portion 60 such that the component holding portion 40 is moved to any one of the arrangement regions ARs in a state where the electronic component W is held by the
15 component holding portion 40, and control the displacement drive portion 70 so as to vertically move downward the component holding portion 40 that is moved to the arrangement region AR. Hereinafter, an example of the control procedure executed by the controller 100 until one electronic component W is collected by the collection portion 12B will be described.

20 [0042] The controller 100 executes the following processing in a state where the component holding portion 40 that holds the electronic component W to be collected is disposed in the arrangement region AR that is separated from the arrangement region AR at which the collection portion 12B is positioned by one pitch of an angular pitch around the central axis Ax. That is, the controller 100 causes the turning drive portion 60 to turn the
25 turning portion 20 by one pitch of the angular pitch such that the component holding portion 40 that holds the electronic component W to be collected is disposed in the arrangement region AR at which the collection portion 12B is positioned. When the component holding portion 40 is disposed in the arrangement region AR, the pusher 74 of the displacement drive portion 70, the reaction spring 80, and the component holding portion 40 (the electronic
30 component W held by the component holding portion 40) are aligned on the above line L1. The controller 100 controls the collection portion 12B such that the empty pocket 92 is disposed vertically below the component holding portion 40.

[0043] Next, the controller 100 causes the displacement drive portion 70 (the pusher 74) to

displace the movable portion 30 vertically downward such that the component holding portion 40 in the arrangement region AR moves vertically downward. At the time of displacing the movable portion 30 by the pusher 74, the displacement drive portion 70 positioned in the arrangement region AR lowers the pusher 74. When the pusher 74 is lowered from an initial position by a predetermined amount, the pusher 74 comes into contact with the receiving portion 34 of the movable portion 30. Then, when the displacement drive portion 70 further presses the receiving portion 34 vertically downward with the pusher 74, the movable portion 30 is displaced vertically downward with respect to the turning portion 20. Accordingly, the component holding portion 40 moves vertically downward.

10 [0044] When the electronic component W held by the component holding portion 40 (suctioned by the suction nozzle 44) reaches a position where the electronic component W is stored in the empty pocket 92, the controller 100 causes the displacement drive portion 70 to stop an operation of the pusher 74 pressing the movable portion 30 vertically downward (see Fig. 5(a)). Then, the controller 100 controls the component holding portion 40 to release the suction of the electronic component W by the suction nozzle 44. Accordingly, the electronic component W is delivered to the empty pocket 92.

[0045] Next, the controller 100 controls the displacement drive portion 70 to raise the pusher 74 to the initial position. When a state where the pusher 74 presses the receiving portion 34 is released, the movable portion 30 is displaced vertically upward by the reaction force of the reaction spring 80. Accordingly, the component holding portion 40 that does not hold the electronic component W returns to the position before the lowering. The controller 100 repeatedly executes the above processing for the other electronic components W (the subsequent electronic components W).

25 [0046] Fig. 5(a) shows an example of an operation in a case where the above delivery (collection) of the electronic component W is performed normally, and Fig. 5(b) shows an example of an operation in a case where the delivery of the electronic component W is not performed normally. As shown in Fig. 5(a), when the component holding portion 40 is moved downward, the leaf springs 50a and 50b are not deformed unless the external force is applied to the component holding portion 40. Therefore, the component holding portion 40 is not displaced with respect to the movable portion 30.

[0047] As shown in Fig. 5(b), the empty pocket 92 in which the electronic component W is to be stored may be disposed at a position deviated from a position vertically below the component holding portion 40. In this case, when the component holding portion 40 is moved

downward, the electronic component W suctioned by the suction nozzle 44 comes into contact with a peripheral edge portion of the pocket 92 (an upper surface of the storage member 90), and the external force is applied to the component holding portion 40. In this case, the leaf springs 50a and 50b are deformed, and the component holding portion 40 is displaced upward with respect to the movable portion 30. In this way, even if the external force is applied to the electronic component W (the component holding portion 40), the component holding portion 40 can be retracted upward, and application of an excessive force to the electronic component W can be avoided. When the component holding portion 40 is displaced upward with respect to the movable portion 30, a reaction force due to the deformation of the leaf springs 50a and 50b and the reaction force due to the compression of the auxiliary spring 88 may be applied to the component holding portion 40.

[0048] (Modifications)

In the processing device 1 shown above, the two leaf springs (the leaf springs 50a and 50b) are provided, but the movable portion 30 and the component holding portion 40 may be connected by three or more parallel leaf springs. In this case, the center of gravity CG of the component holding portion 40 may be positioned between an uppermost leaf spring and a lowermost leaf spring in the displacement direction (a direction in which the three or more leaf springs are aligned). For example, the height position of the center of gravity CG of the component holding portion 40 may substantially coincide with an intermediate position between the uppermost leaf spring and the lowermost leaf spring.

[0049] In the processing device 1 shown above, the pusher 74, the reaction spring 80, and the component holding portion 40 are aligned along the displacement direction (the line L1) in the arrangement region AR, but the pusher 74 and the reaction spring 80 may be arranged at positions different from the component holding portion 40. For example, in a plan view, positions of the pusher 74 and the reaction spring 80 may be different from a position of the component holding portion 40 (the suction nozzle 44) in the arrangement region AR. In this case, the action point of the force from the pusher 74 to the movable portion 30 and the action point of the reaction force from the reaction spring 80 to the movable portion 30 may not be positioned vertically above the component holding portion 40. The processing device 1 may not include the auxiliary spring 88 provided between the first connection portion 36 and the component holding portion 40.

[0050] In the processing device 1 shown above, the first connection portion 36 of the movable portion 30 extends toward the central axis Ax from the connection portion with the

slide portion 32 as the starting point, but a direction in which the first connection portion 36 extends may be any direction (any horizontal direction). For example, the first connection portion 36 may extend along a tangential direction of the conveyance track CR. In this case, the leaf springs 50a and 50b also extend along the tangential direction of the conveyance track CR. Alternatively, the first connection portion 36 may extend in a direction away from the central axis Ax from the connection portion with the slide portion 32 as the starting point. In this case, the central axis Ax, the component holding portion 40 (the nozzle holder 42), the leaf springs 50a and 50b, and the second connection portion 38 may be arranged in this order along the radial direction of the conveyance track CR.

[0051] The connection portion of the first connection portion 36 with the slide portion 32 may be a portion other than the end portion of the first connection portion 36, and the second connection portion 38 may be connected to a portion other than the end portion of the first connection portion 36. The horizontal direction in which the first connection portion 36 extends may be different from the horizontal direction in which the leaf springs 50a and 50b extend. In this case, the nozzle holder 42 and the first connection portion 36 may not face each other in the displacement direction. The movable portion 30 may include a connection portion that is connected to the slide portion 32 and extends vertically downward without including the first connection portion 36 and the second connection portion 38. The leaf springs 50a and 50b may be provided so as to connect the connection portion and the nozzle holder 42.

[0052] In the processing device 1 shown above, the center of gravity CG of the component holding portion 40 is positioned between the leaf spring 50a and the leaf spring 50b in the displacement direction, but the center of gravity CG may be positioned above the leaf spring 50a or below the leaf spring 50b. For example, Fig. 6(a) and Fig. 6(b) show a component holding portion 40A according to a modification. The component holding portion 40A includes a nozzle holder 42A and a suction nozzle 44A. The nozzle holder 42A and the suction nozzle 44A have the same functions as the nozzle holder 42 and the suction nozzle 44 of the component holding portion 40, respectively. The center of gravity CG of the component holding portion 40A is positioned below the leaf spring 50b.

[0053] [Effects of Embodiment]

As described above, the processing device 1 according to the above embodiments includes the turning portion 20 configured to turn around the central axis Ax of the conveyance track CR passing through the predetermined arrangement region AR, the movable

portion 30 provided on the turning portion 20 in a displaceable manner along a predetermined displacement direction, the component holding portion 40, 40A configured to hold the electronic component W and attached to the movable portion 30 so as to be positioned in the conveyance track CR, the turning drive portion 60 configured to turn the turning portion 20
5 around the central axis Ax so as to dispose the component holding portion 40, 40A in the arrangement region AR, the displacement drive portion 70 configured to displace the movable portion 30 to the one side in the displacement direction such that the component holding portion 40, 40A moves to the one side in the displacement direction in the arrangement region AR, and the plurality of leaf springs parallel to each other that intersect with the displacement
10 direction of the component holding portion 40, 40A with respect to the movable portion 30 and connect the component holding portion 40, 40A and the movable portion 30 in a displaceable manner along the displacement direction.

[0054] In the processing device 1, the component holding portion 40, 40A and the movable portion 30 are connected by the plurality of leaf springs parallel to each other, and thus when
15 the movable portion 30 is displaced in the displacement direction, the component holding portion 40, 40A is also moved. The plurality of leaf springs enable the displacement of the component holding portion 40, 40A with respect to the movable portion 30, and thus when an external force is applied to the electronic component W held by the component holding portion 40, 40A while the movable portion 30 is displaced, the component holding portion 40,
20 40A is displaced with respect to the movable portion 30. As a result, it is possible to prevent an excessive force in a direction opposite to the displacement direction from being applied to the electronic component W held by the component holding portion 40, 40A. Therefore, the processing device 1 is useful for suppressing damage to the electronic component W.

[0055] In the processing device 1 according to the above embodiments, the movable
25 portion 30 may include the first connection portion 36 aligned with the component holding portion 40, 40A along the displacement direction, and the second connection portion 38 connected to the first connection portion 36 and aligned with the component holding portion 40, 40A along the direction intersecting with the displacement direction. The plurality of leaf springs may connect the component holding portion 40, 40A and the second connection
30 portion 38. In this case, the movable portion 30 and the component holding portion 40 can be at least partially overlapped with each other when viewed from the displacement direction, which is useful for saving a space of the processing device 1.

[0056] The processing device 1 according to the above embodiments may further include

the auxiliary spring 88 that connects the first connection portion 36 and the component holding portion 40, extends and contracts along the displacement direction, and generates the reaction force according to the extension and contraction. The plurality of leaf springs tend to be difficult to adjust the spring constant, but in the above configuration, by providing the auxiliary spring 88 in addition to the plurality of leaf springs, it is possible to flexibly adjust a force applied from a spring member to the component holding portion 40 while restricting a displacement operation of the component holding portion 40 by the plurality of leaf springs.

[0057] In the processing device 1 according to the above embodiments, the plurality of leaf springs may be aligned along the displacement direction. The center of gravity CG of the component holding portion 40 may be positioned between the plurality of leaf springs in the displacement direction. An inertial force is applied to the component holding portion 40 when the turning (rotation) of the turning portion 20 is started or stopped. In the above configuration, the center of gravity CG is positioned between the leaf springs, and thus it is possible to suppress occurrence of vibration of the component holding portion 40 due to the inertial force applied to the component holding portion 40.

[0058] For example, in the component holding portion 40A according to the modification shown in Fig. 6(b), the center of gravity CG of the component holding portion 40A is positioned below the leaf springs 50a and 50b, and thus when rotation of the turning portion 20 is stopped in a rotation direction R1, a force F in the same direction as the rotation direction R1 is applied to the suction nozzle 44A, and a moment is applied to the component holding portion 40A. As a result, positional deviation of the electronic component W, dropping of the electronic component W, and the like may occur. On the other hand, by disposing the center of gravity CG of the component holding portion 40 between the leaf springs 50a and 50b, it is possible to suppress the moment applied to the component holding portion 40 when the rotation of the turning portion 20 is started and when the rotation is stopped, thereby reducing a possibility of the positional deviation of the electronic component W and the dropping of the electronic component W. In addition, it is possible to prevent an excessive force from being applied to joint portions of the leaf springs 50a and 50b with the other members.

[0059] The processing device 1 according to the above embodiments may further include the reaction spring 80 that presses the movable portion 30 toward the other side in the displacement direction. The displacement drive portion 70 may include the pusher 74 that presses the movable portion 30 toward the one side in the displacement direction. In the

arrangement region AR, the pusher 74, the reaction spring 80, and the component holding portion 40, 40A may be aligned along the displacement direction. In this case, when the electronic component W comes into contact with another member, a force is applied to the electronic component W from the displacement drive portion 70 along a direction

5 perpendicular to the main surface of the electronic component W held by the component holding portion 40. Therefore, when the electronic component W comes into contact with the other member in the processing portion, it is possible to suppress a load from being applied to the main surface of the electronic component W in an oblique direction. Disposing the second connection portion 38 on the inner side of the conveyance track CR is more useful for saving

10 the space of the processing device 1.

[0060] The present application is based on Japanese Patent Application No. 2020-159931 filed on September 24, 2020, the contents of which are incorporated herein by reference.

REFERENCE SIGNS LIST

15 [0061] 1: processing device
 20: turning portion
 30: movable portion
 36: first connection portion
 38: second connection portion

20 40, 40A: component holding portion
 50a, 50b: leaf spring
 60: turning drive portion
 70: displacement drive portion
 74: pusher

25 80: reaction spring
 88: auxiliary spring
 W: electronic component
 CG: center of gravity

CLAIMS

1. An electronic component processing device comprising:
 - a turning portion configured to turn around a central axis of a conveyance track passing through a predetermined arrangement region;
 - 5 a movable portion provided on the turning portion in a displaceable manner along a predetermined displacement direction;
 - a component holding portion configured to hold an electronic component and attached to the movable portion so as to be positioned in the conveyance track;
 - a turning drive portion configured to turn the turning portion around the central axis
 - 10 so as to dispose the component holding portion in the arrangement region;
 - a displacement drive portion configured to displace the movable portion to one side in the displacement direction such that the component holding portion moves to the one side in the displacement direction in the arrangement region;
 - a plurality of leaf springs parallel to each other; and
 - 15 an auxiliary spring,
 - wherein the movable portion includes a first connection portion aligned with the component holding portion along the displacement direction, and a second connection portion connected to the first connection portion and aligned with the component holding portion along a direction intersecting with the displacement direction,
 - 20 wherein each of the plurality of leaf springs extends along the direction intersecting with the displacement direction of the component holding portion and connects the component holding portion and the second connection portion of the movable portion so that the component holding portion is displaceable along the displacement direction with respect to the movable portion, and
 - 25 wherein the auxiliary spring connects the first connection portion and the component holding portion, and is configured to extend and contract along the displacement direction and generate a reaction force according to extension and contraction.
2. The processing device according to claim 1, wherein the plurality of leaf springs are
- 30 aligned with each other along the displacement direction, and
 - wherein a center of gravity of the component holding portion is positioned between the plurality of leaf springs in the displacement direction.