

DESCRIPTION

TITLE OF INVENTION: ELECTRONIC COMPONENT TEST HANDLER AND ELECTRONIC COMPONENT REARRANGEMENT METHOD OF ELECTRONIC COMPONENT TEST HANDLER

5 **Technical Field**

[1] The present invention relates to a handler for supporting the testing of electronic components by electrically connecting the electronic components and a tester to each other.

10 **Background Art**

[2] An electronic component test handler is the equipment that handles electronic components in order to electrically connect the electronic components to a tester.

[3] As the degree of integration of electronic components
15 such as semiconductor devices increases, there is a trend toward the line width of circuits becoming increasingly narrow. Accordingly, higher precision is required when electronic components are connected to testers.

[4] For example, although an error range of 20 μm was
20 previously sufficient to ensure the appropriate electrical connection between electronic components and testers, an error range of 10 μm or less, up to a few μm is required now.

[5] Meanwhile, among electronic components, there are dies that are separated into individual units from a wafer state.

[6] Dies may be completed as final products by undergoing a packaging task or by stacking them for High Bandwidth Memory (HBM) production and then undergoing a packaging task.

[7] The testing of dies is required to perform post-die tasks.

[8] Electronic components in a die state may be tested by electrically connecting the contact pads thereof to a tester.

[9] Dies have fine intervals between the contact pads thereof and are significantly thin, making them prone to breaking or cracking, so that no suitable test method capable of adequately supporting the testing of electronic components in a die or HBM state has been proposed until now. Accordingly, the applicant proposed Korean Patent Application Publication No. 10-2021-0088373 (hereinafter referred to as the 'conventional art').

[10] The conventional art proposes a technology for aligning the positions of electronic components by rearranging the electronic components before connecting them to a tester.

[11] The conventional art is configured to determine the current positions of electronic components by scanning them on a test table (named the 'chuck' in the conventional art)

with a camera and reduce an error range by adjusting the positions to regular zones.

[12] The test table is capable of being lifted/lowered.

[13] When the test table is lifted, a tester and electronic components are electrically connected to each other. When the test table is lowered, the electrical connection between the tester and electronic components is released.

[14] When the lifting height of the test table is excessive, excessive pressure is applied to electronic components and the tester, so that damage is caused.

[15] When the lifting height of the test table is insufficient, the electrical connection between electronic components and the tester will become poor.

[16] Therefore, the test table has to be lifted and lowered to the set lifting height accurately.

[17] [Conventional Art Literature]

[18] [Patent Literature]

[19] (Patent Document 1) Korean Patent Application Publication No. 10-2021-0088373

20 **Disclosure**

Technical Problem

[20] It is necessary to accurately adjust the height of a test table to ensure the electrical connection between electronic components and a tester while utilizing the movement of the test table to rearrange the electronic components.

Technical Solution

[21] An electronic component test handler according to the present invention includes: a transport shuttle provided with a transport table capable of transporting electronic components by moving with the electronic components loaded thereonto; a first hand configured to load the electronic components onto the transport table that is placed in a first area by the operation of the transport shuttle; a second hand configured to unload the electronic components from the transport table that is moved from the first area to a second area by the operation of the transport shuttle; a test table configured such that the electronic components unloaded from the transport table by the second hand are loaded thereonto; a rearrangement mechanism configured to rearrange the electronic components, loaded into temporary zones of the test table by the second hand, to regular zones; a movement mechanism configured to move the test table to rearrange the electronic components to the regular zones by using the rearrangement mechanism; a connector configured to enable the electronic components, loaded onto the test table, to be tested by electrically connecting the electronic components to a tester; and a controller configured to control the transport shuttle, the first hand, the second hand, the rearrangement mechanism, the movement mechanism, and the connector; and the rearrangement mechanism includes: a rearrangement picker capable of

gripping an electronic component; a rearrangement camera disposed to be spaced apart from the rearrangement picker; and an elevator configured to lift the rearrangement picker to enable the rearrangement picker to grip the electronic component on the test table or seat an electronic component onto the test table.

[22] The rearrangement picker and the rearrangement camera may have their fixed positions in the horizontal directions.

[23] The rearrangement picker and the rearrangement camera may be coupled to each other so that the relative arrangement positions thereof are fixed.

[24] The movement mechanism may include: a rotary mover configured to rotate the test table; and a horizontal mover configured to move the test table horizontally.

[25] The rearrangement mechanism may further include a buffer configured to buffer the pressure applied to the electronic component when the rearrangement picker is lowered by the elevator.

[26] An electronic component rearrangement method for an electronic component test handler according to the present invention includes: an electronic component photographing step of photographing an electronic component on a test table with a rearrangement camera; a first calculation step of analyzing, by a controller, an image acquired in the photographing step to calculate the temporary zone of the electronic component; a second calculation step of calculating, by the controller, a movement distance required

to move the electronic component from the temporary zone, calculated in the first calculation step, to a regular zone; a test table moving step of moving the test table with a movement mechanism so that a rearrangement picker can grip the electronic component placed in the temporary zone; an electronic component gripping step of lowering the rearrangement picker with an elevator to grip the electronic component, placed in the temporary zone of the test table, with the rearrangement picker; and an electronic component seating step of, after the gripping step, operating the elevator, the movement mechanism responsible for horizontal and rotational movements of the test table, and the rearrangement picker to seat the electronic component in the regular zone.

[27] The moving step may include: a rearrangement picker lifting step of lifting the rearrangement picker with the elevator; an adjustment step of operating the movement mechanism to adjust the position of the test table so that the electronic component gripped by the rearrangement picker is aligned with the regular zone; and an electronic component seating step of lowering the rearrangement picker with the elevator so that the electronic component gripped by the rearrangement picker is seated into the regular zone.

Advantageous Effects

[28] According to the present invention, the handover of an electronic component between the rearrangement picker and

the test table is enabled by the lifting/lowering of the rearrangement picker, so that it may be possible to precisely rearrange an electronic component on the test table while improving the accuracy of the electrical connection between the electronic component on the test table and a tester.

Description of Drawings

[29] FIG. 1 is a conceptual plan view of an electronic component test handler according to one embodiment of the present invention;

[30] FIG. 2 is a schematic plan view of a transport table applied to the electronic component test handler of FIG. 1;

[31] FIG. 3 is a schematic perspective view of a first hand applied to the electronic component test handler of FIG. 1;

[32] FIG. 4 is a reference view illustrating the first hand of FIG. 3;

[33] FIG. 5 is a schematic perspective view of a test table applied to the electronic component test handler of FIG. 1;

[34] FIG. 6 is a schematic plan view of a test board coupled to the electronic component test handler of FIG. 1;

[35] FIG. 7 is a reference view illustrating the electrical connection relationship between the test board of FIG. 6 and an electronic component;

[36] FIG. 8 is a reference view illustrating temporary zones in the test table of FIG. 5;

[37] FIG. 9 is a reference view illustrating regular zones generated in the test table of FIG. 5;

[38] FIG. 10 is a schematic diagram of a rearrangement mechanism applied to the electronic component test handler of FIG. 1;

[39] FIG. 11 is a reference view illustrating the areas of an electronic component photographed by a rearrangement camera in the rearrangement mechanism of FIG. 10;

[40] FIGS. 12 and 13 are reference views comparing the conventional art with the present invention;

[41] FIGS. 14 and 15 are reference views illustrating the operational relationship between the test table of FIG. 5 and the rearrangement mechanism of FIG. 10;

[42] FIG. 16 is a reference diagram view illustrating a movement mechanism applied to the electronic component test handler of FIG. 11; and

[43] FIGS. 17 and 18 are flowcharts illustrating a method of rearranging an electronic component in the electronic component test handler of FIG. 1.

Mode for Invention

[44] Preferred embodiments according to the present invention will be described with reference to the accompanying drawings. For the sake of brevity, descriptions of well-known or redundant components are omitted or abridged as much as possible.

[45] <Description of Electronic Component Test Handler>

[46] FIG. 1 is a conceptual plan view of an electronic component test handler (hereinafter abbreviated as the 'handler') TH according to the present invention.

[47] The electronic component test handler TH according to
5 the present invention may be divided into a movement part MP, an unloading part LU, rearrangement parts RP, and a connection part CP. The electronic component test handler TH includes a transport shuttle 100, a first hand 210, second hands 220, test tables 300, vacuum devices 400,
10 rearrangement mechanisms 500, movement mechanisms 600, connectors 700, and a controller 800.

[48] In the movement part MF, electronic components may be moved such that the electronic components are handed over between the unloading part LU and the rearrangement part RP.
15 To this end, the transport shuttle 100 for transporting electronic components is installed in the movement part MP.

[49] The transport shuttle 100 is provided to transport electronic components between the unloading part LU and the rearrangement part RP.

20 [50] The transport shuttle 100 has a movable transport table 110.

[51] The transport shuttle 100 may have at least one transport table 110.

[52] The transport table 110 is capable of reciprocating in
25 one direction. According to a preferred example, the transport table 110 is capable of reciprocating in the X-axis direction.

[53] In the case where the transport table 100 includes a plurality of transport tables 100, the plurality of transport tables 110 may be provided in parallel with each other in the Y-axis direction.

5 [54] Furthermore, the plurality of transport tables 110 need to be implemented to reciprocate in the X-axis direction independently of each other.

[55] The transport table 110 may move back and forth between a first area A1 located on an unloading part (LU)
10 side and a second area A2 located on a rearrangement part (RP) side.

[56] Electronic components may be loaded onto the transport table 110.

[57] The transport table 110 does not have a pocket
15 structure having depressions into which electronic components can be seated, but has rather a vacuum structure which secures electronic components seated on a flat surface by using vacuum pressure.

[58] As shown in the schematic plan view of FIG. 2, vacuum
20 holes VH and vacuum depressions VG for vacuum-sucking electronic components are formed in the transport table 110.

[59] One vacuum hole VH and one vacuum depression VG form a pair.

[60] The vacuum pressure coming via the vacuum hole VH acts
25 on an electronic component while being evenly distributed via the vacuum depression VG.

[61] Since electronic components may be fixed to the transport table 110 by vacuum pressure, the movement of the electronic components does not occur during the process of moving on the transport table 110 in the X-axis direction.

5 Accordingly, as long as the electronic components are placed precisely on the transport table 110, the tolerance for the positional misalignment of the electronic components, which has been a problem in the past, may be minimized.

10 [62] The vacuum holes VH and the vacuum depressions VG may be arranged in a 2×8 matrix, but the loading capacity of the transport table 110 may be increased or decreased as needed.

[63] In the unloading part LU, electronic components are fed to the handler TH or recovered from the handler TH.
15 That is, electronic components to be tested are fed to the handler TH through the unloading part LU, and tested electronic components are recovered from the handler TH through the unloading part. Electronic components may be loaded onto a carrier such as a JEDEC tray, a ring frame, or
20 some other customer tray and may then be fed to the handler TH or recovered from the handler TH.

[64] Electronic components to be tested in the unloading part LU are loaded onto the transport table 110 in the first area A1, and tested electronic components and loaded onto
25 the transport table 110 in the first area A1 are unloaded from the transport table 110. To this end, the first hand 210 is provided in the unloading part LU.

[65] The first hand 210 is provided to load electronic components onto the transport table 110 or unload electronic components from the transport table 110.

5 [66] For unloading operations by the first hand 210, the transport table 110 has to be moved toward the unloading part LU and be placed in the first area A1.

[67] The first hand 210 loads electronic components to be tested onto the transport table 110 in the first area A1, or unloads tested electronic components from the transport
10 table 110 in the first area A1.

[68] The first hand 210 may have one or more pickers capable of gripping or releasing electronic components.

[69] The pickers may grip electronic components by vacuum pressure.

15 [70] The first hand 210 may be provided with a plurality of pickers to increase the working capacity in a single operation. For example, as shown in the schematic diagram of FIG. 3, the first hand 210 may have four pickers P1 arranged in a 2×2 matrix. It is obvious that the number of
20 pickers P1 provided in the first hand 210 may be increased or decreased depending on the implementation.

[71] The first hand 210 has elevators E1 for independently lifting/lowering the pickers P1. By the elevators E1, the pickers P1 may selectively grip or release electronic
25 components. Accordingly, the electronic components moved to the transport table 110 by the first hand 210 may be individually seated on the transport table 110 while their

positions are being individually and precisely adjusted. Furthermore, the electronic components unloaded from the transport table 110 by the first hand 210 may be classified according to the test grade.

5 [72] The first hand 210 may further include a camera C1.

[73] The first hand 210 may grip an electronic component with the picker P1 after accurately calculating the position of the electronic component by analyzing an image captured by the camera C1 before gripping the electronic component.

10 Accordingly, the picker P1 may grip the electronic component more precisely, and, thus, can place the electronic component at a correspondingly correct position on the transport table 110.

[74] The picker P1 may be implemented to grip electronic components of various heights.

[75] For example, an implementation may be made in such a manner as to determine the lifting height of the picker P1 according to the height of an electronic component preset by an administrator. In this case, when the specifications of an electronic component to be tested change, it entails the inconvenience in which an administrator has to re-enter the height of the electronic component.

20 [76] For example, an implementation may be made in such a manner as to determine the lifting height of the picker P1 for gripping or releasing an electronic component by calculating the height of the electronic component from an image captured by the camera C1. In this case, operational

convenience is improved because the handler TH automatically recognizes the height of the electronic component and then operates the picker P1.

[77] The first hand 210 may further include rotators R1.

5 [78] The rotators R1 each rotate an electronic component ED in the Θ -axis direction by using a vertical line in the Z-axis direction as the axis of rotation, as shown in FIG. 4.

[79] The rotators R1 may rotate the respective pickers P1 individually. Accordingly, the first hand 210 may not only
10 move the electronic component ED in the X-, Y-, and Z-axis directions, but may also rotate the electronic component ED in the Θ -axis direction. That is, the first hand 210 may correct the misalignment of the electronic component ED photographed by the camera C1 before gripping and may then
15 seat it on the transport table 110. The position of the electronic component ED seated at a precise position on the transport table 110 by the first hand 210 is fixed by vacuum pressure. Accordingly, during the process of moving the electronic component ED by the first hand 210, the positions
20 of the electronic component ED in the X-, Y-, Z-, and Θ -axis directions may be precisely adjusted.

[80] However, it may also be possible to provide a rotation means for the electronic component ED separately from the first hand 210.

25 [81] For example, an implementation may be made such that, when the first hand 210 grips the electronic component ED from a JEDEC tray or ring frame and feeds it to the rotation

means, the rotation means may correct the misalignment of the electronic component ED by fixing the electronic component ED with vacuum pressure and then rotating it. The electronic component ED, the misalignment of which has been
5 corrected by the rotation means, may be gripped again by the first hand 210 and then moved to the transport table 110.

[82] In the example of FIG. 3, the first hand 210 is provided with four pickers P1. When a plurality of pickers P1 are provided in this manner, the targets to be gripped
10 may be different for the respective pickers P1.

[83] For example, some pickers P1 may be implemented to grip electronic components ED in a live-bug state (in the state in which terminals face downward), and the remaining pickers P1 may be implemented to grip electronic components
15 ED in a dead-bug state (in the state in which terminals face upward). In this case, all the electronic components ED fed to the handler TH via a JEDEC tray or ring frame may be handled regardless of their loading state, thereby increasing the usability of the handler TH.

20 [84] In the rearrangement parts RP, electronic components ED to be tested are unloaded from the transport table 110, and the unloaded electronic components ED are rearranged.

[85] According to the present embodiment, two rearrangement parts RP are symmetrically arranged on both sides with the connection part CP disposed therebetween. By having the two
25 rearrangement parts RP in this manner, the handling capacities of the handler TH and a tester are improved.

[86] The second hands 220 are provided in the rearrangement parts RP.

[87] The second hands 220 unload electronic components ED to be tested from the transport table 110 or load tested
5 electronic components ED onto the transport table 110.

[88] For unloading operations by the second hands 220, the transport table 110 has to be moved toward the rearrangement part RP and then placed in the second area A2.

[89] The second hands 220 unload electronic components ED
10 to be tested from the transport table 110 in the second area A2 or load tested electronic components ED onto the transport table 110 in the second area A2.

[90] In the same manner, the second hands 220 each have one or more pickers capable of gripping or releasing electronic
15 components ED. Preferably, the second hands 220 may each be provided with a plurality of pickers to increase the working capacity in a single operation. For example, the second hands 220 may each have four pickers arranged in a 2×2 matrix. It is obvious that the number of pickers provided
20 in the second hand 220 may be increased or decreased depending on the implementation. Furthermore, the pickers of the second hand 220 may be provided to be independently movable in order to selectively grip or release electronic components ED.

[91] The second hands 220 may be provided in the same
25 operational structure as the first hand 210. However, the number of pickers P1 provided in the first hand 210 and the

number of pickers provided in each of the second hands 220 may differ from each other. Meanwhile, to lower the manufacturing cost of the second hands 220, individual elevation or rotation means for the pickers may not be
5 applied to the second hands 220.

[92] The second hand 220 unloads the electronic components ED to be tested from the transport table 110 in the second area A2 and loads them onto the test table 300 that has been moved to the rearrangement part RP.

10 [93] Furthermore, the second hand 220 loads the electronic components ED, loaded onto the test table 300 and having been tested, onto the transport table 110 in the second area A2.

[94] The test table 300 is provided to be loaded with the
15 electronic components ED that are unloaded from the transport table 110 by the second hand 220.

[95] As shown in the schematic excerpt of FIG. 5, the test table 300 is provided to have a flat top surface. Accordingly, electronic components ED are loaded onto the
20 test table 300 in such a manner that the electronic components ED are placed on the flat top surface of the test table 300.

[96] When viewed in a plan view, the test table 300 may be formed in the shape of a disk as in FIG. 5(a) or in the
25 shape of a square plate as in FIG. 5(b).

[97] According to the present invention, the test table 300 may be moved in the X- and Y-axis directions, or may be

rotated in the Θ -axis direction by using a vertical line V, passing through the center of the test table 300 in the Z-axis direction, as the axis of rotation.

[98] Furthermore, the test table 300 may be lifted/lowered
5 by the connector 700 to be described later.

[99] Generally, during the process of moving an electronic component ED to the test table 300, shock or inertia accompanying the movement occurs. Accordingly, the position of the electronic component ED loaded onto the test table
10 300 may be misarranged due to shock or inertia. To prevent this problem, the vacuum holes h are formed in the areas where electronic components ED are loaded on the test table 300. Furthermore, when vacuum pressure is applied through the vacuum holes h, the electronic components ED may be
15 fixed to the test table 300. That is, when the electronic component ED is placed on the test table 300 by the second hand 220, the electronic component ED may be seated at the position, where it was placed, without change by the vacuum pressure.

[100] According to a preferred example, a camera C2 may be
20 installed at the center of the test table 300. In this case, the camera C2 is used to identify the angular position (the position in the Θ -axis direction) of a test board TB to be described later. However, any position where the angular
25 position of the test board TB can be identified may preferably be considered as a position for the installation of the camera C2.

[101] The vacuum device 400 provides vacuum pressure to the vacuum holes h in the test table 300 via a vacuum circuit (not shown). It is obvious that the vacuum pressure provided by the vacuum device 400 is transmitted to the electronic components ED through the vacuum holes h. Accordingly, the positions of the electronic components ED loaded onto the test table 300 may be fixed by the vacuum pressure.

[102] The vacuum holes h may be implemented to be selectively opened or closed depending on the control of the vacuum circuit (not shown). Accordingly, the electronic components ED may be fixedly loaded onto the test table 300, or may be removed from the test table 300.

[103] According to the present invention, the electronic components ED loaded onto the test table 300 and to be tested are precisely rearranged in the rearrangement part RP. This will be described in detail later.

[104] In the connection part CP, the electrical connection is set up between the electronic components ED, loaded onto the test table 300 that is moved to the connection part CP, and the tester.

[105] For the electrical connection between the electronic components ED and the tester, the tester is provided with the test board TB. Furthermore, the test board TB is coupled to the handler TH. More specifically, the test board TB is coupled to the connection part CP.

[106] The electronic components ED loaded onto the test table 300 are electrically connected to the test board TB. Accordingly, the electronic components ED may ultimately be electrically connected to the tester via the test board TB.

5 [107] In this case, the test board TB will be described in brief.

[108] As shown in the bottom view of FIG. 6, test zones TZ corresponding to respective electronic components ED are arranged on the test board TB. The test zones TZ correspond
10 to the electronic components ED, loaded onto the test table 300, in a one-to-one correspondence.

[109] Each of the test zones TZ is provided with test pins t for electrically connecting to one electronic component ED.

[110] The test pins t in each test zone TZ form a single set
15 to form the test zone TZ, and are electrically connected to an electronic component ED. Accordingly, the test zone TZ and the electronic component ED have to be aligned with each other. When the coordinates of the electronic component ED on the test table 300 do not match the coordinates of the
20 test zone TZ on the X-Y plane, a failure occurs in the electrical connection between the electronic component ED and the tester.

[111] In particular, as shown in the conceptual example of FIG. 7, when the electronic component ED on the test table
25 300 is placed at an angular position rotated by a rotation angle θ_1 in the θ -axis direction relative to the test zone TZ, a failure occurs in the electrical connection between

the electronic component ED and the tester. Accordingly, all the test zones TZ of the test board TB and all electronic components ED on the test table 300 have to be aligned with each other.

5 [112] The rearrangement mechanism 500 is provided to achieve the alignment between the test zones TZ and the electronic components ED.

[113] According to the present embodiment, the electronic components ED are moved from the transport table 110 to the
10 test table 300 by the second hand 220. During this process, an error in the position of the electronic component ED may occur due to an operational error or shock of the second hand 220. Accordingly, the positions on the X-Y plane or angular positions of the electronic components ED loaded
15 onto the test table 300 by the second hand 220 may differ from each other. That is, the electronic components ED loaded onto the test table 300 may not be aligned with the test zones TZ of the test board TB.

[114] It is obvious that it does not matter when the range
20 of error tolerances between the electronic components ED and the test zones TZ is wide. However, the reality is that a precision within 30 μm is required for the packaged semiconductor device and a precision within 5 μm is required for the die or HBM. To overcome this issue, in the present
25 invention, when the second hand 220 moves electronic components ED from the transport table 110 to the test table 300, it loads them into temporary zones first. Then, the

electronic components ED are rearranged from the temporary zones to regular zones. According to a preferred example, the planar shape and area of the temporary and regular zones may be the same as the planar shape and area of the electronic components ED.

[115] The temporary zones are not set positions, but are any positions where electronic components ED are placed on the test table 300 by the second hand 220. That is, the temporary zones are not set by the controller 800 or are not fixed, but are the positions determined by the second hand 220 as desired. For example, when the second hand 220 seats electronic components ED onto the test table 300, the zones where the electronic components ED are seated become the temporary zones BZ. The exaggerated FIG. 8 shows an example of the temporary zones BZ on the test table 300.

[116] The regular zones RZ refer to the positions where the electronic components ED and the test zones TZ are aligned with each other. The exaggerated FIG. 9 shows the relationship between the temporary zones BZ and the regular zones RZ on the test table 300.

[117] Although the regular zones RZ may be preset, they may be set to match the positions and arrangement of the test zones TZ on the test board TB after the electronic components ED to be tested have been loaded onto the test table 300.

[118] The rearrangement mechanism 500 is provided to rearrange the positions of the electronic components ED,

loaded onto the test table 300 by the second hand 220, from the temporary zones BZ to the regular zones RZ.

[119] According to the present embodiment, the second hand 220 loads the electronic components ED, unloaded from the transport table 110 and to be tested, into the temporary zones BZ. Then, the rearrangement mechanism 500 operates to move the electronic components ED, placed in the temporary zones BZ, to the regular zones RZ. In this case, the temporary zones BZ include not only the positions in the X- and Y-axis directions, but also the angular positions in the Θ -axis direction based on the angularly misaligned, rotated states of electronic components ED.

[120] For reference, when only a theoretical design that does not give consideration to machining errors is taken into consideration, the interval between the pickers of the second hand 220 may be the same as the interval between the electronic components seated onto the transport table 110. In this case, the adjustment of the interval between the electronic components ED moved from the transport table 110 to the test table 300 or from the test table 300 to the transport table 110 by the second hand 220 may not be required. Accordingly, the manufacturing cost may be reduced accordingly. In the same manner, the interval between the pickers of the second hand 220 may be the interval between the test zones TZ of the test board TB, and may be the same as the interval between the regular zones RZ on the test table 300.

[121] Meanwhile, as shown in the schematic diagram of FIG. 10, the rearrangement mechanism 500 includes a rearrangement picker 510, a rearrangement camera 520, an elevator 530, and a buffer 540.

5 [122] The rearrangement mechanism 500 has a fixed position. For example, the rearrangement mechanism 500 may be fixedly mounted onto a frame that forms the skeleton of the handler TH.

10 [123] The rearrangement picker 510 may grip or release an electronic component ED. The rearrangement picker 510 may grip the electronic component ED by vacuum pressure.

[124] The rearrangement picker 510 has a fixed position in the horizontal directions, which are the X- and Y-axis directions.

15 [125] The rearrangement camera 520 is disposed to be spaced apart from the rearrangement picker 510.

[126] The rearrangement camera 520 is provided to photograph an electronic component ED. In particular, as shown in the example of FIG. 11, the rearrangement camera 520 is provided
20 to photograph a first or second corner E1 or E2 out of the four corners of the electronic component ED. In this case, the first and second corners E1 and E2 face each other in a diagonal direction.

[127] According to a preferred example of the present
25 invention, the distance between the rearrangement camera 520 and the electronic component ED is kept shorter than that in the conventional art. Accordingly, as shown in the example

of FIG. 12, assuming that the rearrangement camera 520 captures an image by using the center O of the electronic component ED as the center of the image, all or at least a portion of the edge of the electronic component ED exceeds the field of view. That is, according to the present invention, the rearrangement camera 520 is installed such that the overall electronic component ED cannot be placed intact within an image I captured by the rearrangement camera 520. It is obvious that the focal length of the rearrangement camera 520 is set to the distance between the lens of the rearrangement camera 520 and the electronic component ED. Accordingly, in the image captured by the rearrangement camera 520, the first and second corners E1 and E2 of the electronic component ED may be distinguished more clearly.

[128] FIG. 13(a) shows an image I1 captured by a camera according to the conventional art, and FIGS. 13(b) and 13(c) show images I2 and I3 captured by the rearrangement camera 520 according to the present embodiment. FIG. 13(b) is the image I2 of the first corner E1 of an electronic component ED, and FIG. 13(c) is the image I3 of the second corner E2 of the electronic component ED.

[129] When the numbers of pixels of the images I1, I2, and I3 in FIGS. 13(a), 13(b), and 13(c) are the same as one another, the corners E1 and E2 and edge of the electronic component ED may be distinguished more clearly in the images I2 and I3 of FIGS. 13(b) and 13(c) than in the image I1 of

FIG. 13(a). Accordingly, according to the present invention, the processing and analysis of the images I2 and I3 may be made easier, and thus the time required may be reduced. Furthermore, according to the present invention,
5 the processing and analysis of the images I2 and I3 may be performed more precisely. Therefore, according to the present invention, the current position (the coordinates on the X-Y plane and angular position) of the electronic component ED placed in the temporary zone BZ may be
10 determined more precisely.

[130] The positions of the corners E1 and E2 may be accurately determined by comparison with other specific points on the test table 300 or by comparison with the coordinates of the test table 300.

15 [131] For reference, the corners E1 and E2, which are the targets photographed by the rearrangement camera 520, may be replaced with special marks or patterns depending on the implementation.

[132] According to a preferred example, the rearrangement
20 picker 510 and the rearrangement camera 520 are grouped and combined into a single module. Accordingly, the relative positions of the rearrangement picker 510 and the rearrangement camera 520 are fixed.

[133] The elevator 530 lifts/lowers the rearrangement picker
25 510.

[134] The rearrangement picker 510 may be lifted/lowered by the elevator 530.

[135] According to the present embodiment, the position of the rearrangement picker 510 is fixed in the horizontal directions, but the rearrangement picker 510 may be moved in the vertical direction by the elevator 530.

5 [136] When the rearrangement picker 510 is lowered, it becomes possible for the rearrangement picker 510 to grip the electronic component ED from the test table 300 or seat the electronic component ED on the test table 300. That is, according to the present invention, the vertical position of
10 the test table 300 in the rearrangement part RP is fixed, and the electronic component ED may be handed over between the test table 300 and the rearrangement picker 510 by the lowering of the rearrangement picker 510.

[137] FIG. 14(a) shows the state in which the rearrangement
15 picker 510 has been lifted currently.

[138] In the state of FIG. 14(a), the test table 300 may be moved horizontally such that the rearrangement camera 520 can photograph an electronic component ED or the rearrangement picker 510 can grip the electronic component
20 ED.

[139] FIG. 14(b) shows the state in which the rearrangement picker 510 has been lowered. In the state of FIG. 14(b), the electronic component ED may be handed over between the rearrangement picker 510 and the test table 300.

25 [140] The buffer 540 buffers the pressure applied to the electronic component ED that the rearrangement picker 510 is gripping or intends to grip.

[141] The buffer 540 may be provided as a spring, a pneumatic cylinder, or the like.

[142] According to the present embodiment, the position of the rearrangement picker 510 is fixed in the horizontal
5 directions. Then, as the rearrangement picker 510 is lifted in the vertical direction, the rearrangement picker 510 may grip the electronic component ED on the test table 300 or seat the electronic component ED on the test table 300.

[143] According to the present invention, the precise
10 positioning of the electronic component ED is significantly important. The position of the electronic component ED has to be prevented from changing when the rearrangement picker 510 is lowered to grip the electronic component ED on the test table 300 or release the electronic component ED. To
15 this end, the position of the electronic component ED has to be prevented from changing when the electronic component ED is handed over between the rearrangement picker 510 and the test table 300. Accordingly, the lowering distance of the rearrangement picker 510 has to be determined considerably
20 precisely.

[144] When the lowering distance of the rearrangement picker 510 is even slightly insufficient, the electronic component ED may be heaved to change its position during the process
25 in which the rearrangement picker 510 vacuum-sucks the electronic component ED.

[145] However, when the rearrangement picker 510 is subjected to even slightly excessive downward force by the

elevator 530, excessive pressure is applied to the electronic component ED, which may cause damage to the electronic component ED.

[146] FIG. 15(a) shows the rearrangement picker 510 in the state in which it has been lowered to the most ideal lowering distance, and FIG. 15(b) shows the case where slightly excessive lowering force is applied to the rearrangement picker 510.

[147] As shown in FIG. 15(b), even when slightly excessive downward force is applied to the rearrangement picker 510, the buffer 530 is compressed from L1 to L2, thereby absorbing part of the excessive downward force applied by the elevator 530. Due to the action of the buffer 530, the pressure applied to the electronic component ED that the rearrangement picker 510 has to grip or is gripping is reduced. Accordingly, it may be possible to minimize damage to the electronic component ED while performing the handover of the electronic component ED without a change in the position between the rearrangement picker 510 and the test table 300.

[148] The movement mechanism 600 is provided to move the test table 300.

[149] The movement mechanism 600 in the present embodiment may rotate the test table 300 in the Θ -axis direction.

[150] Furthermore, the movement mechanism 600 in the present embodiment may move the test table 300 horizontally.

[151] As shown in the schematic excerpt of FIG. 16, the movement mechanism 600 includes a rotary mover 610 and a horizontal mover 620.

[152] The rotary mover 610 may rotate the test table 300 forward or rearward in the Z-axis direction by using a vertical line V, passing through the center of the test table 300, as the axis of rotation. The reason why the rotation of the test table 300 is required is to correct the angular position of the electronic component ED in the temporary zone BZ in the Θ -axis direction and rearrange it to the regular zone RZ.

[153] The angular position of the temporary zone BZ may not be aligned with the angular position of the regular zone RZ. This means that the angular position of the electronic component ED in the temporary zone BZ is not aligned with the angular position of the regular zone RZ.

[154] The angular position of the regular zone RZ is aligned with the angular position of the test zone TZ on the test board TB.

[155] When the angular position of the temporary zone BZ is not aligned with and is rotated from the angular position of the regular zone RZ, the angular position of the temporary zone BZ will be aligned with the angular position of the test zone TZ. In this case, alignment between the electronic component ED and the test zone TZ may not be achieved without the correction of the angular position of the electronic component ED in the temporary zone BZ.

Accordingly, when the electronic component ED in the temporary zone BZ is rearranged to the regular zone RZ, the angular position of the electronic component ED has to be corrected.

5 [156] In the present embodiment, the rearrangement picker 510 is fixed in the Θ -axis direction, so that the test table 300 is rotated by the rotary mover 610 instead to correct the angular position of the electronic component ED gripped by the rearrangement picker 510.

10 [157] The horizontal mover 620 moves the test table 300 horizontally on the X-Y plane.

[158] The horizontal mover 620 may be divided into and provided as an X-axis mover 621 and a Y-axis mover 622.

15 [159] The X-axis mover 621 may move the test table 300 horizontally in the X-axis direction.

[160] The Y-axis mover 622 may move the test table 300 horizontally in the Y-axis direction.

[161] According to the present invention, the movement mechanism 600 has two functions.

20 [162] A first function of the movement mechanism 600 is to move the test table 300 horizontally in order to selectively position the test table 300 in the rearrangement part RP and the connection part CP. Under the first function, an operation for moving the test table 300 horizontally in the
25 X-axis direction is performed as a main operation. By the first function of the movement mechanism 600, the test table

300 may move back and forth between the rearrangement part RP and the connection part CP.

[163] A second function of the movement mechanism 600 is to move the test table 300 to rearrange the electronic component ED using the rearrangement mechanism 500. Under the second function, an operation for rotating the test table 300 by using a vertical line V as the axis of rotation while moving the test table 300 horizontally in the X- and Y-axis directions is performed as a main operation. By the second function of the movement mechanism 600, the electronic component ED placed in the temporary zone BZ may be moved to the regular zone RZ.

[164] The connector 700 electrically connects the electronic components ED, loaded onto the test table 300 that is moved to the connection part CP and, to the tester.

[165] The connector 700 may press the test table 300 toward the test board TB placed above the test table 300. Accordingly, the electronic components ED loaded onto the test table 300 are electrically connected to the test board TB, thereby ultimately electrically connecting the electronic components ED to the tester. The testing of the electronic components ED is performed in the state in which the electronic components ED have been electrically connected to the tester by the connector 700. In this case, the electronic components ED loaded onto the test table 300 has to be in the state in which they have been rearranged from the temporary zones BZ to the regular zones RZ through

a rearrangement operation performed in the rearrangement part RP.

[166] In the present embodiment, the test table 300 is positioned below the test board TB. Accordingly, the
5 connector 700 is provided to lift/lower the test table 300.

[167] According to the present embodiment, the connector 700 electrically connects the electronic components ED, placed on the test table 300, to the test board TB by lifting the
10 test table 300 toward the test board TB placed above the test table 300. In this case, the electronic components ED are electrically connected to the test board TB via respective corresponding test zones TZ.

[168] The lifting height of the test table 300 is preset according to the type of electronic component ED to be
15 tested. Accordingly, the connector 700 lifts/lowers the test table 300 by the preset lifting height.

[169] The connector 700 operates only when electrically connecting or disconnecting the electronic component ED, placed on the test table 300, to or from the tester.
20 Accordingly, the occurrences of operational errors caused by settings being disrupted due to frequent use may be minimized, and the electrical connection between the electronic component ED and the tester may be set up accurately.

[170] As described above, according to the present
25 embodiment, during the process of rearranging the electronic component ED, the position of the rearrangement picker 510

in the horizontal directions or the Θ -axis direction and the position of the rearrangement camera 520 are fixed. Then, the rearrangement picker 510 is lifted/lowered and the test table 300 is moved horizontally or rotationally, thereby
5 rearranging the electronic component ED. This will be further described using an example.

[171] To rearrange the electronic component ED, the test table 300 is moved horizontally first such that the rearrangement camera 510 can photograph the electronic
10 component ED placed in the temporary zone BZ.

[172] The rearrangement camera 520 photographs the electronic component ED on the test table 300. In this case, the test table 300 may be moved horizontally again by a predetermined distance to photograph both corners E1 and
15 E2 in two stages.

[173] When the photographing is completed by the rearrangement camera 520, the test table 300 is moved horizontally such that the electronic component ED in the temporary zone BZ can be gripped by the rearrangement camera
20 520. Then, the rearrangement picker 510 is lowered by the elevator 530 and grips the electronic component ED in the temporary zone BZ.

[174] When the rearrangement picker 510 grips the electronic component ED, the rearrangement picker 510 is lifted by the
25 elevator 530, and the movement mechanism 600 operates to move the test table 300 horizontally and rotate it so that the electronic component ED gripped by the rearrangement

picker 510 is aligned with the regular zone RZ. When the electronic component ED gripped by the rearrangement picker 510 is aligned with the regular zone RZ, the rearrangement picker 510 is lowered again by the elevator 530, thereby
5 enabling the rearrangement picker 510 to seat the electronic component ED on the regular zone RZ of the test table 300.

[175] When the electronic component ED is fixed to the test table 300 by the vacuum pressure provided through the vacuum hole h in the state in which the test table 300 is
10 supporting the electronic component ED, the rearrangement picker 510 releases the electronic component ED.

[176] When the rearrangement picker 510 releases the electronic component ED, the elevator 530 lifts the rearrangement picker 510.

15 [177] As in the present embodiment, when an implementation is made to move horizontally the test table 300 instead of the rearrangement picker 510 during the process of moving the electronic component ED from the temporary zone BZ to the regular zone RZ, the manufacturing cost may be reduced.

20 [178] According to a preferred example of the handler TH according to the present invention, the rotational movement, horizontal movement, and vertical movement of the test table 300 are required for alignment between the test table 300 and the test board TB. Accordingly, when the structure
25 required for the horizontal movement and rotational movement of the test table 300 is also utilized for the rearrangement of the electronic component ED, the manufacturing cost may

be reduced. However, as previously described, the structure required for the vertical movement of the test table 300 is utilized only in the process of electrical connection and disconnection between the electronic component ED and the tester.

[179] The controller 800 controls the components, such as the transport shuttle 100, the first hand 210, the second hands 220, the vacuum devices 400, the rearrangement mechanisms 500, the movement mechanisms 600, and the connectors 700, required for the appropriate operation of the handler TH.

[180] The controller 800 analyzes images to calculate the degree of misalignment of the electronic component ED when the camera C1 photographs the electronic component ED loaded onto a JEDEC tray or ring frame, and also controls the rotator R1 to operate to correct the misalignment of the electronic component ED when the picker P1 of the first hand 210 grips the electronic component ED.

[181] The controller 800 analyzes images acquired by sequentially photographing the first and second corners E1 and E2 of the electronic component ED, loaded onto the test table 300 by the second hand 220, with the rearrangement camera 520 to calculate the temporary zone BZ of the electronic component ED on the test table 300. Then, the relative positional relationship between the temporary zone BZ and the regular zone RZ may be known, so that the direction and movement distance for the rotation and

horizontal movement of the test table 300 required to move the electronic component ED to the regular zone RZ may be determined.

[182] The controller 800 may be implemented to calculate the height of the electronic component ED via an image captured by the camera C1 or the rearrangement camera 520 and determine the lifting height of the picker P1 or the lifting height of the test table 300. However, when an implementation is made to allow an administrator to input the height of the electronic component ED via a separate input means, the controller 800 determines the lifting height of the picker P1 and the rearrangement picker 510 according to the height of the electronic component ED set by the input.

[183] Next, the operation of the handler TH described above will be described.

[184] First, in the unloading part LU, the first hand 210 loads the electronic components ED to be tested onto the transport table 110 in the first area A1. During this process, the positions of the electronic components in the X-, Y-, and Θ -axis directions may be adjusted.

[185] Once all the electronic components ED have been loaded onto the transport table 110, the transport shuttle 100 operates to move the transport table 110 to the second area A2. Then, the second hand 220 unloads the electronic components ED from the transport table 110 and moves them to the test table 300 placed in the rearrangement part RP. In

this case, the positions of the electronic components ED loaded onto the test table 300 by the second hand 220 are temporary zones BZ. In this case, the number of electronic components ED that can be loaded onto the test table 300 may be larger than the number of electronic components ED that can be loaded onto the transport table 110. In this case, the transport table 110 may move back and forth between the first area A1 and the second area A2 two or more times to transport electronic components ED to be tested.

[186] Once all the electronic components ED to be tested have been loaded onto the test table 300, the controller 800 operates the rearrangement mechanism 500 and the movement mechanism 600 to rearrange the electronic components ED from the temporary zones BZ to the regular zones RZ. The rearrangement of these electronic components ED will be described later in a separate section.

[187] When the rearrangement of electronic components ED on the test table 300 is completed, the movement mechanism 600 operates to move the test table 300 to the connection part CP. Thereafter, the connector 700 operates to lift the test table 300 toward the test board TB so that the electronic components ED are electrically connected to the tester.

[188] When the testing of the electronic components ED is completed, the connector 700 operates to lower the test table 300 and then the test table 300 is moved to the rearrangement part RP by the movement mechanism 600. Then, the second hand 220 moves the tested electronic components

ED to the transport tray 110 in the second area A2, and the transport tray 110 filled with the tested electronic components ED moves to the first area A1. Then, the first hand 210 unloads the tested electronic components ED from the transport table 110.

[189] According to the present invention, two rearrangement parts RP are disposed, and are provided with two second hands 220, two test tables 300, two rearrangement mechanisms 500, two movement mechanisms 600, and two connectors 700. This is intended to improve the operation rate by reducing the idle time of the tester.

[190] For example, it is assumed that the testing of electronic components ED is performed in the state in which the test table 300 on one side has been aligned with the test board TB. Then, on the test table 300 on the other side, the task of emptying the tested electronic components ED, the task of filling the test table 300 with electronic components ED to be tested after the tested electronic components ED have been emptied, and the task of rearranging the electronic components ED are performed. Accordingly, the operation rate of the handler TH may be increased and the idle time of the tester may be minimized.

[191] **<Electronic Component Rearrangement Method>**

[192] According to the present invention, when all electronic components ED are loaded onto the test table 300, each of the electronic components ED undergoes a rearrangement process. Accordingly, all the electronic

components ED placed in the temporary zones BZ are rearranged to the regular zones RZ.

[193] In the following description, a method of rearranging electronic components will be described with reference to the flowcharts of FIGS. 16 and 17. The description of a method of rearranging one electronic component ED from a temporary zone BZ to a regular zone RZ will substitute for the description of the task of rearranging the remaining electronic components ED.

10 [194] **1. Photographing of Electronic Component <S10>**

[195] The controller 800 operates the movement mechanism 600 to move the test table 300 horizontally so that an electronic component ED in a temporary zone BZ of the test table 300 can be photographed by the rearrangement camera 520. Thereafter, the controller 800 photographs the electronic component ED in the temporary zone BZ with the rearrangement camera 520.

[196] As mentioned earlier, the photographing of the electronic component ED by the rearrangement camera 520 is performed in two stages, one for each of the two corners. To this end, the test table 300 is moved slightly in the horizontal directions during the two stages of photographing.

[197] **2. First Calculation <S20>**

25 [198] The controller 800 analyzes an image acquired via step S20 to calculate the temporary zone BZ of the electronic component ED. The temporary zone BZ refers to the position

of the electronic component ED on the test table 300. The temporary zone BZ calculated in step S20 may be determined by a relative comparison with a specific point on the test table 300, a comparison of the coordinates of the test table 300 upon photographing, and/or the like.

[199] **3. Second Calculation <S30>**

[200] When the temporary zone BZ is calculated in step S20, the controller 800 calculates the movement distance required to move the electronic component ED from the temporary zone BZ to a regular zone RZ. In this case, the movement distance includes the movement distance in the horizontal directions and the movement distance in the Θ -axis direction.

[201] **4. Movement of Test Table <S40>**

[202] The controller 800 operates the movement mechanism 600 to move the test table 300 so that the rearrangement picker 520 can grip the electronic component ED placed in the temporary zone BZ. In this case, the movement may entail only movement in the horizontal directions. However, it may also entail movement in the Θ -axis direction to perform correction in the Θ -axis direction for the electronic component ED in advance.

[203] **5. Gripping of Electronic Component <S50>**

[204] When the test table 300 is moved to the position, at which the rearrangement picker 510 can grip the electronic component ED in the temporary zone BZ, via step S40, the controller 800 operates the elevator 530 to lower the

rearrangement picker 510 and controls the rearrangement picker 510 to grip the electronic component ED.

[205] **6. Seating of Electronic Component <S60>**

[206] When the rearrangement picker 510 grips the electronic component ED placed in the temporary zone BZ, the controller 800 operates the elevator 530 and the rearrangement picker 510 to align the electronic component ED with the regular zone RZ and then seats the electronic component ED, gripped by the rearrangement picker 510, into the regular zone RZ.
This step S60 will be described in more detail.

[207] **6-1. Lifting of Rearrangement Picker <S61>**

[208] When the rearrangement picker 510 grips the electronic component ED in the temporary zone BZ, the controller 800 first operates the elevator 530 to lift the rearrangement picker 510. By the lifting of the rearrangement picker 510, the test table 300 may be moved in the horizontal and Θ -axis directions without causing interference with the electronic component ED being gripped by the rearrangement picker 510.

[209] **6-2. Adjustment of Position of Test Table <S62>**

[210] When the rearrangement picker 510 is lifted, the controller 800 operates the movement mechanism 600 based on the values obtained in steps S20 and S30 to move the test table 300. In this case, the movement of the test table 300 includes both movement in the horizontal directions and movement in the Θ -axis direction. Accordingly, the position of the test table 300 may be adjusted such that the

electronic component ED gripped by the rearrangement picker 510 is aligned with the regular zone RZ.

[211] **6-3. Seating of Electronic Component <S63>**

5 [212] When the electronic component ED gripped by the rearrangement picker 510 in step S62 is aligned with the regular zone RZ, the controller 800 operates the elevator 530 to lower the rearrangement picker 510. Then, the electronic component ED gripped by the rearrangement picker 510 is seated into the regular zone RZ.

10 [213] Thereafter, the electronic component ED seated into the regular zone RZ is fixed to the test table 300 by vacuum pressure, and the rearrangement picker 510 releases the grip. Then, the rearrangement picker 510 is lifted.

15 [214] The above-described embodiments have been described using preferred examples of the present invention, and may have various forms of application. Therefore, the present invention should not be understood as being limited only to the content described above. Instead, the scope of the present invention should be understood as the separately
20 described claims and their equivalents.

CLAIMS

[Claim 1] An electronic component test handler comprising:

5 a transport shuttle provided with a transport table capable of transporting electronic components by moving with the electronic components loaded thereonto;

a first hand configured to load the electronic components onto the transport table that is placed in a first area by an operation of the transport shuttle;

10 a second hand configured to unload the electronic components from the transport table that is moved from the first area to a second area by an operation of the transport shuttle;

15 a test table configured such that the electronic components unloaded from the transport table by the second hand are loaded thereonto;

a rearrangement mechanism configured to rearrange the electronic components, loaded into temporary zones of the test table by the second hand, to regular zones;

20 a movement mechanism configured to move the test table to rearrange the electronic components to the regular zones by using the rearrangement mechanism;

25 a connector configured to enable the electronic components, loaded onto the test table, to be tested by electrically connecting the electronic components to a tester; and

a controller configured to control the transport shuttle, the first hand, the second hand, the rearrangement mechanism, the movement mechanism, and the connector;

wherein the rearrangement mechanism comprises:

5 a rearrangement picker capable of gripping an electronic component;

 a rearrangement camera disposed to be spaced apart from the rearrangement picker; and

10 an elevator configured to lift the rearrangement picker to enable the rearrangement picker to grip the electronic component on the test table or seat an electronic component onto the test table.

15 [Claim 2] The electronic component test handler of claim 1, wherein the rearrangement picker and the rearrangement camera have their fixed positions in horizontal directions.

20 [Claim 3] The electronic component test handler of claim 2, wherein the rearrangement picker and the rearrangement camera are coupled to each other so that relative arrangement positions thereof are fixed.

 [Claim 4] The electronic component test handler of claim 1, wherein the movement mechanism comprises:

 a rotary mover configured to rotate the test table;

and

a horizontal mover configured to move the test table horizontally.

[Claim 5] The electronic component test handler of
5 claim 1, wherein the rearrangement mechanism further comprises a buffer configured to buffer a pressure applied to the electronic component when the rearrangement picker is lowered by the elevator.

[Claim 6] An electronic component rearrangement method
10 for an electronic component test handler, the electronic component rearrangement method comprising:

an electronic component photographing step of photographing an electronic component on a test table with a rearrangement camera;

15 a first calculation step of analyzing, by a controller, an image acquired in the photographing step to calculate a temporary zone of the electronic component;

a second calculation step of calculating, by the controller, a movement distance required to move the
20 electronic component from the temporary zone, calculated in the first calculation step, to a regular zone;

a test table moving step of moving the test table with a movement mechanism so that a rearrangement picker can grip the electronic component placed in the temporary zone;

25 an electronic component gripping step of lowering the

rearrangement picker with an elevator to grip the electronic component, placed in the temporary zone of the test table, with the rearrangement picker; and

5 an electronic component seating step of, after the gripping step, operating the elevator, the movement mechanism responsible for horizontal and rotational movements of the test table, and the rearrangement picker to seat the electronic component in the regular zone.

[Claim 7] The electronic component rearrangement
10 method of claim 6, wherein the moving step comprises:

a rearrangement picker lifting step of lifting the rearrangement picker with the elevator;

an adjustment step of operating the movement mechanism to adjust a position of the test table so that the
15 electronic component gripped by the rearrangement picker is aligned with the regular zone; and

an electronic component seating step of lowering the rearrangement picker with the elevator so that the electronic component gripped by the rearrangement picker is
20 seated into the regular zone.