

**COMPONENT ADHERING APPARATUS AND
A CONVEYING METHOD THEREOF**

FIELD

5 The disclosure relates to a component adhering apparatus and a conveying method thereof, and more particularly to a component adhering apparatus and a conveying method thereof for adhering a plurality of adhering components on at least one base component in an
10 automatic manufacturing process.

BACKGROUND

 In machining a flexible printed circuit board, a process of adhering a base component (such as a flexible printed circuit board) with an adhering component (such as a
15 substrate or another flexible printed circuit board) is required. During this adhering process, the adhering component is generally placed on a carrier unit, and is picked up to adhere on the base component, and then a press-bonding step of applying heat and pressure to the
20 components is performed for fixing the components.

 For the adhering process, the carrier unit is generally positioned on a machine table, and a press mechanism is mounted above the carrier unit to be operatively pressed toward the carrier unit. The adhered and adhering
25 components are placed one-by-one on the carrier unit by an operator, and the press mechanism is then operated to carry out a press-bonding process, which renders a low

production efficiency and is labor-intensive. In another machining method, a plurality of adhered and adhering components are placed on a carrier unit in a matrix arrangement, and the carrier unit is then mounted under a press mechanism by an operator for performing a press-bonding process. There is still room for improvement in terms of production efficiency. Besides, the press-bonded components have to go through many inspection procedures. The adhering process and the conveying process have to be improved.

SUMMARY

Therefore, an object of the disclosure is to provide a component adhering apparatus and a conveying method thereof that can alleviate at least one of the drawbacks of the prior art.

According to the disclosure, a component adhering apparatus is provided for adhering a plurality of adhering components on at least one base component, and includes a machine base, a supply and receiving device disposed on the machine base for accommodating the base component, a conveying device disposed on the machine base and having a carrier unit for carrying the base component, a feeding device disposed on the machine base and having a pick-up part for providing the adhering components, and a transfer device disposed on the machine base. The carrier unit is operative to perform a reciprocating movement between a transporting position and a working position that are

proximate to and distal from the supply and receiving device, respectively. The transfer device has a transfer mechanism which is operatively movable between a pick-up position that is adjacent to the pick-up part and the working position and which is configured to pick up the adhering components at the pick-up position and to transfer the adhering components to the working position so as to adhere the adhering components on the base component at the working position.

10 According to the disclosure, a conveying method of a component adhering apparatus includes providing an base component, and carrying the base component by a conveying device in a reciprocating movement between a transporting position and a working position; providing a plurality of adhering components, and feeding the adhering components by a plurality of feeding devices to a pick-up part of each of the feeding devices; and picking up the adhering component from the pick-up part by a transfer mechanism of a transfer device, transferring the adhering component to the working position, and adhering the adhering component on the base component at the working position.

25 According to the disclosure, a conveying method of a component adhering apparatus includes a step of loading an base component pressed from a supply and receiving device on a switching rail of a displaceable bracket; a step of carrying the base component by a carrier unit at a

transporting position; a step of transferring the base component by the carrier unit to a working position, of providing an adhering component by a feeding device and feeding the adhering component to a pick-up part of the feeding device, of picking up the adhering component from the pick-up part by a transfer mechanism of a transfer device and transferring the adhering component to the working position, and of adhering the adhering component on the base component on the carrier unit so as to form a product assembly; a step of returning the product assembly to the transporting position by the carrier unit; a step of switching the product assembly from the carrier unit to the switching rail of the displaceable bracket; and a step of moving and receiving the product assembly in the supply and receiving device.

According to the disclosure, a component adhering apparatus includes devices that perform a conveying method of a component adhering apparatus as mentioned above.

BRIEF DESCRIPTION OF THE DRAWINGS

Other features and advantages of the disclosure will become apparent in the following detailed description of the embodiment with reference to the accompanying drawings, of which:

FIG. 1 is an exploded perspective view illustrating a plurality of adhering components and a disk carrier packaged with a base component;

FIG. 2 is a schematic top view illustrating an embodiment

of a component adhering apparatus according to the disclosure;

FIG. 3 is a perspective view of the embodiment;

FIG. 4 is a fragmentary perspective view illustrating
5 a supply and receiving device of the component adhering apparatus;

FIG. 5 is a fragmentary perspective view illustrating a switching device of the component adhering apparatus;

FIG. 6 is a fragmentary perspective view illustrating
10 a conveying device of the component adhering apparatus, the adhering components and the disk carrier packaged with the base component;

FIG. 7 is a fragmentary, partly-sectioned side view of the conveying device;

15 FIG. 8 is a fragmentary, exploded perspective view of the conveying device;

FIG. 9 is a fragmentary perspective view illustrating a first inspection device of the component adhering apparatus;

20 FIG. 10 is a fragmentary perspective view illustrating a feeding device of the component adhering apparatus;

FIG. 11 is a perspective view illustrating a carrier tape assembly packaged with a plurality of adhering components and reeled on a reel of the feeding device;

25 FIG. 12 is a perspective view of the feeding device viewed from another angle;

FIG. 13 is a side view of the feeding device;

FIG. 14 is a fragmentary, partly-exploded perspective view illustrating a guiding mechanism of the feeding device;

FIG. 15 is a fragmentary enlarged view illustrating first and second sensing units of the feeding device;

FIG. 16 is a fragmentary schematic view illustrating the second sensing unit and a pick-up part of the feeding device; and

FIG. 17 is a fragmentary perspective view illustrating a transfer device of the component adhering apparatus.

DETAILED DESCRIPTION

Referring to FIGS. 1 to 3, an embodiment of a component adhering apparatus according to the disclosure is used for conveying at least one base component (A3), and adhering a plurality of adhering components (L) on a plurality of adhered regions (A31) of the base component (A3). The adhered regions (A31) are disposed in a matrix arrangement. One of the adhered and adhering components (A3, L) may be a flexible printed circuit board, while the other one thereof may be an adhesive, such as a pressure-sensitive adhesive (PSA) or another flexible printed circuit board. In this embodiment, the adhering component (L) is a pressure-sensitive adhesive, and the base component (A3) is a flexible printed circuit board.

The base component (A3) is packaged in a disk carrier (A) which includes an upper disk (A1) and a lower disk (A2) superimposed upon and magnetically attractive to the

upper disk (A1). The upper disk (A1) has a plurality of void working regions (A11) formed in a matrix arrangement and respectively aligned with the adhered regions (A31) of the base component (A3). The lower disk (A2) has a plurality of void attracting regions (A21) each aligned with a column of the adhered regions (A31) of the base component (A3). Each void working region (A11) corresponds in position to a corresponding one of the attracting regions (A21) with the corresponding adhered region (A31) located therebetween, and is interrupted by the corresponding adhered region (A31) of the base component (A3).

In this embodiment, the component adhering apparatus includes a machine base 1, a supply and receiving device 2, two conveying devices 4, a switching device 3, a first inspection device 5, two feeding devices 6, a transfer device 7 and a second inspection device 8.

The machine base 1 has a horizontal platform 11 and a surrounding wall 12 extending downwardly from a periphery of the platform 11.

The supply and receiving device 2 is mounted on the surrounding wall 12 of the machine base 1 and has a plurality of cartridges 21 each for accommodating a plurality of rectangular disk-like disk carriers (A).

The conveying devices 4 are disposed on the platform 11 of the machine base 1 and are spaced apart from each other in a Y-direction and parallel to each other in an X-direction that is transverse to the Y-direction. Each

conveying device 4 has a slide rail 42 which extends in the X-direction to define a conveying path between a transporting position and a working position that are proximate to and distal from the supply and receiving device 2, respectively, a carrier unit 41 which is slidable on the slide rail 42 to operatively perform a reciprocating movement along the conveying path. The carrier unit 41 is operated by a drive cylinder in a known manner.

The switching device 3 is disposed on the platform 11 of the machine base 1, and has a first gantry 31 which is disposed above and extends across the conveying devices 4 in the Y-direction, and a displaceable bracket 32 which is operatively displaceable on the first gantry 31, and which is formed with a switching rail 321 that extends in the X-direction. The displaceable bracket 32 can be disposed for receiving the disk carrier (A) from a cartridge 21 of the supply and receiving device 2, and can be disposed above and across the carrier unit 41 of the selected conveying device 4 to push the disk carrier (A) back to the corresponding cartridge 21 of the supply and receiving device 2 after an adhering process is carried out.

The first inspection device 5 is disposed on the platform 11 of the machine base 1 and above a path of the reciprocating movement of the conveying devices 4. The first inspection device 5 includes a second gantry 51 which is disposed above and extends across the slide rails 42 of the conveying devices 4 in the Y-direction, and first and second

inspection units 52, 53 which are disposed on and
displaceable relative to the second gantry 51 in the
Y-direction. The first and second inspection units 52,
53 are disposed at two opposite sides of the second gantry
5 51 so as to perform a reciprocate movement in the Y-direction.
The first inspection unit 52 is operatively displaceable
to be registered with the carrier unit 41 in a Z-direction
(i.e. an up-and-down direction) for inspecting the base
component (A3) which is packaged in the disk carrier (A)
10 and carried by the carrier unit 41 to the working position.
The second inspection unit 53 is operatively displaceable
to be registered with the carrier unit 41 in the Z-direction
for inspecting the base component (A3) which is carried
by the carrier unit 41 back to the transporting position
15 and having the adhering components (L) adhered thereon.

The feeding devices 6 are disposed on the platform 11
of the machine base 1 and opposite to each other in the
Y-direction and at two opposite sides of the conveying
path of the reciprocating movement of each conveying device
20 4 for providing the adhering components (L). The feeding
devices 6 have the same construction but are disposed to
be a mirror image of each other. Each feeding device 6
includes two feeding modules 63 each formed with a pick-up
part 61 for feeding the adhering components (L) in a
25 lengthwise direction to the pick-up part 61. The lengthwise
direction of the feeding route of the adhering components
(L) and the conveying path of the reciprocating movement

of the conveying devices 4 for conveying the disk carrier (A) are parallel to each other.

The transfer device 7 is disposed on the platform 11 of the machine base 1, and includes a third gantry 71 which has a transverse beam 712 supported by a plurality of posts 711 (only one is shown in FIG. 3) and extending in the Y-direction, and a slide rail 713 disposed on the transverse beam 712. The second gantry 51 is parallel to and interposed between the first gantry 31 and the third gantry 71. The transfer device 7 also includes a transfer mechanism 72 which is mounted and operatively movable on the slide rail 713 between a pick-up position that is adjacent to the pick-up parts 61 and the working position. The transfer mechanism 72 is configured to pick up the adhering components (L) at the pick-up position and to transfer the adhering components (L) to the working position so as to adhere the adhering components (L) on the base component (A3) at the working position.

The second inspection device 8 is disposed on the platform 11 of the machine base 1 and below a path of the movement of the transfer mechanism 72 between the pick-up position and the working position. The second inspection device 8 is disposed for inspecting the adhering components (L) picked up by the transfer mechanism 72 from the pick-up part 61.

Specifically, with reference to FIGS. 2, 4 and 5, the supply and receiving device 2 has an upright first rail

member 22 disposed on the surrounding wall 12 of the machine base 1, a slide member 23 operatively and reciprocately slid on the first rail member 22 in the Z-direction, a plurality of bracket members 24 disposed on the slide member 23 and spaced apart from each other in the Z-direction for respectively mounting the cartridges 21, and a first driving mechanism 25. Each cartridge 21 has two opened sides 211 opposite to each other in the X-direction with one opened side 211 facing the switching device 3 while the other opened side 211 facing the first driving mechanism 25. A plurality of disk carriers (A) are spacedly accommodated in the corresponding cartridge 21 such that short sides of each disk carrier (A) protrude out of the opened sides 211. The first driving mechanism 25 has a driving rail 251 extending in the Y-direction, two driving sliders 252, 253 slidable on the driving rail 251 in an opposite direction to be close to or away from each other, and a presser 254 having a scissor presser body 2541 which is connected with the sliders 252, 253 to be displaced with the movement of the sliders 252, 253 in the X-direction so as to press one of the disk carriers (A) toward the switching device 3.

The switching device 3 is disposed above and extends across the conveying devices 4 and adjacent to the supply and receiving device 2. The displaceable bracket 32 has two rail rods 324 extending in the X-direction and spaced apart from each other in the Y-direction to corporately

define the switching rail 321, and a transmitting belt 322 operatively disposed within the switching rail 321 to permit each disk carrier (A) to move reciprocally in the X-direction. The switching device 3 also has a second driving mechanism 323 disposed laterally of one rail rod 324. The second driving mechanism 323 has a mounting seat 3231 which is formed with a slope 3235 adjacent to the rail rod 324, a push slider 3233 which is operatively slid on the mounting seat 3231 in the X-direction, a push rod 3232 which is driven by the displacement of the push slider 3233 to push one disk carrier (A) in the corresponding cartridge 21, and a roller 3234 which is movable with the push rod 3232 and rollable on the slope 3235. When the roller 3232 is rolled up on the slope 3235, the push rod 3232 is lifted higher than the disk carrier (A) by a predetermined height. The displaceable bracket 32 also has a detector 3237 disposed below an outlet port end 3236 of the switching rail 321 for detecting whether the disk carrier (A) is completely pushed in the cartridge 21.

With reference to FIGS. 6 to 8, the carrier unit 41 of each conveying device 4 includes a support frame 411, a worktable 413 and a load measuring unit 414. The support frame 411 includes flat plate-like upper and lower frame walls 4111, 4112 spaced apart from each other in the Z-direction, a plurality of upright shafts 4113 connected to the upper and lower frame walls 4111, 4112 at corners thereof to keep a height distance between the walls 4111,

4112, and a height adjusting mechanism 412 disposed to move the upper frame wall 4111 in the Z-direction relative to the lower frame wall 4112 so as to adjust the height thereof. The worktable 413 is mounted on the upper frame wall 4111, and is in the form of a rectangular box which has a rectangular top wall 4133, four side walls 4135 extending downwardly from a periphery of the top wall 4133 to cooperatively define a chamber 4131 with a lower opened end 4132, and four flanges 41351 extending outwardly from the lower opened end 4132. A plurality of holding members 41331 are formed on the top wall 4133 in a matrix arrangement, and each holding member 41331 has a plurality of air holes 41332. Four tapered positioning members 41333 are mounted on four corners of the top wall 4133. Two penetrating bores 41334 are formed in and through the top wall 4133 and adjacent to the periphery thereof to be communicated with the chamber 4131 and opposite to each other in the X-direction. Two sensing members 4134 are disposed in the penetrating bores 41334, respectively. The worktable 413 also has a bottom wall 4136 which is secured on the flanges 41351 by fasteners (not shown) passing through a notch slot 41352 formed in two of the flanges 41351 that are opposite to each other in the X-direction. The load measuring unit 414 is disposed between the worktable 413 and the upper frame wall 4111 for measuring the load applied to each holding member 41331 on the top wall 4133 of the worktable 413.

The height adjusting mechanism 412 is disposed between the upper and lower frame walls 4111, 4112, and includes two mounting slots 4124 formed in a lower surface of the upper frame wall 4111 and spaced apart from each other in the X-direction, two rollers 4121 respectively mounted in the mounting slots 4124 and partially exposed, a slide rail 4126 disposed on an upper surface of the lower frame wall 4112 and extending in the X-direction, two slide blocks 4127 slidable on the slide rail 4126 in the X-direction, a movement transmitting member 4128 disposed on the slide blocks 4127 and elongated in the X-direction, and a carrier driving member 4129 disposed to drive a reciprocating movement of the movement transmitting member 4128 in the X-direction. Each mounting slot 4124 has two spaced V-shaped slot sections 4125 and an enlarged slot section interconnecting the V-shaped slot sections 4125. Each roller 4121 has a central shaft 4123 mounted in the corresponding mounting slot 4124, and four bearings 4122 disposed on a middle portion of the central shaft 4123 to be received in the enlarged slot section when two ends of the central shaft 4123 are secured in the V-shaped slot sections 4125. The bearings 4122 of each roller 4121 are partially exposed out of the lower surface of the upper frame wall 4111.

The movement transmitting member 4128 has an upper transmitting surface which extends in the X-direction and, in turns along the X-direction, has a first lower section

41281, a first slope section 41283, a first higher section 41282, a second lower section 41281, a second slope section 41283 and a second higher section 41282, as shown in FIG. 8.

5 The support frame 411 also has four pairs of buckles 4151, each pair disposed on minor surfaces of the upper and lower frame walls 4111, 4112, and four biasing members 415 each connected to the respective pair of the buckles 4151 to bias the upper frame wall 4111 toward the lower
10 frame wall 4112 so as to keep the rollers 4121 in abutment against the upper transmitting surface of the movement transmitting member 4128.

 With reference to FIG. 9, the second gantry 51 has a transverse beam 511 extending in the Y-direction. The first
15 inspection unit 52 has upper and lower inspection rails 521, 522 mounted on the transverse beam 511 and extending in the Y-direction, an inspection slider 5211 slidably mounted between the upper and lower inspection rails 521, 522 to perform a reciprocating movement in the Y-direction,
20 an inspection driving member 5212 disposed to drive the reciprocating movement of the inspection slider 5211, and an inspection member 524 disposed on the inspection slider 5211. The second inspection unit 53 has the same construction as that of the first inspection unit 52, is
25 disposed at the opposite side of the transverse beam 511 relative to the first inspection unit 52, and has upper and lower inspection rails 531, 532, an inspection slider

5311, an inspection driving member 5312 and an inspection member 534.

With reference to FIGS. 3, 10 and 11, each feeding device 6 also has a feeding rail 65 disposed on the platform 11 of the machine base 1 and extending in the X-direction, and a reel support 62 slidable on the feeding rail 65 to perform a reciprocating movement by a feeding driver 64. The reel support 62 has a support seat 621 disposed adjacent to the third gantry 71. The feeding modules 63 are mounted on the reel support 62 and spaced apart from each other in the Y-direction such that the pick-up parts 61 thereof are disposed outwardly of the support seat 621 at the same height position and are spaced apart from each other in the Y-direction.

In this embodiment, the component adhering apparatus is disposed for reeling a plurality of carrier tape assemblies (L1). On each of the carrier tape assemblies (L1), the adhering components (L) are peelably attached and arranged in a lengthwise direction. The carrier tape assembly (L1) has a flexible elongated carrier tape (L11) and a flexible elongated cover tape (L12) peelably attached to the carrier tape (L11) to cover the adhering components (L). Two rows of through holes (L111) are formed in the carrier tape (L11) adjacent to two long edges thereof and respectively aligned with the adhering components (L). The adhering components (L) may be a pressure-sensitive adhesive (PSA) to be peelably attached to a flat surface

of the carrier tape (L11). The cover tape (L12) is attached to the carrier tape (L11) by static electricity.

With reference to FIGS. 12 to 14, each feeding module 63 is mounted for reeling one of the carrier tape assemblies (L1), and includes a reel mechanism 631 disposed on the reel support 62, a reel assembly 635 driven to rotate by the reel mechanism 631 for reeling the carrier tape assembly (L1), and a guiding mechanism 632. The reel mechanism 631 includes a rolling shaft 6311 driven to be rotated relative to the reel support 62, a first reel shaft 6314, a second reel shaft 6315, a feeding driver 6312, and a belt 6313 disposed to transmit a torque of the feeding driver 6312 to rotate the first and second reel shafts 6314, 6315 in opposite rotational directions. The reel assembly 635 has a feeding reel 6351 sleeved on the rolling shaft 6311, a first blank reel 6352 sleeved on the first reel shaft 6314 for reeling the cover tape (L12) that is peeled from the carrier tape (L11), and a second blank reel 6353 sleeved on the second reel shaft 6315 for reeling the carrier tape (L11) from that the cover tape (L12) and the adhering component (L) are peeled. In use, the carrier tape (L11) is moved along a carrier-tape route indicated by the solid arrows of FIG. 13 and is wound on the second blank reel 6353, and the cover tape (L12) is moved along a cover-tape route indicated by the dotted arrows of FIG. 13 and is wound on the first blank reel 6352.

With reference to FIG. 14, the guiding mechanism 632

includes a guiding seat 6321 secured on the reel support 62. The guiding seat 6321 has a transporting channel 63211 for passage of the carrier tape (L11), a collecting groove 63212 formed below the transporting channel 63211, and a plurality of suction holes 63213 formed in communication with the transporting channel 63211, and a plurality of insert pins 63214 disposed at opposite sides of the transporting channel 63211. The guiding mechanism 632 also includes a cover plate 6322 disposed to cover the transporting channel 63211. The cover plate 6322 has a plurality of pin holes 63221 respectively and retainingly engaged with the insert pins 63214, and a longitudinal groove 63222 aligned and in communication with the collecting groove 63212 in the Z-direction. When the carrier tape (L11) is transported and moved along and above the transporting channel 63211, the carrier tape (L11) is attached on the upper surface of the transporting channel 63211 by a negative-pressure air supplied from the suction holes 63213.

When foreign articles or the adhering component (L) are attached to a lower surface of the carrier tape (L11) during the movement of the carrier tape (L11), they can be dropped and collected in the collecting groove 63212. The adhering component (L) projecting from the carrier tape (L11) is moved out through the longitudinal groove 63222 during the movement. Also, the guiding mechanism 632 has a carrying seat 6323 which is disposed forwardly

of and spaced apart from the guiding seat 6321 to define a gap 6324 (see FIG. 16) therebetween, and which is operatively movable relative to the guiding seat 6321 by a seat driver 63231, as shown in FIGS. 14 and 16.

5 With reference to FIGS. 14 to 16, the guiding mechanism 632 also has a first sensing unit 6325 disposed on the reel support 62, a second sensing unit 6327, and a retaining member 6326 disposed to retain the second sensing unit 6327 on the reel support 62 and be registered with the gap 6324. The carrying seat 6323 has a slope surface 63232 facing and inclined downwardly toward the gap 6324. The first sensing unit 6325 is disposed above a feeding route of the carrier tape (L11), and may be in the form of an optical fiber sensor for sensing the carrier tape (L11) in the Z-direction. The second sensing unit 6327 is moved with the carrying seat 6323 but kept in register with the gap 6324. The second sensing unit 6327 has an optical fiber sensor and an air channel (not shown) surrounding the sensor for supplying positive-pressure air (e.g., by blowing air). During the movement of the carrier tape (L11) along the feeding route on the upper surface of the transporting channel 63211, the first sensing unit 6325 senses the through holes (L111) in the carrier tape (L11) to submit a signal to the second sensing unit 6327. When the carrier tape (L11) is transported and passes through the front of the guiding seat 6321 to be deviated downwardly from the feeding route through the gap 6324, an adhering

component (L) attached on the carrier tape (L11) is sensed by the second sensing unit 6327 to activate blowing of air toward the adhering component (L) for facilitating separation of the adhering component (L) from the carrier tape (L11). The adhering component (L) is subsequently moved over the gap 6324 to the carrying seat 6323 through the slope surface 63232. Once the second sensing unit 6327 does not sense the adhering component (L), a control system is activated to carry out an appropriate operation. The pick-up part 61 is formed above the gap 6324 such that the adhering component (L) is picked up by a negative-pressure in the pick-up part 61.

With reference to FIGS. 12 to 14, each feeding module 63 also includes a pinching mechanism 633 disposed on the reel support 62. The pinching mechanism 633 includes a stationary first pinch member 6331, a second pinch member 6332, a third pinch member 6333 and a movable pinch member 6334.

Each of the first, second and third pinch members 6331, 6332, 6333 has two jaws operatively opened and closed. The first and second pinch members 6331, 6332 are aligned with each other uprightly to grip the carrier tape (L11). The third pinch member 6333 is disposed to pinch and hold the cover tape (L12). The fourth pinch member 6334 is disposed to pinch, hold and draw the carrier tape (L11) so as to facilitate reeling of the carrier tape (L11) on the second blank reel 6353. The second pinch member 6332

is disposed at the moving path of the carrier tape (L11) and between the guiding seat 6321 and the feeding reel 6351. The pinching mechanism 633 also includes a sensing member 63311 disposed adjacent to the first pinch member 6331 for sensing the adhering component (L) before passing over the first pinch member 6331, a first pulley 63312 disposed between the first pinch member 6331 and the feeding reel 6351 for guiding the moving path of the carrier tape (L11), and a second pulley 63321 disposed at the moving path of the carrier tape (L11) between the second pinch member 6332 and the guiding seat 6321.

The third pinch member 6333 is disposed at the moving path of the cover tape (L12) and between the feeding reel 6351 and the first blank reel 6352 for pinching and holding the cover tape (L12). The pinching mechanism 633 also includes third and fourth pulleys 63331, 63332 disposed at the moving path of the cover tape (L12) at two opposite sides of the third pinch member 6333. That is, the third pulley 63331 is disposed between the third pinch member 6333 and the first blank reel 6352, and the fourth pulley 63332 is disposed between the third pinch member 6333 and the feeding reel 6351. The pinching mechanism 633 also includes a fifth pulley 63333 disposed at the moving path of the cover tape (L12) and between the third pinch member 6333 and the feeding reel 6351 at a position closer to the feeding reel 6351, and a sensing member 63334 disposed between the fifth pulley 63333 and the feeding reel 6351.

When the sensing member 63334 senses loosening of the cover tape (L12), the first blank reel 6352 is activated to reel up the cover tape (L12). When the sensing member 63334 senses tightening of the cover tape (L12), the third pinch member 6333 is activated to pinch the cover tape (L12).

The movable fourth pinch member 6334 is disposed at the moving path of the carrier tape (L11) and between the second pinch member 6332 and the second blank reel 6353. The fourth pinch member 6334 is disposed in front of a notched space 634 (see FIG. 13) of the reel support 62. The pinching mechanism 633 also includes a pair of parallel pinch rails 6343 disposed on a front side of the reel support 62, a pinch driver 6341 disposed on a rear side of the reel support 62, and a movement transmitting member 6342 connected with the pinch driver 6341 (see FIG. 12) and the fourth pinch member 6334 and extending through the notched space 634 so as to transmit a driving force to the fourth pinch member 6334 to perform a reciprocating movement in the X-direction along the pinch rails 6343 for gripping, releasing and drawing the carrier tape (L11). The reciprocating movement of the fourth pinch member 6334 is ranged within the width of the notched space 634. Also, the pinching mechanism 633 includes sixth and seventh pulleys 63341, 63342 disposed at the moving path of the carrier tape (L11) and between the fourth pinch member 6334 and the second blank reel 6353.

With reference to FIGS. 2, 14 and 17, the transfer

mechanism 72 of the transfer device 7 includes two transfer modules 721 for picking up and transferring the adhering components (L) that are fed at the pick-up part 61 of each of the feeding devices 6 that are disposed outboard of the transfer modules 721. Each transfer module 721 has a transfer slider 7211 slidable between the pick-up position and the working position, and two pick-up heads 7212, 7213 mounted on the transfer slider 7211 and spaced apart from each other for picking up the adhering components (L) from the respective pick-up part 61. The pick-up heads 7212, 7213 are arranged side by side in the Y-direction and are displaceable in the Z-direction so as to pick up or release the adhering components (L).

The second inspection device 8 includes a third inspection unit 81 which is disposed on the platform 11 and between one side of the path of the reciprocating movement of one of the conveying devices 4 and one of the feeding devices 6 to be located below the moving path of the pick-up heads 7212, 7213 of one transfer module 721 for inspecting the adhering components (L) thereon, and a fourth inspection unit 82 which is disposed on the platform 11 and between the other side of the path of the reciprocating movement of the other one of the conveying devices 4 and the other one of the feeding devices 6 to be located below the moving path of the pick-up heads 7212, 7213 of the other transfer module 721 for inspecting the adhering components (L) thereon.

With reference to FIGS. 2, 3 and 6, a conveying method of a component adhering apparatus of the embodiment includes:

5 a step of loading one disk carrier (A) pressed, using the first driving mechanism 25, from the corresponding cartridge 21 of the supply and receiving device 2 to be placed on the switching rail 321 of the displaceable bracket 32 of the switching device 3;

10 a first route changing step: in accordance with the order preset in the displaceable bracket 32, the displaceable bracket 32 is selectively and operatively displaced above the corresponding slide rail 42 of the conveying device 4 to be aligned with the corresponding carrier unit 41 in the Z-direction such that, as shown
15 in FIGS. 6 to 8, the holding members 41331 of the worktable 413 of the carrier unit 41 are disposed under and aligned with the adhered regions (A31) of the disk carrier (A) for facilitating connection of the disk carrier (A) with the carrier unit 41;

20 a step of carrying the disk carrier (A) by the carrier unit 41 at a transporting position: the movement transmitting member 4128 is moved in the X-direction by the carrier driving member 4129 relative to the upper frame wall 4111 so as to raise the worktable 413 when the higher
25 sections 41282 abut against the rollers 4121 against the biasing action of the biasing members 415. The raised top wall 4133 of the worktable 413 lifts the disk carrier (A)

to separate the disk carrier (A) from the switching rail 321 and transfer the disk carrier (A) to the worktable 413. With the air holes 41332 having negative-pressure air flowing therethrough, the base component (A3) is
5 retained precisely on the holding members 41331 of the top wall 4133. In this embodiment, the rollers 4121 are partially exposed from the mounting slots 4124, and are raised and lowered with the displacement of the movement transmitting member 4128 in the X-direction (a horizontal
10 direction). Thus, the height of the upper frame wall 4111 can be lowered to decrease the total height of the carrier unit 41 so as to permit movement thereof under the switching rail 321 of the displaceable bracket 32 for carrying the disk carrier (A);

15 a step of base component inspection: with reference to FIGS. 2, 3 and 9, the disk carrier (A) is carried by the carrier unit 41 to the working position and through an underside of the first inspection unit 52 of the first inspection device 5, and the base component (A3) on the
20 disk carrier (A) is inspected by the first inspection unit 52. At this time, the displaceable bracket 32 is displaced in the Y-direction above the other slide rail 42 to align with the corresponding carrier unit 41 in the Z-direction;

a step of transferring the disk carrier (A) by the
25 carrier unit 41 along the corresponding slide rail 42 to the working position, with reference to FIGS. 2, 3 and 17. At this time, one of the transfer modules 721 of the

transfer device 7 is moved to permit the pick-up heads 7212, 7213 to align with the pick-up parts 61 of the feeding device 6, and to pick up the adhering components (L) from the pick-up parts 61. The picked-up adhering components (L) are transferred, through the third inspection unit 81 of the second inspection device 8 to be inspected by the third inspection unit 81, to the working position, where the adhering components (L) are disposed above the carrier unit 41. With the movement of the pick-up heads 7212, 7213 in the Z-direction, the adhering components (L) are adhered on the corresponding adhered regions (A31) of the base component (A3) through the void working regions (A11) of the upper disk (A1) so as to form a product assembly. The weight load applied to adhere the adhering components (L) on the base component (A3) can be measured by the load measuring unit 414 (see FIG. 7) which detects and regulates the load applied to each holding member 41331 on the top wall 4133 of the worktable 413. Similarly, the other transfer module 721 of the transfer device 7 is moved to pick up the adhering components (L) from the other feeding device 6, and the picked-up adhering components (L) are transferred, through inspection by the fourth inspection unit 82, to the working position and to be attached to the corresponding adhered regions (A31) of the base component (A3). In this manner, the transfer modules 721 can be moved alternately to pick up the adhering components (L) from the feeding devices 6 and to adhere the components

(L) on the base component (A3) alternately. In this embodiment, with each feeding device 6 having two reel assemblies 635 for loading two carrier tape assemblies (L1), four adhering components (L) can be adhered on the
5 base components (A3) at the same time;

a step of product assembly inspection: the product assembly is carried by the carrier unit 41 to the transporting position and through a second inspection unit 53, and is inspected by the second inspection unit 53;

10 a step of returning the product assembly to the transporting position (to the displaceable bracket 32) by the carrier unit 41;

a second route changing step: the displaceable bracket 32 is displaced to a position above the product assembly
15 on the carrier unit 41 at the transporting position so as to permit switching of the product assembly to the switching rail 321 of the displaceable bracket 32;

a step of switching the product assembly from the carrier unit 41 to the switching rail 321 of the displaceable bracket
20 32: the displaceable bracket 32 is moved above the carrier unit 41;

a step of moving and receiving the product assembly in the supply and receiving device 2: with reference to FIGS. 2, 3 and 7, the movement transmitting member 4128
25 is moved in the X-direction by the carrier driving member 4129 toward the supply and receiving device 2 so as to lower the worktable 413 when the lower sections 41281 abut

against the rollers 4121 by means of the biasing action of the biasing members 415. The supply of negative-pressure air is stopped to permit release of the disk carrier (A) with the adhering components (L) adhered thereon from the worktable 413. The disk carrier (A) is received in the
5 corresponding cartridge 21.

In other words, a conveying method of a component adhering apparatus according to the disclosure includes:
providing an base component (A3), and carrying the base
10 component (A3) by the conveying device 5 in a reciprocating movement between a transporting position and a working position;

providing a plurality of adhering components (L), and feeding the adhering components (L) by two feeding devices
15 6 to the pick-up part 61 of each of the feeding devices 6; and

picking up the adhering component (L) from the pick-up part 61 by the transfer mechanism 72 of the transfer device 7, transferring the adhering component (L) to the working
20 position, and adhering the adhering component (L) on the base component (A3) at the working position.

As illustrated, the adhering component (A3) is retained in the disk carrier (A) which is transported by the carrier unit 41 of the conveying device 4, and the adhering
25 components (L) are peelably attached to a corresponding carrier tape assembly (L1) which is fed by the feeding device 6 to the corresponding pick-up part 61. The transfer

device 7 is used to transfer each adhering component (L) to permit adhering of the adhering components (L) on the base component (A3). Thus, the component adhering and conveying method can be automatically carried out on the machine base 1 to greatly improve the process efficiency and product quality.

While the disclosure has been described in connection with what is considered the exemplary embodiment, it is understood that this disclosure is not limited to the disclosed embodiment but is intended to cover various arrangements included within the spirit and scope of the broadest interpretation so as to encompass all such modifications and equivalent arrangements.

CLAIMS:

1. A component adhering apparatus for adhering a plurality of adhering components on at least one base component, comprising:
 - 5 a machine base;
 - a supply and receiving device disposed on said machine base for accommodating the at least one base component;
 - at least one conveying device disposed on said machine base and having a carrier unit for carrying
10 the at least one base component, said carrier unit being operative to perform a reciprocating movement;
 - at least one feeding device disposed on said machine base and having at least one pick-up part for providing
15 the adhering components; and
 - a transfer device disposed on said machine base and having a transfer mechanism which is operatively movable and which is configured to pick up the adhering components and to transfer the adhering components so
20 as to adhere the adhering components on the at least one base component.
2. The component adhering apparatus as claimed in Claim 1, wherein said apparatus comprises two of said conveying devices which are disposed parallel to each other, each of said conveying devices having a slide
25 rail which extends to define a conveying path and on which said carrier unit is slidable to perform the

reciprocating movement.

3. The component adhering apparatus as claimed in Claim 2, further comprising a switching device disposed on said machine base, and having a displaceable bracket
5 which is operatively displaceable, and which is formed with a switching rail that extends to be selectively displaced to align with said conveying path of a selected one of said conveying devices.
4. The component adhering apparatus as claimed in Claim
10 1, wherein said apparatus comprises two of said feeding devices which are respectively disposed at two opposite sides of a path of the reciprocating movement of said at least one conveying device.
5. The component adhering apparatus as claimed in Claim
15 1, wherein said apparatus is disposed for reeling a carrier tape assembly on which the adhering components are peelably attached and arranged in a lengthwise direction, said at least one feeding device having a feeding rail that is disposed on said machine base,
20 a reel support that is slidable on said feeding rail, and at least one feeding module that is mounted on said reel support for feeding the carrier tape assembly on which the adhering components are attached to said pick-up part and moving and receiving the carrier tape
25 assembly from which the adhering components are peeled away from said pick-up part.
6. The component adhering apparatus as claimed in Claim

1, wherein said apparatus is disposed for reeling a carrier tape assembly, the carrier tape assembly having a carrier tape on which the adhering components are peelably attached and arranged in a lengthwise direction, said at least one feeding device having at least one feeding module which is disposed for feeding the carrier tape assembly on which the adhering components are attached to said pick-up part and moving and receiving the carrier tape assembly from which the adhering components are peeled away from said pick-up part, said feeding module including:

a reel mechanism including a rolling shaft;

a guiding mechanism including a guiding seat which defines a transporting channel for passage of the carrier tape, a carrying seat which is spaced apart from said guiding seat to define a gap therebetween, and which is operatively movable relative to said guiding seat; and

a pinching mechanism including a plurality of pinch members each operative for gripping and releasing the carrier tape.

7. The component adhering apparatus as claimed in Claim 1, wherein said pick-up part is in form of a gap for passage of the adhering components.
8. The component adhering apparatus as claimed in Claim 1, wherein said apparatus is disposed for reeling two carrier tape assemblies on which the adhering

components are peelably attached and arranged in a lengthwise direction, said at least one feeding device having two feeding modules, each of which defines a feeding route that terminates at said pick-up part for passage of the respective carrier tape assembly.

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9. The component adhering apparatus as claimed in Claim 8, wherein said transfer mechanism includes two transfer modules, said apparatus comprising two of said feeding devices which are disposed outboard of said transfer modules, one of said transfer modules being movable to pick up the adhering components at said pick-up parts of one of said feeding modules, to transfer the adhering components to said carrier unit so as to attach the adhering components on the base component on said carrier unit, the other one of said transfer modules being movable to pick up the adhering components at said pick-up parts of the other one of said feeding modules, and to transfer the adhering components to said carrier unit so as to adhere the adhering components on the base component on said carrier unit.

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10. The component adhering apparatus as claimed in Claim 9, wherein each of said transfer modules has a transfer slider and two pick-up heads mounted on said transfer slider and spaced apart from each other for picking up the adhering components from said respective pick-up part.

11. The component adhering apparatus as claimed in Claim

1, further comprising a first inspection device disposed on said machine base and above a path of the reciprocating movement of said at least one conveying device, said first inspection device including a first inspection unit which is operatively displaceable to be registered with said carrier unit for inspecting the base component carried by said carrier unit, and a second inspection unit which is operatively displaceable to be registered with said carrier unit for inspecting the base component carried by said carrier unit and having the adhering components adhered thereon.

12. The component adhering apparatus as claimed in Claim 1, further comprising a second inspection device disposed on said machine base and below a path of the movement of said transfer mechanism, said second inspection device being disposed for inspecting the adhering components picked up by said transfer mechanism from said pick-up part.

13. The component adhering apparatus as claimed in Claim 12, wherein said apparatus comprises two of said feeding devices which are respectively disposed at two opposite sides of a path of the reciprocating movement of said at least one conveying device, said second inspection device including a third inspection unit which is disposed between one side of the path of the reciprocating movement and one of said feeding devices,

and a fourth inspection unit which is disposed between the other side of the path of the reciprocating movement and the other one of said feeding devices.

14. A conveying method of a component adhering apparatus, comprising:

providing an base component, and carrying the base component by a conveying device in a reciprocating movement;

providing a plurality of adhering components, and feeding the adhering components by a plurality of feeding devices to at least one pick-up part of each of the feeding devices; and

picking up the adhering component from the pick-up part by a transfer mechanism of a transfer device, transferring the adhering component, and adhering the adhering component on the base component.

15. A conveying method of a component adhering apparatus, comprising:

a step of loading an base component pressed from a supply and receiving device on a switching rail of a displaceable bracket;

a step of carrying the base component by at least one carrier unit;

a step of transferring the base component by the carrier unit, of providing an adhering component by a feeding device and feeding the adhering component to a pick-up part of the feeding device, of picking

up the adhering component from the pick-up part by a transfer mechanism of a transfer device and transferring the adhering component, and of adhering the adhering component on the base component on the carrier unit so as to form a product assembly;

a step of returning the product assembly by the carrier unit;

a step of switching the product assembly from the carrier unit to the switching rail of the displaceable bracket; and

a step of moving and receiving the product assembly in the supply and receiving device.

16. The conveying method as claimed in Claim 15, wherein the step of carrying the base component is conducted by a plurality of the carrier units, and the conveying method further comprises a first route changing step between the step of loading and the step of carrying, where the displaceable bracket is selectively and operatively displaced to align with a corresponding one of the carrier units.

17. The conveying method as claimed in Claim 15, further comprising a step of base component inspection between the step of carrying and the step of transferring, where the base component is carried by said carrier unit and through an underside of a first inspection unit of a first inspection device, and is inspected by the first inspection unit.

18. The conveying method as claimed in Claim 15, further comprising a step of product assembly inspection between the step of transferring and the step of returning, where the product assembly of the base component and the adhering component is carried by said carrier unit and through a second inspection unit, and is inspected by the second inspection unit.
19. The conveying method as claimed in Claim 15, further comprising a second route changing step between the step of returning and the step of switching, where the displaceable bracket is operatively displaced to a position above the product assembly on the carrier unit so as to permit switching of the product assembly to the switching rail of the displaceable bracket.
20. The conveying method as claimed in Claim 15, wherein the feeding device is disposed to provide a feeding route of a carrier tape assembly, on which a plurality of the adhering components are peelably attached, that terminates at the pick-up part.
21. A component adhering apparatus comprising devices that perform a conveying method of a component adhering apparatus as claimed in any one of Claims 14 to 20.