

**CARRIAGE DEVICE, BONDING EQUIPMENT HAVING THE SAME AND
TRANSPORT METHOD USING THE SAME**

FIELD

5 The disclosure relates to a carriage device, and more particularly to a carriage device for carrying carriage plate, a bonding equipment having the carriage device, and a transport method using the carriage device.

BACKGROUND

10 In the production of flexible printed circuits (FPC), a to-be-bonded element (e.g., a FPC) and a bonding element (e.g., another FPC or a substrate) usually bond with each other. In a conventional bonding process, the to-be-bonded element is placed on a carriage device,
15 and the bonding element is moved to bond to the to-be-bonded element by either thermo-compression bonding or by adhesive. The carriage device is disposed on a machine body, and a bonding mechanism is disposed above the carriage device to perform the bonding
20 operation. An operator needs to sequentially place the to-be-bonded element and the bonding element onto the carriage device, and then operate the bonding mechanism to bond the to-be-bonded element and the bonding element. However, this process is inefficient and laborious, and
25 is not suitable for mass production.

 In another conventional bonding process, a plurality of to-be-bonded elements and bonding elements are placed

on a carriage plate in rows and columns, and the carriage plate is disposed below a bonding mechanism to sequentially bond the to-be-bonded elements and bonding elements. However, this process is also inefficient, and needs to be incorporated with an inspection device for quality control of the FPCs.

SUMMARY

Therefore, an object of the disclosure is to provide a carriage device that can alleviate at least one of the drawbacks of the prior arts.

According to the disclosure, the carriage device includes a frame seat and a working stage. The frame seat includes an upper platform, a lower platform that is disposed below and spaced apart from the upper platform, a guide rod that interconnects the upper and lower platforms, and an adjusting mechanism that is operable to adjust the distance between the upper and lower platforms. The working stage is disposed on the frame seat and includes a carrying platform. The carrying platform has a plurality of engaging seats that protrude upwardly and that are arranged in rows and columns. Each of the engaging seats has at least one communication hole.

Another object of the disclosure is to provide a bonding equipment that can alleviate at least one of the drawbacks of the prior arts.

According to the disclosure, the bonding equipment

is adapted to transport a carriage plate and includes the abovementioned carriage device and a conveyor. The carriage device is for carrying the carriage plate. The conveyor includes a conveyor frame that is disposed over
5 the carriage devices, and a conveyor belt that is movably mounted to the conveyor frame for conveying the carriage plates.

Still another object of the disclosure is to provide a transport method that can alleviate at least one of
10 the drawbacks of the prior arts.

According to the disclosure, the transport method uses the abovementioned carriage device for transporting a carriage plate. The carriage plate carries a to-be-bonded element and has a plurality of
15 suction void regions. The transport method includes steps of: a) moving the carriage device to the lower side of the carriage plate, and aligning each of the engaging seats of the carrying platform of the carriage device with one of the suction void regions; and b) moving
20 one of the carrying platform and the to-be-bonded element to contact the other one of the carrying platform and the to-be-bonded element via the suction void regions, and generating negative pressure in the communication hole of each of the engaging seats such that the
25 to-be-bonded element is attached to the engaging seats.

Still another object of the disclosure is to provide a bonding equipment that execute the abovementioned

transport method.

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
5 drawings, of which:

Figure 1 is a fragmentary perspective view illustrating an embodiment of the carriage device according to the disclosure mounted to a transport rail
10 unit;

Figure 2 is a fragmentary side view illustrating the embodiment mounted to the transport rail unit;

Figure 3 is a partly exploded perspective view illustrating the embodiment;

15 Figure 4 is a schematic view illustrating a follower wheel and an upper platform of the embodiment;

Figure 5 is a fragmentary sectional view illustrating the follower wheel and the upper platform;

20 Figure 6 is a perspective view illustrating an embodiment of a bonding equipment according to the disclosure;

Figure 7 is a fragmentary top view illustrating the embodiment;

25 Figure 8 is a partly exploded perspective view illustrating the embodiment; and

Figure 9 is a fragmentary side view illustrating the embodiment.

DETAILED DESCRIPTION

Before the disclosure is described in greater detail, it should be noted that where considered appropriate, reference numerals or terminal portions of reference numerals have been repeated among the figures to indicate corresponding or analogous elements, which may optionally have similar characteristics.

Referring to Figures 1, 2 and 7, an embodiment of the bonding equipment according to the disclosure includes two carriage devices (A). Each of the carriage devices (A) includes a frame seat (A1), a working stage (A2), and a detection unit (A3). In a modification, the bonding equipment may include only one or more than two carriage devices (A).

The frame seat (A1) includes a plate-shaped upper platform (A11), a plate-shaped lower platform (A12) that is disposed below the upper platform (A11) and that is spaced apart from and parallel to the upper platform (A11), a plurality of guide rods (A13) each of which interconnects the upper and lower platforms (A11, A12), and an adjusting mechanism (A14). In one embodiment, each of the guide rods (A13) interconnects a respective one of the corners of the upper platform (A11) and a corresponding one of the corners of the lower platform (A12). The upper platform A11 is movable relative to the lower platform (A12) in a Z-direction (i.e., a top-bottom direction). The guide rods (A13) are for

guiding the relative movement between the upper and lower platforms (A11, A12). The adjusting mechanism (A14) is operable to adjust the distance between the upper and lower platforms (A11, A12).

5 The working stage (A2) is located above the upper platform A11 of the frame seat (A1), and is box-shaped. The working stage (A2) includes a carrying platform (A23) that is parallel to the upper platform (A11), and a surrounding wall (A25) that extends downwardly from a periphery of the carrying platform (A23) and that
10 cooperates with the carrying platform (A23) to define a chamber (A21) therebetween. The chamber (A21) has an opening (A22) that opens downwardly. The carrying platform (A23) has a plurality of engaging seats (A231)
15 that protrude upwardly and that are arranged in rows and columns. Each of the engaging seats (A231) has a plurality of spaced-apart communication holes (A232). The carrying platform (A23) further has a plurality of conical positioning portions (A233) that are disposed
20 on an upper surface of the carrying platform (A23) and that are respectively disposed at the corners of the carrying platform (A23), and two mounting holes (A234) that are spaced from each other in an X-direction (i.e., a horizontal direction) and that are in communication
25 with the chamber (A21). The working stage (A2) further includes two sensing components (A24) that are respectively mounted to the mounting holes (A234) of

the carrying platform (A23), and a bottom seat (A26) that is disposed on the upper platform (A11) of the frame seat (A). The sensing components (A24) are spaced apart from the engaging seats (A231), and are accessible to a top side of the carrying platform (A23). The working stage (A2) further has a plurality of flange portions (A251) that extend outwardly from an lower periphery of the surrounding wall (A25) of the working stage (A2), and two securing grooves (A252) that are respectively formed in two of the flange portions (A251) opposite from each other in the X-direction, and that respectively permit two fasteners (not shown) to extend therethrough for securing the carrying platform (A23) to the bottom seat (A26)

The detection unit (A3) is disposed between the working stage (A2) and the upper platform (A11) of the frame seat (A1), and is for detecting the load on each of the engaging seats (A231) of the carrying platform (A23).

Referring to Figures 3 to 5, the adjusting mechanism (A14) is disposed between the upper and lower platforms (A11, A12) of the frame seat (A1), and includes two receiving grooves (A144) that are formed in a bottom surface of the upper platform (A11) and that are spaced apart from each other in the X-direction, two follower wheels (A141) that are respectively mounted to the receiving grooves (A144), an adjusting guide rail (A146)

that is disposed on a top surface of the lower platform (A12) and that extends in the X-direction, two spaced-apart adjusting slide blocks (A147) that are slidably mounted to the adjusting guide rail (A146) and
5 that are movable along the adjusting guide rail (A146), a cam member (A148) that is mounted to the adjusting slide blocks (A147), and an adjusting actuator (A149) that is operable to drive movement of the cam member (A148) along the adjusting guide rail (A146) (i.e., in
10 the X-direction). Each of the receiving grooves (A144) has two spaced-apart V-shaped groove portions (A145), and an enlarged groove portion that is located between the V-shaped groove portions (A145). In one embodiment, the cam member (A148) is elongated.

15 Each of the follower wheels (A141) includes an axle (A143) that is mounted to the V-shaped groove portions (A145) of a respective one of the receiving grooves (A144), and a plurality of bearings (A142) that are mounted to a middle portion of the axle (A143), that
20 partially project out of the bottom surface of the upper platform (A11), and that are in contact with the cam member (A148). The cam member (A148) has two cam portions (A1480) that are disposed in the X-direction. Each of the cam portions (A1480) has a lower cam surface (A1481),
25 an upper cam surface (A1482) that is spaced apart from the lower cam surface (A1481), and an inclined cam surface (A1483) that is connected between the lower cam

surface (A1481) and the upper cam surface (A1482). The lower cam surface (A1481), the inclined cam surface (A1483) and the upper cam surface (A1482) of each of the cam portions (A1480) are sequentially disposed in the same direction.

The frame seat (A1) further includes a plurality of biasing units (A150) for resiliently biasing the upper and lower platforms (A11, A12) toward each other. Each of the biasing units (A150) includes a first securing member (A1501) that is mounted to the upper platform (A11), a second securing member (A1502) that is mounted to the lower platform (A12), and a resilient member (A1503) that has two opposite ends respectively connected to the first and second securing members (A1501, A1502) and that resiliently biases the upper and lower platforms (A11, A12) toward each other such that the follower wheels (A141) are respectively in contact with the cam portions (A1480) of the cam member (A148). Initially, the follower wheels (A141) are respectively in contact with the lower cam surfaces (A1481) of the cam portions (A1480) of the cam member (A148).

Referring to Figures 6 to 8, the bonding equipment according to the disclosure is adapted to transport a plurality of carriage plates (D6). Each of the carriage plates (D6) is for carrying a to-be-bonded element (D63) (e.g., a flexible printed circuit). The to-be-bonded element (D63) has a plurality of to-be-bonded regions

(D631) that are arranged in rows and columns. Each of the carriage plates (D6) includes an upper plate (D61), and a lower plate (D62) that is coupled to the upper plate (D61) by magnetic attraction and that cooperates with the upper plate (D61) to clamp the to-be-bonded element (D63) therebetween. The upper plate (D61) has a plurality of working void regions (D611) that respectively correspond in position to the to-be-bonded regions (D631) of the to-be-bonded element (D63). The lower plate (D62) has a plurality of suction void regions (D621) each of which corresponds in position to a portion of the to-be-bonded regions (D631), and also to the corresponding portion of the working void regions (D611) of the upper plate (D61).

The bonding equipment further includes a machine body (C), and two transport rail units (B) that are respectively associated with the carriage devices (A). The machine body C has a top surface (C1), and a side surface (C2) that extend downwardly from one side of the top surface (C1) and that is perpendicular to the top surface (C1). The transport rail units (B) are disposed on the top surface (C1) of the machine body (C), and are parallel to each other. Each of the transport rail units (B) includes a transport slide block (B1), and a transport actuator (B2) that is operable to drive movement of the slide block (B1) in the X-direction. The lower platform (A12) of each of the carriage devices

(A) is disposed on the transport slide block (B1) of the corresponding transport rail unit (B).

The bonding equipment further includes a storage device (D), a switch device (F) and an inspection device (E).

The storage device (D) includes a fixing seat (D1) that is fixedly mounted to the side surface (C2) of the machine body (C), a storage guide rail (D2) that is mounted to the fixing seat (D1) and that extends in the top-bottom direction, and a storage slide seat (D3) that is able to be driven to move along the storage guide rail (D2). The storage slide seat (D3) includes three racks D4 that are spaced apart from each other in the top-bottom direction and that are horizontally disposed, and three box frames (D5) that are respectively disposed on the racks (D4). Each of the box frames (D5) permits a plurality of carriage plates D6 to be received therein, and has two openings (D51) at two opposite ends thereof. The openings (D51) of each of the box frames (D5) respectively permit two opposite edges of a carriage plates (D6) received in the box frame (D5) to be accessible therethrough. The storage device (D) further includes a storage push device (D7) that corresponds in position to one of the openings (D51) of each of the box frames (D5).

The switch device (F) includes a switch gantry (F1) that is disposed on the top surface (C1) of the machine

body (C) and that extends in a horizontal Y-direction to span the transport rail units (B). The switch gantry (F1) is proximate to the storage device (D), and includes a switch guide rail (F11) that extends in the Y-direction, a switch slide seat (F13) that is slidably mounted to the switch guide rail (F11), a switch actuator (F12) (see Figure 7) that is operable to drive movement of the switch slide seat (F13) along the switch guide rail (F11), and a conveyor (F2) that is mounted on the switch slide seat (F13). The conveyor (F2) includes a conveyor frame (F21) that is co-movably mounted to the switch slide seat (F13) and that is disposed over the carriage devices (A), and a conveyor belt (F22) that is movably mounted to the conveyor frame (F21) for conveying the carriage plates (D6) in the X-direction. The conveyor (F2) is able to be moved by the switch slide seat (F13) to correspond in position to the box frames (D5) of the storage device (D), so that the conveyor belt (F22) is able to receive the carriage plate (D6) moved out of the box frames (D5) or to move the carriage plate (D6) into the box frames (D5). The switch device (F) further includes a switch push device (F23) that is disposed at one side of the conveyor (F2) for pushing and moving the carriage plate (D6) disposed on the conveyor (F2) into the box frames (D5).

The inspection device (E) includes an inspection gantry E1 that spans the transport rail units (B) and

that is parallel to the switch gantry (F1), and first and second inspection mechanisms (E2, E4) that are respectively mounted to two opposite sides of the inspection gantry (E1). The inspection gantry (E1) includes a horizontal beam (E3) that extends in the Y-direction. The first and second inspection mechanisms (E2, E4) are structurally the same to each other, and only the first inspection mechanism (E2) is described in detail. The first inspection mechanism (E2) includes an inspection guide rail (E31) that extends in the Y-direction and that is mounted to the horizontal beam (E3), an auxiliary guide rail (E33) that is parallel to and disposed below the inspection guide rail (E31) and that is mounted to the horizontal beam (E3), an inspection slide seat (E32) that is slidably mounted to the inspection guide rail (E31) and the auxiliary guide rail (E33), an inspection unit (E35) that is disposed on the inspection slide seat (E32), and an inspection actuator (E34) that is operable to drive movement of the inspection slide seat (E32) along the inspection guide rail E31 and the auxiliary guide rail (E33).

The bonding equipment according to the disclosure is able to execute a transport method that includes steps of:

A) moving the carriage plate (D6), by the push device (D7), out of the corresponding box frame (D5) of the

storage device (D) and onto the conveyor belt (F22) of the conveyor (F2) of the switch device (F);

5 B) moving the conveyor (F2) of the switch device F to correspond in position to a selected one of the transport rail units (B), and moving the corresponding carriage device (A), by the transport slide block (B1) of the selected one of the transport rail units (B), such that the corresponding carriage device (A) is located under and aligned with the carriage plate (D6) on the conveyor belt (F22);

10 C) moving, by the adjusting actuator (A149), the cam member (A148) toward the storage device (D) in the X-direction until the follower wheels (A141) are respectively in contact with the upper cam surfaces (A1482) of the cam portions (A1480) of the cam member (A148), such that the upper platform (A11) of the corresponding carriage device (A) is moved upwardly against the biasing action of the biasing units (A150), and that the carrying platform (A23) of the corresponding carriage device (A) supports the carriage plate (D6) and separates the carriage plate (D6) from the conveyor belt (F22);

20 D) moving the carriage plate (D6), by the corresponding carriage device (A), to the inspection gantry (E1) such that the carriage plate (D6) is located below the first inspection mechanism (E2) of the inspection device (E) for inspection of the to-be-bonded

element (D63) on the carriage plate (D6);

E) moving the carriage plate (D6), by the corresponding carriage device (A), to a distal end of the selected one of the transport rail units (B) distal
5 from the switch device (F) for being bonded with a bonding element (not shown);

F) moving the carriage plate (D6), by the corresponding carriage device (A), such that the carriage plate (D6) is located below the first inspection
10 mechanism (E2) of the inspection device (E) for inspection of the to-be-bonded element (D63) and the bonding element;

G) moving the conveyor (F2) to correspond in position to the selected one of the transport rail units (B),
15 and moving the corresponding carriage device (A), by the transport slide block (B1) of the selected one of the transport rail units (B), such that the carriage plate (D6) is located above the conveyor belt (F22) of the conveyor (F2);

20 H) moving, by the adjusting actuator (A149), the cam member (A148) away from the storage device (D) in the X-direction until the follower wheels (A141) are respectively in contact with the lower cam surfaces (A1481) of the cam portions (A1480) of the cam member
25 (A148), such that the upper platform (A11) of the corresponding carriage device (A) is permitted to move downwardly by the biasing action of the biasing units

(A150), and that the carrying platform (A23) is lowered to place the carriage plate (D6) onto the conveyor belt (F22) and is separated from the carriage plate (D6); and

5 I) moving the carriage plate (D6) from the conveyor belt (F22) and into one of the box frames (D5).

Referring to Figures 6, 8 and 9, after the execution of step B), each of the engaging seats (A231) of the carrying platform (A23) of the corresponding carriage device (A) corresponds in position to one of the suction
10 void regions (D621) of the carriage plate (D6).

After the execution of step C), each of the engaging seats (A231) of the carrying platform (A23) engages the corresponding one of the suction void regions (D621)
15 of the carriage plate (D6), and negative pressure is generated in the communication holes (A232) of each of the engaging seats (A231) such that the to-be-bonded element (D63) is attached to the carrying platform (A23).

During the execution of step E), the bonding element
20 is bonded to the to-be-bonded element (D63) via the working void regions (D611) of the upper plate (D61) of the carriage plate (D6). The detection unit (A3) detects the load applied on each of the engaging seats (A231) of the carrying platform (A23) during the bonding
25 process.

During the execution of step H), when the carrying platform (A23) is lowered to place the carriage plate

D6 onto the conveyor belt (F22), negative pressure is no longer generated in the communication holes (A232) of each of the engaging seats (A231) such that the to-be-bonded element (D63) is permitted to be separated
5 from the carrying platform (A23).

It should be noted that, after the execution of step C), the conveyor (F2) of the switch device (F) can move back to the storage device (D) to receive another carriage plate (D6), and move the carriage plate (D6)
10 to correspond in position the other one of the one of the transport rail units (B) for another bonding operation of the carriage plate (D6).

In summary, the bonding equipment according to the disclosure is able to automatically perform operations
15 of transport, inspection, bonding and storage, and is suitable for mass production. Moreover, since the upper platform (A11) of the carriage device (A) is moved in the top-bottom direction by the cam member (A148) that is moved in the horizontal direction, the thickness of
20 the carriage device (A) in the top-bottom direction is relatively small.

In the description above, for the purposes of explanation, numerous specific details have been set forth in order to provide a thorough understanding of
25 the embodiment. It will be apparent, however, to one skilled in the art, that one or more other embodiments may be practiced without some of these specific details.

It should also be appreciated that reference throughout this specification to "one embodiment," "an embodiment," an embodiment with an indication of an ordinal number and so forth means that a particular
5 feature, structure, or characteristic may be included in the practice of the disclosure. It should be further appreciated that in the description, various features are sometimes grouped together in a single embodiment, figure, or description thereof for the purpose of
10 streamlining the disclosure and aiding in the understanding of various inventive aspects, and that one or more features or specific details from one embodiment may be practiced together with one or more features or specific details from another embodiment,
15 where appropriate, in the practice of the disclosure. 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
20 arrangements included within the spirit and scope of the broadest interpretation so as to encompass all such modifications and equivalent arrangements.

CLAIMS:

1. A carriage device comprising:

a frame seat including an upper platform, a lower platform that is disposed below and spaced apart from said upper platform, a guide rod that interconnects said upper and lower platforms, and an adjusting mechanism that is operable to adjust the distance between said upper and lower platforms; and

a working stage disposed on said frame seat and including a carrying platform, said carrying platform having a plurality of engaging seats that protrude upwardly and that are arranged in rows and columns, each of said engaging seats having at least one communication hole.

2. The carriage device as claimed in claim 1, wherein said carrying platform further has at least one conical positioning portion that is disposed on an upper surface of said carrying platform.

3. The carriage device as claimed in claim 1, wherein said carrying platform further includes a plurality of sensing components that are spaced apart from said engaging seats and that are accessible to a top side of said carrying platform.

4. The carriage device as claimed in claim 1, wherein

said working stage further includes a bottom seat that is disposed on said upper platform of said frame seat, said working stage defining a chamber therein that is located below said carrying platform, said chamber
5 having an opening that opens downwardly.

5. The carriage device as claimed in claim 1, further comprising a load-detection unit that is disposed between said working stage and said upper platform of
10 said frame seat.

6. The carriage device as claimed in claim 1, wherein said adjusting mechanism includes at least one follower wheel that is mounted to a bottom side of said upper
15 platform, a cam member that is disposed on a top side of said lower platform and that is in contact with said at least one follower wheel, and an adjusting actuator that is operable to drive movement of said cam member relative to said at least one follower wheel.

20

7. The carriage device as claimed in claim 6, wherein said adjusting mechanism includes two of said follower wheels that are spaced apart from each other, said cam member having two cam portions that are respectively
25 in contact with said follower wheels, each of said cam portions having a lower cam surface, an upper cam surface that is spaced apart from said lower cam surface, and

an inclined cam surface that is connected between said lower cam surface and said upper cam surface.

8. The carriage device as claimed in claim 6, wherein
5 said at least one follower wheel includes an axle, and a plurality of bearings that are mounted to a middle portion of said axle.

9. The carriage device as claimed in claim 8, wherein
10 said adjusting mechanism further includes at least one receiving groove that is formed at said bottom side of said upper platform for being mounted with said at least one follower wheel, said at least one receiving grooves having two spaced-apart groove portions that receive
15 portions of said axle, said bearings of said at least one receiving groove partially projecting out of said receiving groove and being in contact with said cam member.

20 10. The carriage device as claimed in claim 6, wherein said adjusting mechanism further includes an adjusting guide rail that is disposed on said lower platform and that extends in an X-direction, and two adjusting slide blocks that are slidably mounted to said adjusting guide
25 rail, that are movable along the adjusting guide rail, and that permit said cam member to be disposed thereon.

11. The carriage device as claimed in claim 1, wherein
said frame seat further includes at least one resilient
member that has two opposite ends respectively connected
to said upper and lower platforms and that resiliently
5 biases said upper and lower platforms toward each other.

12. A bonding equipment adapted to transport a carriage
plate comprising:

10 a carriage device as claimed in any one of claims
1 to 11 for carrying the carriage plate; and

a conveyor including a conveyor frame that is
disposed over said carriage devices, and a conveyor belt
that is movably mounted to said conveyor frame for
conveying the carriage plates.

15

13. The bonding equipment as claimed in claim 12, wherein
the carriage plate is for holding a to-be-bonded element,
and includes an upper plate, and a lower plate that
cooperates with the upper plate to clamp the to-be-bonded
20 element therebetween.

14. The bonding equipment as claimed in claim 12, further
comprising a transport rail unit, said transport rail
unit including a transport slide block that is located
25 below said lower platform of the frame seat of said
carriage device, and a transport actuator that is
operable to drive movement of the slide block for moving

said carriage device.

15. A transport method using the carriage device as claimed in any one of claims 1 to 11 for transporting
5 a carriage plate, the carriage plate carrying a to-be-bonded element and having a plurality of suction void regions, the transport method comprising steps of:

a) moving the carriage device to the lower side of the carriage plate, and aligning each of the engaging
10 seats of the carrying platform of the carriage device with one of the suction void regions; and

b) moving one of the carrying platform and the to-be-bonded element to contact the other one of the carrying platform and the to-be-bonded element via the
15 suction void regions, and generating negative pressure in the communication hole of each of the engaging seats such that the to-be-bonded element is attached to the engaging seats.

20 16. The transport method as claimed in claim 15, further comprising, after step b), a step of:

c) moving, by the carrying platform, the to-be-bonded element to a bonding device so that the to-be-bonded element is bonded with a bonding element.

25

17. A bonding equipment configured to execute the transport method as claimed in claim 15.