Description

Title of Invention:

RESIN SUPPLY DEVICE, RESIN-MOLDING DEVICE, AND METHOD FOR PRODUCING MOLDED RESIN ARTICLE

Technical Field

[0001]

The present invention relates to a resin molding device and a method for producing a resin molded article.

Background Art

[0002]

PTL 1 discloses a resin molding method for a wafer level package. In this resin molding method, it is disclosed that a resin material is also applied to a region where a chip is not disposed in order to suppress generation of an unfilled region of a resin.

Citation List

Patent Literature

[0003]

PTL 1: US Patent Application Publication No. 2022/115247

Summary of Invention

Technical Problem

[0004]

Meanwhile, a panel to be molded with resin by compression includes a large panel assumed to be cut into a plurality of panels. In such a large panel, a plurality of regions (Hereinafter, the region is referred to as an island.) including a plurality of electronic components is formed, and a gap is formed between adjacent islands. Then,

after the resin molding, the gap between the islands is cut, so that the panel to be molded is divided into a plurality of panels.

[0005]

However, at the time of resin molding, since the molten resin tends to flow into the gap between the islands described above, there is a problem that the electronic component is detached from the panel by this flow. The present invention has been made to solve such a problem, and an object of the present invention is to provide a resin supply device, a resin molding device, and a method for producing a resin molded article capable of suppressing detachment of an electronic component due to a flow of a resin during compression molding.

Solution to Problem

[0006]

A resin supply device according to the present invention is a resin supply device configured to supply a resin material to a molding die that molds a resin on a substrate by compression molding, the resin supply device including: a first tray on which a resin material is placed; at least one second tray that is smaller than the first tray and on which the resin material is placed; a tray conveyance unit that conveys the second tray onto the first tray; a resin supply unit that supplies the resin material to the second tray; and a control unit, in which the control unit executes a first step of spreading the resin material on the second tray by the resin supply unit; a second step of spreading the resin material so as to overlap an outer edge of the resin material spread in the first step by the resin supply unit; and a third step of conveying the second tray to the first tray and placing the resin material on the second tray in a region of the first tray where the resin material is not placed, and the resin material is placed in the first tray by repeating the first to third steps.

[0007]

A resin supply method according to the present invention is a resin supply method for supplying a resin material to a molding die that molds a resin on a substrate by compression molding, the resin supply method including: a first step of preparing a first tray and a second tray smaller than the first tray; a second step of spreading a resin material on the second tray; a third step of spreading the resin material so as to overlap an outer edge of the resin material spread in the first step; and a fourth step of conveying the second tray to the first tray and placing the resin material on the second tray in a region of the first tray where the resin material is not placed, in which the resin material is disposed on the first tray by repeating the second to fourth steps.

[0008]

A method for producing a resin molded article according to the present invention includes: a step of preparing a substrate including a carrier and a plurality of electronic components fixed onto the carrier by a temporary fixing material, a plurality of islands including the plurality of electronic components being placed on the carrier with a gap; a step of supplying a resin material to the first tray by the resin supply method described above; a step of placing the resin material of the first tray in a molding die; a step of placing the substrate in the molding die; and a step of molding the resin material on the substrate by compression molding in the molding die.

Advantageous Effects of Invention

[0009]

According to the present invention, it is possible to suppress detachment of an electronic component due to a flow of a resin during compression molding.

Brief Description of Drawings

[0010]

[Fig. 1A] Fig. 1A is a plan view of a panel on which electronic components are mounted.

[Fig. 1B] Fig. 1B is a cross-sectional view of Fig. 1A.

[Fig. 2A] Fig. 2A is a plan view of a panel after resin molding.

[Fig. 2B] Fig. 2B is a cross-sectional view of Fig. 2A.

[Fig. 3] Fig. 3 is a plan view schematically illustrating a resin molding device.

[Fig. 4] Fig. 4 is a plan view schematically illustrating a resin supply module.

[Fig. 5] Fig. 5 is a front view of a resin supply module provided with resin material supply devices.

[Fig. 6] Fig. 6 is a front view of the resin material supply device.

[Fig. 7] Fig. 7 is a side view of Fig. 6.

[Fig. 8] Fig. 8 is a side cross-sectional view illustrating configurations of a small tray and a large tray.

[Fig. 9A] Fig. 9A is a plan view illustrating a method for supplying a resin material to a small tray.

[Fig. 9B] Fig. 9B is a plan view illustrating the method for supplying the resin material to the small tray.

[Fig. 9C] Fig. 9C is a plan view illustrating the method for supplying the resin material to the small tray.

[Fig. 9D] Fig. 9D is a plan view illustrating the method for supplying the resin material to the small tray.

[Fig. 9E] Fig. 9E is a plan view illustrating the method for supplying the resin material to the small tray.

[Fig. 9F] Fig. 9F is a plan view illustrating the method for supplying the resin material to the small tray.

[Fig. 9G] Fig. 9G is a plan view illustrating the method for supplying the resin material to the small tray.

[Fig. 9H] Fig. 9H is a plan view illustrating the method for supplying the resin material to the small tray.

[Fig. 9I] Fig. 9I is a plan view illustrating the method for supplying the resin material to the small tray.

[Fig. 9J] Fig. 9J is a plan view illustrating the method for supplying the resin material to the small tray.

[Fig. 10A] Fig. 10A is a plan view illustrating a method for supplying a resin material from a small tray to a large tray.

[Fig. 10B] Fig. 10B is a plan view illustrating the method for supplying the resin material from the small tray to the large tray.

[Fig. 10C] Fig. 10C is a plan view illustrating the method for supplying the resin material from the small tray to the large tray.

[Fig. 10D] Fig. 10D is a plan view illustrating the method for supplying the resin material from the small tray to the large tray.

[Fig. 10E] Fig. 10E is a plan view illustrating the method for supplying the resin material from the small tray to the large tray.

[Fig. 11A] Fig. 11A is a cross-sectional view showing a molding step.

[Fig. 11B] Fig. 11B is a cross-sectional view showing the molding step.

Description of Embodiments

[0011]

Hereinafter, an embodiment of a resin molding device of the present invention will be described with reference to the drawings. Hereinafter, first, a panel (substrate) formed by a resin molding device will be described, and then the resin molding device

for molding a resin on the panel will be described. Further, in the following description, for convenience of explanation, description will be made according to directions attached to the drawings, but the present invention is not limited to such directions.

[0012]

<1. Panel>

Fig. 1A is a plan view of a panel to be subjected to resin molding, and Fig. 1B is a cross-sectional view of Fig. 1A. As illustrated in Figs. 1A and 1B, the panel P includes a rectangular panel carrier 81 made of glass or the like, a rectangular double-sided tape 82 fixed on the panel carrier 81, and a plurality of electronic components 83 such as semiconductor chips disposed on the double-sided tape 82. Four rectangular islands 83A to 83D are formed on the double-sided tape 82, and in each of the islands 83A to 83D, the plurality of electronic components 83 is arranged at predetermined intervals in a longitudinal direction and a lateral direction. Hereinafter, for convenience of description, the four islands are referred to as a first island 83A, a second island 83B, a third island 83C, and a fourth island 83D.

[0013]

The first island 83A and the second island 83B are arranged side by side in the lateral direction with a gap 85 extending in the longitudinal direction. Similarly, the third island 83C and the fourth island 83D are also arranged side by side in the lateral direction with the gap 85 extending in the longitudinal direction. Further, a gap 86 extending in the lateral direction is formed between the first island 83A and the third island 83C and between the second island 83B and the fourth island 83D. That is, in the present embodiment, the four islands 83A to 83D are arranged with the cross-shaped gaps 85 and 86. Further, a gap 87 is also formed on outer peripheries of the four

islands 83A to 83D. That is, the frame-shaped gap 87 is formed between an outer edge of the double-sided tape 82 and the four islands 83A to 83D.

[0014]

In the present embodiment, it is assumed that the relatively large panel P is used. For example, the panel P is formed in a rectangular plate shape having one side of 450 mm or more, 500 mm or more, or 600 mm or more.

[0015]

In the present embodiment, a resin material is molded for the panel P configured as described above. Fig. 2A is a plan view of a panel on which a resin material is molded, and Fig. 2B is a cross-sectional view of Fig. 2A. As illustrated in Figs. 2A and 2B, a resin material having a rectangular shape in plan view is molded on the panel P so as to cover all the electronic components. The panel P on which the resin is molded corresponds to a resin molded article.

[0016]

<2. Resin Molding Device>

A resin molding device 1 according to the present embodiment is a device that resin-seals the electronic components 83 on the panel P described above to manufacture a resin molded article. In particular, in the present embodiment, as will be described later, the resin molding device 1 adopting a compression molding method (compression method) for compressing and molding a resin material in a cavity is illustrated. Note that, in the present embodiment, it is assumed that a granular resin material is used, but as the resin material, not only a granular resin material but also a resin material in an arbitrary form such as a powder form or a liquid form can be used.

[0017]

Fig. 3 is a schematic view of a resin molding device. As illustrated in Fig. 3,

the resin molding device 1 includes a substrate carry-in and carry-out module 10, a substrate transfer module 20, a molding module 30, a resin supply module (resin supply device) 40, and a control unit 50 as components. Each component is detachable and replaceable with respect to other components. Each component will be described below.

[0018]

<2-1. Substrate Carry-In and Carry-Out Module>

The substrate carry-in and carry-out module 10 is a module that carries out the panel P before resin molding and carries in the panel P after resin molding. The substrate carry-in and carry-out module 10 mainly includes a carry-in unit 11, a carry-out unit 12, an inspection unit 13, and an arm mechanism 14.

[0019]

The carry-in unit 11 is a portion where the panel P before resin molding is disposed, and the carry-out unit 12 is a portion where the panel P after resin molding is disposed. Each of the carry-in unit 11 and the carry-out unit 12 can accommodate the plurality of panels P.

[0020]

The inspection unit 13 is a portion that inspects the panel P after resin molding. The inspection unit 13 includes a placement portion (not illustrated) for placing the panel P after resin molding, an inspection mechanism (not illustrated) for inspecting the panel P, and the like.

[0021]

The arm mechanism 14 is a mechanism that moves the panel P. The arm mechanism 14 includes a suction hand unit 14a that sucks the panel P, an arm unit 14b to which the suction hand unit 14a is attached, a drive unit 14c that appropriately rotates

and moves the arm unit 14b, and the like.

[0022]

<2-2. Substrate Transfer Module>

The substrate transfer module 20 is a module that transfers the panel P between the substrate carry-in and carry-out module 10 and the molding module 30 to be described later. The substrate transfer module 20 mainly includes a loader 21 and an unloader 22.

[0023]

The loader 21 receives the panel P before resin sealing from the arm mechanism 14, and conveys the panel P to a molding die 31 of the molding module 30 described later. The unloader 22 receives the resin-molded panel P from the molding die 31 to be described later, and conveys the resin-molded panel P to the substrate carry-in and carry-out module 10. The loader 21 and the unloader 22 can move along a rail L extending in a left-right direction. In the present embodiment, the loader 21 and the unloader 22 are connected to each other so as to move integrally.

[0024]

<2-3. Molding Module>

The molding module 30 is a module that resin-seals electronic components attached to the panel P using a resin material supplied from the resin supply module 40 described later. In the present embodiment, two molding modules 30 are arranged side by side. The resin sealing of the panel P can be performed in parallel by the two molding modules 30, whereby production efficiency of a resin molded article can be improved. The molding module 30 mainly includes the molding die 31, a clamping mechanism (not illustrated), and the like.

[0025]

The molding die 31 performs compression molding on the panel P using the molten resin material. The molding die 31 has a pair of upper and lower dies (an upper die and a lower die), and a recessed cavity (not illustrated) in which a resin material is accommodated is formed in the lower die. On the other hand, in the upper die, the panel P before resin molding is held with the electronic components facing the cavity side. Furthermore, the molding die 31 is provided with a heater (not illustrated) for melting the resin material.

[0026]

<2-4. Molding Module>

The control unit 50 is configured to control an operation of each module of the resin molding device 1. The control unit 50 controls operations of the substrate carry-in and carry-out module 10, the substrate transfer module 20, the molding module 30, and the resin supply module 40 to be described later. In addition, the operation of each module can be arbitrarily changed (adjusted) using the control unit 50.

[0027]

<3. Resin Supply Module>

Hereinafter, the resin supply module 40 will be described in detail. Fig. 4 is a schematic plan view of the resin supply module 40. The resin supply module 40 is a module for supplying a resin material to the molding die 31 of the molding module 30. As illustrated in Figs. 3 and 4, the resin supply module 40 mainly includes two resin material supply devices 100, four small trays (second trays) 411 to 414, a small tray conveyance mechanism (not illustrated), a dust collection table 43, a large tray (first tray) 44, and a large tray conveyance mechanism 45.

[0028]

The dust collection table 43 is disposed between the two resin material supply

devices 100 and the large tray 44. Each of the small trays 411 to 414 is movable between the resin material supply device 100, the dust collection table 42, and the large tray 44 by the small tray conveyance mechanism. During this movement, each of the small trays 411 to 414 stands by on the dust collection table 43, and dust attached to a bottom surface of each of the trays 411 to 414 at that time is collected.

[0029]

As described later, the resin supply module 40 is configured to supply a resin material to one rectangular large tray 44 using four rectangular small trays 411 to 414. That is, the resin material disposed in the small trays 411 to 414 is supplied to the large tray 44. Therefore, a size of each small tray 411 to 414 is approximately 1/4 of a size of the large tray. Hereinafter, for convenience of description, the respective small trays will be referred to as first to fourth small trays 411 to 414. Hereinafter, each part will be described in detail.

[0030]

<3-1. Resin Material Supply Device>

Fig. 5 is a front view of the resin material supply device disposed in the resin supply module. As illustrated in Fig. 5, the two resin material supply devices 100 are provided in a housing 40a of the resin supply module 40 so as to be arranged side by side on the left and right. The two resin material supply devices 100 have substantially the same configuration as each other except that the devices are arranged substantially symmetrically to the left and right. Therefore, hereinafter, a configuration of the one (right) resin material supply device 100 will be specifically described, and description of a configuration of the other (left) resin material supply device 100 will be omitted.

[0031]

Further, each of the resin material supply devices 100 is provided with two

troughs 130. Hereinafter, for convenience of description, the troughs provided in the one resin material supply device 100 will be referred to as a first trough 130A and a second trough 130B. The troughs provided in the other resin material supply device 100 are referred to as a third trough 130C and a fourth trough 130D. As illustrated in Fig. 4, the first trough 130A and the second trough 130B supply the resin material to each of the first small tray 411 and the third small tray 413. On the other hand, the third trough 130C and the fourth trough 130D supply the resin material to each of the second small tray 412 and the fourth small tray 414.

[0032]

Fig. 6 is a front view of the resin material supply device, and Fig. 7 is a side view of Fig. 6. As illustrated in Figs. 6 and 7, the resin material supply device 100 mainly includes a stocker 110, a first vibration unit 120, the two troughs 130A and 130B, a second vibration unit 140, a weight scale 150, and a distributor 160. Note that, in Figs. 6 and 7, the resin material accommodated in the stocker 110 and the troughs 130A and 130B is illustrated in gray.

[0033]

The stocker 110 accommodates the resin material and supplies the resin material to the troughs 130 described later. The stocker 110 mainly includes an accommodation unit 111 and a supply unit 112.

[0034]

The accommodation unit 111 has an opening in an upper portion and has an internal space for housing the resin material, and the resin material is supplied (replenished) at a predetermined timing.

[0035]

The supply unit 112 is a portion that supplies the resin material accommodated

in the accommodation unit 111 to the troughs 130A and 130B. The supply unit 112 is formed in a hollow shape so that the resin material can move inside. The supply unit 112 extends from a lower portion of one side surface of the accommodation unit 111 to an upper side of the distributor 160 described later. A supply port 112a for discharging the resin material inside the supply unit 112 downward is provided in the vicinity of a distal end portion (left end portion) of the supply unit 112.

[0036]

The first vibration unit 120 is used to discharge the resin material from the stocker 110. The first vibration unit 120 is provided at a lower portion of the stocker 110 and vibrates the stocker 110. As a result, the resin material in the accommodation unit 111 can be moved to the supply unit 112 and discharged downward from the supply port 112a.

[0037]

Each of the troughs 130A and 130B has the same structure, accommodates the resin material, and supplies the resin material to each of the small trays 411 to 414. As illustrated in Fig. 6, the two troughs 130 are arranged side by side (in a plan view, at bilaterally symmetrical positions across the supply port 112a of the stocker 110) below the stocker 110. Each of the troughs 130A and 130B mainly includes an accommodation unit 131 and a supply unit 132.

[0038]

The accommodation unit 131 has an opening in an upper portion and has an internal space for accommodating the resin material. The supply unit 132 is a portion that supplies the resin material accommodated in the accommodation unit 131 to each of the small trays 411 to 414, and is formed in a hollow shape so that the resin material can move inside. The supply unit 132 extends in one direction (rearward) from a lower

portion of one side surface of the accommodation unit 131, and a supply port 132a for discharging the resin material inside the supply unit 132 downward is provided in the vicinity of a distal end portion of the supply unit 132.

[0039]

Note that the two troughs 130A and 130B are arranged at positions close to each other to some extent so that the resin material can be simultaneously supplied to one small tray 41. Specifically, the two troughs 130A and 130B (in particular, the supply ports 132a) are arranged such that an interval in the left-right direction is about 1/2 of a left-right width of the small trays 411 to 414.

[0040]

The second vibration unit 140 illustrated in Fig. 7 is used to discharge the resin from each of the troughs 130A and 130B. The second vibration unit 140 is provided at a lower portion of each of the troughs 130A and 130B to vibrate them. As a result, the resin material in the accommodation unit 131 can be moved to the supply unit 132 and discharged downward from the supply port 132a.

[0041]

The weight scale 150 measures weight of the resin material accommodated in the trough 130A and 130B. The weight scale 150 is provided at a lower portion of the second vibration unit 140, and can measure weights of the trough 130A and 130B and the second vibration unit 140. Since the weights of the troughs 130A, 130B and the second vibration unit 140 are known, the weight of the resin material accommodated in the trough 130A and 130B can be measured by subtracting the weights of the trough 130 and the second vibration unit 140 from a measurement value of the weight scale 150.

[0042]

The distributor 160 is used to distribute the resin material supplied from the stocker 110 to the two troughs 130A and 130B. A rotatable guide plate (not illustrated) is provided inside the distributor 160, and the guide plate is inclined at a predetermined timing so that the resin material supplied from the stocker 110 is guided to one of the troughs 130. As a result, the resin material can be supplied to the two troughs 130A and 130B by one stocker 110.

[0043]

<3-2. Small Tray and Large Tray>

Next, the small trays 411 to 414 and the large tray 44 will be described with reference to Fig. 8. Note that Fig. 8 is a schematic cross-sectional view for explaining configurations of respective members, and an illustrated relative positional relationship between the respective members is different from an actual positional relationship.

[0044]

As illustrated in Fig. 8, the small tray 41 mainly includes a resin holding unit 41a and a shutter 41b. The resin holding unit 41a is a portion that holds the resin material. The resin holding unit 41a is formed in a plate shape having a substantially square shape in plan view, and a plurality of slits 41c extending in the left-right direction is formed so as to be arranged in a front-rear direction.

[0045]

The shutter 41b is a portion capable of closing the slit 41c of the resin holding unit 41a from below. The shutter 41b is formed in a plate shape having a substantially square shape in plan view. The shutter 41b is formed with a slit 41d so as to correspond to the slit 41c of the resin holding unit 41a. That is, the plurality of slits 41d of the shutter 41b is formed so as to extend in the left-right direction and to be arranged in the front-rear direction. Further, a front-rear interval of the slit 41d of the

shutter 41b is formed to be the same as a front-rear interval of the slit 41c of the resin holding unit 41a. The shutter 41b is disposed immediately below the resin holding unit 41a, and can be moved forward and backward relative to the resin holding unit 41a by a moving mechanism (not shown).

[0046]

As illustrated in Fig. 8, when the slit 41d of the shutter 41b does not vertically face the slit 41c of the resin holding unit 41a, the slit 41c of the resin holding unit 41a is closed from below by the shutter 41b. In this state, the resin material can be held on an upper surface of the small tray 41 (specifically, in the slit 41c of the resin holding unit 41a). Further, by moving the shutter 41b to cause the slit 41c of the resin holding unit 41a and the slit 41d of the shutter 41b to face each other, the resin material held in the slit 41c of the resin holding unit 41a can be discharged downward. The resin material discharged from the small tray 41 is supplied to an accommodation unit 44b of the large tray 44 described later.

[0047]

The large tray 44 mainly includes a frame member 44a and the plurality of accommodation units 44b. The frame member 44a is a member that supports the accommodation units 44b, and is formed in a frame shape having a substantially square shape in plan view. That is, the frame member 44a is formed such that a substantially central portion opens in plan view.

[0048]

Each of the accommodation units 44b is a portion that accommodates the resin material, and is formed in a substantially columnar shape. The plurality of accommodation units 44b is arranged side by side on an inner side (opening portion) of the frame member 44a with a longitudinal direction facing left and right. Both left and

right end portions of the accommodation unit 44b are supported so as to be axially rotatable with respect to the frame member 44a. On an outer peripheral surface of the accommodation unit 44b, a groove 44c capable of accommodating a resin material is formed to extend in an axial direction (longitudinal direction). A front-rear interval (pitch) between the adjacent accommodation units 44b is formed to be the same as a front-rear interval (pitch) of the slit 41c of the small tray 41. In addition, the accommodation unit 44b can be rotated at an arbitrary angle with respect to the frame member 44a by a drive mechanism (not illustrated).

[0049]

As illustrated in Fig. 8, when the groove 44c of the accommodation unit 44b faces upward, the resin material can be accommodated in the groove 44c. Further, by rotating the accommodation unit 44b and directing the groove 44c downward, the resin material accommodated in the groove 44c can be discharged downward.

[0050]

Here, the left and right length of the slit 41c of each of the small trays 411 to 414 is formed to be about half of the left and right length of the accommodation unit 44b (groove 44c) of the large tray 44. In addition, the number of slits 41c of each of the small trays 411 to 414 is formed to be half the number of accommodation units 44b of the large tray 44. As described above, the size of each of the small trays 411 to 414 in plan view is formed to be about 1/4 of the size of the large tray 44. Therefore, in order to supply the resin material to all the accommodation units 44b of the large tray 44 using the small trays 411 to 414, it is necessary to use a total of four small trays 411 to 414.

[0051]

<4. Method for Supplying Resin Material to Small Tray>

Next, a method for supplying the resin material from the resin material supply device 100 to the small trays 411 to 414 will be described.

[0052]

First, when the weight scale 150 detects that a weight of the resin material accommodated in each of the troughs 130A to 130D is less than a predetermined value, operations of the first vibration unit 120 and the distributor 160 are controlled by the control unit 50, and the resin material is supplied to each of the troughs 130A to 130D.

[0053]

That is, when the weight of the resin material accommodated in each of the troughs 130A to 130D falls below the predetermined value, the resin material accommodated in the stocker 110 is automatically supplied to the troughs 130A to 130D. As a result, the resin material having the weight of the predetermined value or more is constantly accommodated in each of the troughs 130A to 130D.

[0054]

Next, a method for supplying the resin material to the first small tray 411 by the first trough 130A and the second trough 130B will be described. Note that a method for supplying the resin material to the third small tray 413 by the first trough 130A and the second trough 130B and a method for supplying the resin material to the second small tray 412 and the fourth small tray 414 by the third trough 130C and the fourth trough 130D are the same, and thus description thereof will be omitted.

[0055]

As illustrated in Fig. 9A, when the resin material is supplied to the first small tray 411, the first small tray 411 before the resin material is supplied is moved below the first and second troughs 130A and 130B by the small tray conveyance mechanism. At this time, a position of the first small tray 411 is adjusted such that the supply ports

132a of the two troughs 130A and 130B are positioned directly above predetermined start positions S.

[0056]

Next, the second vibration unit 140 is operated, and the resin material is supplied from each of the supply ports 132a of the two troughs 130A and 130B to the first small tray 411. The operation of the second vibration unit 140 is controlled so that a mass flow rate (supply weight per unit time) of the resin material supplied from each of the troughs 130A and 130B to the first small tray 411 is substantially constant.

[0057]

Further, simultaneously with the operation of the second vibration unit 140, movement of the first small tray 411 in a horizontal direction is started. Specifically, the small tray conveyance mechanism appropriately moves the first small tray 411 back and forth and right and left. The small tray conveyance mechanism moves the first small tray 411 such that the supply port 132a of each of the troughs 130A and 130B passes through a half (front half) region of the first small tray 411. In addition, the small tray conveyance mechanism moves the first small tray 411 such that the supply port 132a of each of the troughs 130A and 130B finally returns immediately above the start position S. Fig. 9A illustrates an example of relative movement loci of the two troughs 130A and 130B with respect to the first small tray 411. When the supply port 132a of each of the troughs 130A and 130B passes through this locus, the resin material can be spread over the half region of the first small tray 411.

[0058]

When the supply port 132a of each of the troughs 130A and 130B returns directly above the start position S, the second vibration unit 140 is stopped, and the supply of the resin material from each of the troughs 130A and 130B to the first small

tray 411 is stopped.

[0059]

In this manner, as illustrated in Fig. 9B, the resin material is supplied to the half (front half) region of the first small tray 411. In Fig. 9, the region to which the resin material is supplied is illustrated in gray. Note that the weight of the resin material supplied to the first small tray 411 is controlled to be a preset target value (target supply amount) by one supply of the resin material by each of the troughs 130A and 130B (supply of the resin material from the activation to the stop of the second vibration unit 140). Specifically, by appropriately controlling the operations of the second vibration unit 140 and the small tray conveyance mechanism, the target supply amount of the resin material is supplied to the first small tray 411.

[0060]

Next, as illustrated in Fig. 9C, a front-rear direction of the first small tray 411 is reversed by the small tray conveyance mechanism. Then, in the first small tray 411, the resin material is supplied from the two troughs 130A and 130B to a remaining half region where the resin material is not supplied. Also in this case, the resin material is supplied from each of the troughs 130A and 130B to the first small tray 411 while moving the first small tray 411 according to the movement loci as illustrated in Fig. 9A. As a result, as illustrated in Fig. 9D, the resin material is disposed on the entire first small tray 411. In this manner, when the resin material is supplied to the first small tray 411, the front-rear direction of the first small tray 411 is reversed, and the resin material is supplied twice.

[0061]

As described above, since the resin material is supplied to the first small tray 411 using the plurality of (two) troughs 130A and 130B, a supply time of the resin

material to the first small tray 411 can be shortened.

[0062]

Next, an additional resin material is supplied along an outer edge of the first small tray 411. This point will be described with reference to Figs. 9E to 9J. First, as illustrated in Fig. 9E, the position of the first small tray 411 is adjusted such that the supply ports 132a of the two troughs 130A and 130B are positioned directly above the predetermined start positions S. The supply port 132a of the first trough 30A is disposed near the center of a right side of the first small tray 411, and the supply port 132a of the second trough 30B is disposed near the center of the first small tray 411.

[0063]

Next, the first small tray 411 is moved forward while only the second vibration unit 140 of the first trough 130A is operated. As a result, as illustrated in Fig. 9F, an additional resin material D is supplied from the vicinity of the center of a left side of the first small tray 411 to a rear end of the left side. The additional resin material D is laminated on the resin material supplied to the entire surface of the first small tray 411. This point is the same in subsequent operations.

[0064]

Next, the first small tray 411 is moved to the left side while the second vibration units 140 of the troughs 130A and 130B are operated. As a result, as illustrated in Fig. 9G, the additional resin material D is supplied along a rear end side of the first small tray 411.

[0065]

Subsequently, the first small tray 411 is moved to a rear side while only the second vibration unit 140 of the second trough 130B is operated. As a result, as illustrated in Fig. 9H, the additional resin material D is supplied from a rear end of a

right side of the first small tray 411 to the vicinity of the center of the right side. In this way, the additional resin material D is supplied to half of the outer edge of the first small tray 411.

[0066]

Subsequently, as illustrated in Fig. 9I, the small tray conveyance mechanism reverses the front-rear direction of the first small tray 411. Then, in the first small tray 411, the additional resin material D is supplied from the two troughs 130A and 130B to the outer edge of the remaining half to which the additional resin material D is not supplied by the procedure illustrated in Figs. 9E to 9H. As a result, as illustrated in Fig. 9J, the additional resin material D is laminated over an entire circumference of the outer edge of the resin material disposed on the entire surface of the first small tray 411.

[0067]

As described above, while the resin material is supplied to the first small tray 411, the resin material is also supplied to the second small tray 412 by the third and fourth troughs 130C and 130D. Therefore, the resin material as shown in Fig. 9J is also disposed on the second small tray 412.

[0068]

<5. Method for Supplying Resin Material from Small Tray to Large Tray>

Next, a method for supplying the resin material from the small tray to the large tray will be described with reference to Figs. 10A to 10E. As illustrated in Fig. 10A, in an initial state, the first small tray 411 and the second small tray 412 are disposed on the resin material supply device 100 side, and the third small tray 413 and the fourth small tray 414 are disposed on the dust collection table 43. Then, when the resin material is disposed on the first small tray 411 and the second small tray 412, the small tray conveyance mechanism moves the first small tray 411 and the second small tray

412 above the large tray 44. As illustrated in Fig. 10B, the first small tray 411 is moved to a right front side of the large tray 44, and the second small tray 412 is moved to a left front side of the large tray 44. Then, as illustrated in Fig. 8, the shutter 41b is moved in the horizontal direction to discharge the resin material held in the slit 41c downward. As a result, the resin material is supplied to the groove 44c of each accommodation unit 44b of the large tray 44. In this way, the resin material is supplied to a front half of the large tray 44.

[0069]

At this time, the third small tray 413 and the fourth small tray 414 are moved to the resin material supply device 100 side.

[0070]

Next, as illustrated in Fig. 10C, the first small tray 411 and the second small tray 412 after the resin material is supplied to the large tray 44 are moved onto the dust collection table 43. Then, dust attached to the bottom surface of each of the small trays 411 and 412 is collected on the dust collection table 43.

[0071]

Subsequently, as illustrated in Fig. 10D, the resin material is supplied to the third small tray 413 and the fourth small tray 414 by the resin material supply device 100. This procedure is as shown in Figs. 9A to 9J.

[0072]

Subsequently, as illustrated in Fig. 10E, the small tray conveyance mechanism moves the third small tray 413 and the fourth small tray 414 above the large tray 44. At this time, the third small tray 413 is moved to a right rear side of the large tray 44, and the fourth small tray 414 is moved to a left rear side of the large tray 44. Then, the resin material held in the third small tray 413 and the fourth small tray 414 is supplied

to the large tray 44. In this way, the resin material is supplied to a rear half of the large tray 44. As a result, the resin material is disposed over the entire large tray 44.

[0073]

At this time, the resin material is disposed on an entire surface of the large tray 44, and the additional resin material D is disposed over a cross-shaped region passing through the center of the large tray 44 and an entire periphery of an outer edge of the large tray 44. A position where the additional resin material D is disposed corresponds to the gaps 85 to 87 on the panel shown in Fig. 1.

[0074]

<6. Molding Step in Molding Module and Subsequent Step>

When the resin material is disposed on the large tray 44 as described above, the loader 21 moves along the rail L to convey the panel P to one molding module 30. As illustrated in Fig. 11A, the panel P conveyed to the molding module 30 is attracted and held by an upper die 311 of the molding die 31.

[0075]

Next, a release film (not shown) is disposed so as to cover a cavity 313 of a lower die 312 of the molding die 31.

[0076]

Subsequently, the large tray conveyance mechanism 45 moves along the rail L, whereby the large tray 44 holding the resin material is conveyed to the molding die 31 of the molding module 30. Thereafter, as illustrated in Fig. 11A, the resin material of the large tray 44 is supplied to the cavity 313 of the lower die 312. The large tray conveyance mechanism 45 supplies the resin material to the molding die 31, and then returns to the resin supply module 40.

[0077]

Subsequently, the resin material is melted by the heater of the molding die 31. Thereafter, as shown in Fig. 11B, the lower die 312 and the upper die 311 are brought close to each other (clamped) by the clamping mechanism, and the electronic components 83 of the panel P are immersed in the molten resin material. In this state, an appropriate pressure is applied to the resin material. Then, by curing the resin material, the panel P in which the electronic components are resin-sealed can be obtained.

[0078]

Next, the lower die 312 and the upper die 311 are separated from each other (opened) by the clamping mechanism. Further, the unloader 22 moves along the rail L, and receives the resin-molded panel P from the molding die 31. At this time, the loader 21 moved together with the unloader 22 allows the new panel P before resin molding to be arranged in the molding die 31. Thereafter, the unloader 22 moves along the rail L and returns to the substrate transfer module 20.

[0079]

Subsequently, the panel P held by the unloader 22 is conveyed to the inspection unit 13 by the arm mechanism 14. The inspection unit 13 inspects the panel P after resin molding.

[0080]

The panel P subjected to the inspection is conveyed to the carry-out unit 12 by the arm mechanism 14. The panel P disposed in the carry-out unit 12 is carried out to the outside as appropriate.

[0081]

<7. Features>

In the panel described above, since the gaps 85 to 87 are formed between the

adjacent islands 83A to 83D and on the outer peripheries of the islands 83A to 83D, when resin molding by compression is performed, the molten resin flows into the gaps 85 to 87 described above. Therefore, there is a problem that the electronic component is detached from the panel by this flow.

[0082]

On the other hand, in the present embodiment, as illustrated in Fig. 11A, in the resin material disposed in the cavity 313 of the lower die 312, the additional resin material D is laminated in a portion corresponding to the gaps 85 to 87. Therefore, the flow of the resin into the gaps 85 to 87 is suppressed by the additional resin material D, and as a result, it is possible to suppress detachment of the electronic component 83.

[0083]

<8. Modifications>

Although one embodiment of the present invention has been described above, the present invention is not limited to each of the above embodiments, and various modifications can be made without departing from the gist thereof. For example, the following modifications are possible. The gist of the following modifications can be appropriately combined.

[0084]

(1) The components (the substrate carry-in and carry-out module 10 and the like) used in the resin molding device 1 of the above embodiment are merely examples, and can be appropriately attached/detached and replaced. For example, the carry-in and carry-out of the panel P can be manually performed by an operator without providing the substrate carry-in and carry-out module 10.

[0085]

(2) In the above embodiment, the large tray is formed to have a size four times

the size of the small tray, and the resin material is disposed on the large tray by supplying the resin material four times with the small tray, but the present invention is not limited thereto. For example, the large tray is formed to be twice the size of the small tray, and the resin material is supplied twice by the small tray, whereby the resin material can be disposed on the large tray. That is, the large tray may be formed n times as large as the small tray (n is a natural number of 2 or more), and the resin material may be disposed on the entire surface of the large tray by supplying the resin by the small tray n times.

[0086]

(3) The configurations of the small tray 41 and the large tray 44 shown in the above embodiment are merely examples, and the method for supplying the resin material and the method for holding the resin material can be appropriately changed.

[0087]

(4) In the above embodiment, the resin material supply device 100 including the two troughs 130 (resin supply units) has been exemplified, but the present invention is not limited thereto, and one or three or more troughs 130 may be provided.

[0088]

(5) The resin molding device 1 according to the above embodiment includes the two resin material supply devices 100, but the present invention is not limited thereto, and may include one or three or more resin material supply devices 100.

[0089]

(6) Further, in the present embodiment, the operation of each module is controlled by the single control unit 50, but the present invention is not limited thereto, and the plurality of control units 50 may be provided. For example, the control unit 50 may be provided for each module or each device, and the operation of each module or

the like may be individually controlled in conjunction with each other.

Reference Signs List

[0090]

1 Resin molding device

30 Molding module

31 Molding die

40 Resin supply module

50 Control unit

83 Electronic component

83A to 83D Island

85 to 87 Gap

411 to 414 Small tray (second tray)

44 Large tray (first tray)

Claims

[Claim 1] A resin supply device configured to supply a resin material to a molding die that molds a resin on a substrate by compression molding, the resin supply device comprising:

a first tray on which a resin material is placed;

at least one second tray that is smaller than the first tray and on which the resin material is placed;

a tray conveyance unit that conveys the second tray onto the first tray;

at least one resin supply unit that supplies the resin material to the second tray; and

a control unit, wherein

the control unit executes

a first step of spreading the resin material on the second tray by the resin supply unit;

a second step of spreading the resin material so as to overlap an outer edge of the resin material spread in the first step by the resin supply unit; and

a third step of conveying the second tray to the first tray, and placing the resin material on the second tray in a region of the first tray where the resin material is not placed, and

the resin material is placed in the first tray by repeating the first to third steps.

[Claim 2] The resin supply device according to claim 1, further comprising two or more of the second trays, wherein

the resin material is supplied to each of the second trays by a plurality of the resin supply units.

[Claim 3] The resin supply device according to claim 1 or 2, wherein the second

tray has a first region on the resin supply unit side and a second region on a side opposite to the first region, and

the control unit

supplies the resin material to the second region by rotating the second tray such that the second region faces the resin supply unit side after the resin material is spread on the first region of the second tray in the first step and the second step.

[Claim 4] The resin supply device according to claim 1 or 2, wherein the first tray and the second tray are formed in a rectangular shape,

the first tray is formed in a size four times as large as a size of the second tray, and

the resin material conveyed by the second tray is supplied to each region obtained by dividing the first tray into four in vertical and horizontal directions.

[Claim 5] The resin supply device according to claim 1 or 2, wherein the substrate includes

a carrier, and

a plurality of electronic components fixed onto the carrier by a temporary fixing material, and

a plurality of islands including the plurality of electronic components is placed on the carrier with a gap,

the resin material is placed so as to face the substrate in the molding die, and

the additional resin material is placed at a position corresponding to the gap of the substrate.

[Claim 6] A resin molding device comprising:

a molding module including a molding die for compression molding; and

a resin supply module including the resin supply device according to claim 1 or

2 and supplying a resin material of the first tray to the molding die of the molding module.

[Claim 7] A resin supply method for supplying a resin material to a molding die that molds a resin on a substrate by compression molding, the resin supply method comprising:

a first step of preparing a first tray and a second tray smaller than the first tray;

a second step of spreading a resin material on the second tray;

a third step of spreading the resin material so as to overlap an outer edge of the resin material spread in the first step; and

a fourth step of conveying the second tray to the first tray and placing the resin material on the second tray in a region of the first tray where the resin material is not placed, wherein

the resin material is placed on the first tray by repeating the second to fourth steps.

[Claim 8] A method for producing a resin molded article, the method comprising:

a step of preparing a substrate including a carrier and a plurality of electronic components fixed onto the carrier by a temporary fixing material, a plurality of islands including the plurality of electronic components being placed on the carrier with a gap;

a step of supplying a resin material to the first tray by the resin supply method according to claim 7;

a step of placing the resin material of the first tray in a molding die;

a step of placing the substrate in the molding die; and

a step of molding the resin material on the substrate by compression molding in the molding die.