RESIN-SPRINKLING METHOD, RESIN-MOLDING METHOD, RESIN-SPRINKLING APPARATUS, RESIN-MOLDING APPARATUS, AND PRODUCTION APPARATUS FOR RESIN-MOLDED ARTICLE

CROSS-REFERENCE TO RELATED APPLICATION

This application claims priority from Japanese Patent Application No. 2013-266088 filed on December 24, 2013. The entire subject matter of the Japanese Patent Application is incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a resin-sprinkling method, a resin-molding method, a resin-sprinkling apparatus, a resin-molding apparatus, and a production apparatus for a resin-molded article.

[0002] Electronic components such as IC, semiconductor electronic components, and the like are mostly molded as resin-encapsulated electronic components to use.

[0003] In a resin-encapsulation method for one or more electronic components, for example, by supplying resin into a die cavity, resin-encapsulation of the electronic component(s) is performed in the die cavity. An example of the method of supplying resin into the die cavity includes the method disclosed in JP 2010-36542A. In this method, first, a plate for resin containment provided with a through-hole corresponding to the die cavity is prepared, and the undersurface of the plate is covered with a release film. Thereby, the through-hole is formed into a resin containing portion of the plate. Next, by supplying a needed amount of resin material to the resin containing portion of the plate and making the thickness of the resin material uniform, a planarized resin-distributed plate is formed. By placing this resin-distributed plate at the position of the die cavity and covering the cavity surface with the release film, the resin is supplied into the die cavity from the resin containing portion.

[0004] According to the method disclosed in JP 2010-36542A, it is possible to efficiently supply resin into the die cavity and efficiently improve the reliability of the amount of the resin to be supplied into the die cavity at the time of supplying the resin into the die cavity.

BRIEF SUMMARY OF THE INVENTION

[0005] In recent years, as substrates (wafers) for electronic components such as semiconductor electronic components and the like, large circular substrates are being used. Hence, for performing resin-encapsulation of one or more electronic components placed on the large circular substrate, there is a need for a method that can supply resin to an area corresponding to such a substrate uniformly with a constant amount.

[0006] Although the method disclosed in JP 2010-36542A can be applied to a relatively small rectangular substrate and die cavity, it is difficult to supply resin to an area corresponding to a large circular substrate uniformly with a constant amount using the method disclosed in JP 2010-36542A.

[0007] Hence, the present invention is intended to provide a resin-sprinkling method, a resin-molding method, a resin-sprinkling apparatus, a resin-molding apparatus, and a production apparatus for a resin-molded article that can supply resin to a large circular area uniformly with a constant amount.

[0008] In order to achieve the aforementioned purpose, the present invention provides a resin-sprinkling method of sprinkling resin on a substantially circular resin-sprinkling area on a release film, wherein resin is sprinkled by moving a drop point of the resin in a direction substantially coincident with a circumferential direction of the resin-sprinkling area while dropping the resin on the resin-sprinkling area.

[0009] The present invention also provides a resin-molding method, including: a resin-sprinkling step of sprinkling resin on a release film by the resin-sprinkling method of the present invention; and a resin-molding step of

molding the sprinkled resin on the release film.

[0010] The present invention also provides a resin-sprinkling apparatus for conducting the resin-sprinkling method of the present invention, including: a resin drop unit dropping resin on the resin-sprinkling area; and a drop point movement unit moving the drop point of the resin in the direction substantially coincident with the circumferential direction of the resin-sprinkling area.

[0011] The present invention also provides a resin-molding apparatus for conducting the resin-molding method of the present invention, including: a resin-sprinkling unit conducting the resin-sprinkling step; and a resin-molding unit conducting the resin-molding step, wherein the resin-sprinkling unit is the resin-sprinkling apparatus of the present invention.

[0012] The present invention also provides a production apparatus for a resin-molded article, including: a release film cutting unit cutting a release film; the resin-molding apparatus of the present invention; and a transfer unit, wherein the resin-sprinkling unit sprinkles resin on the release film that has been cut, the resin-molding unit produces the resin-molded article by molding the sprinkled resin on the release film that has been cut, and the transfer unit transfers at least the resin-molded article after resin-molding.

[0013] According to the resin-sprinkling method, the resin-molding method, the resin-sprinkling apparatus, the resin-molding apparatus, and the production apparatus for a resin-molded article of the present invention, it is possible to supply resin to a large circular area uniformly with a constant amount.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] [FIG. 1] FIG. 1 shows schematic views illustrating an example of the usage pattern of the release film in Example; FIG. 1(A) is a plan view; and FIG. 1(B) is a cross sectional view.

[FIG. 2] FIG. 2 shows schematic views illustrating the outline of the resin-sprinkling apparatus in Example; FIG. 2(A) is a plan view; and FIG. 2(B) is a cross sectional view.

[FIG. 3] FIG. 3 is a plan view schematically showing the locus of the drop point of resin in the resin-sprinkling method of Example.

[FIG. 4] FIG. 4 is a plan view schematically showing the locus of the drop point of the resin in the resin-sprinkling method of Example that is different from Example of FIG. 3.

[FIG. 5] FIG. 5 is a plan view schematically showing an example of the production apparatus for a resin-encapsulated molded article of the present invention.

DETAILED DESCRIPRION OF THE INVENTION

[0015] Next, the present invention will be described in more detail with reference to exemplary embodiments. However, the present invention is not limited by the following description.

[0016] In the resin-sprinkling method of the present invention, preferably, the resin is sprinkled while moving the drop point of the resin in a spiral fashion.

[0017] In the resin-sprinkling method of the present invention, preferably, the resin-sprinkling area is separated into a plurality of virtual areas, sprinkling of the resin is performed for each of the virtual areas on the resin-sprinkling area, the virtual area is an area enclosed by an outer periphery, a center, and radiuses of the resin-sprinkling area, and the sprinkling of the resin within the virtual area is performed by moving the drop point of the resin in a serpentine manner within the virtual area from a center toward an outer edge of the resin-sprinkling area or from the outer edge toward the center of the resin-sprinkling area.

[0018] In the resin-sprinkling method of the present invention, preferably, a substantially circular frame is placed on the release film and the resin is

sprinkled on an inside of the frame as a resin-sprinkling area.

[0019] In the resin-sprinkling method of the present invention, preferably, movement of the drop point of the resin is performed by moving the release film so as to relatively move the drop point relative to the release film.

[0020] In the resin-sprinkling method of the present invention, preferably, the resin is sprinkled in a state where the release film is fixed on a film fixing base.

[0021] In the resin-sprinkling method of the present invention, preferably, the drop point of the resin is moved from the center toward the outer edge of the resin-sprinkling area or from the outer edge toward the center of the resin-sprinkling area while moving the drop point of the resin in the direction substantially coincident with the circumferential direction of the resin-sprinkling area.

[0022] In the resin-sprinkling method of the present invention, preferably, the moving speed of the drop point of the resin is maintained substantially constant.

[0023] In the resin-sprinkling method of the present invention, preferably, the angular speed of the movement of the drop point of the resin slows down as reaching the outer edge from the center of the resin-sprinkling area.

[0024] In the resin-sprinkling method of the present invention, preferably, the movement of the drop point of the resin is controlled by a computer program.

[0025] In the resin-sprinkling method of the present invention, the resin may be, for example, in a form of granule, powder, liquid, or paste.

[0026] In the resin-molding method of the present invention, preferably, in the resin-molding step, at least one electronic component is resin-encapsulated.

[0027] In the resin-sprinkling apparatus of the present invention, preferably, the drop point movement means (unit) is a means moving the drop point of the resin in a spiral fashion.

[0028] In the resin-sprinkling apparatus of the present invention, preferably, the resin-sprinkling area is separated into a plurality of virtual areas, the resin is dropped for each of the virtual areas on the resin-sprinkling area, the virtual area is an area enclosed by an outer periphery, a center, and radiuses of the resin-sprinkling area, and the drop point movement means is a means moving the drop point of the resin in a serpentine manner within the virtual area from a center toward an outer edge of the resin-sprinkling area or from the outer edge toward the center of the resin-sprinkling area.

[0029] Preferably, the resin-sprinkling apparatus of the present invention further includes a substantially circular frame, the substantially circular frame is placed on the release film, and the resin is sprinkled on an inside of the frame as the resin-sprinkling area.

[0030] In the resin-sprinkling apparatus of the present invention, preferably, the drop point movement means is a means moving the release film so as to relatively move the drop point relative to the release film.

[0031] Preferably, the resin-sprinkling apparatus of the present invention further includes a film fixing base, the release film is fixed on the film fixing base, and the resin is sprinkled in this state. In this case, more preferably, the drop point movement means is a means moving the film fixing base together with the release film so as to relatively move the drop point relative to the release film.

[0032] In the resin-sprinkling apparatus of the present invention, preferably, the drop point movement means is a means moving the drop point of the resin from the center toward the outer edge of the resin-sprinkling area or from the outer edge toward the center of the resin-sprinkling area while moving the drop point of the resin in the direction substantially coincident with the circumferential direction of the resin-sprinkling area.

[0033] In the resin-sprinkling apparatus of the present invention, preferably, the drop point movement means is a means maintaining the moving speed of the drop point of the resin substantially constant.

[0034] In the resin-sprinkling apparatus of the present invention, preferably, the drop point movement means is a means slowing down an angular speed of movement of the drop point of the resin as reaching the outer edge from the center of the resin-sprinkling area.

[0035] In the resin-sprinkling apparatus of the present invention, preferably, the movement of the drop point of the resin by the drop point movement means is controlled by a computer program.

[0036] In the production apparatus for a resin-molded article of the present invention, preferably, the release film cutting means (unit), the resin-sprinkling means (unit), the resin-molding means (unit), and the transfer means (unit) are separately arranged as independent units, and at least one of the units is detachable to at least another one of the units.

[0037] Hereinafter, specific Examples of the present invention will be described with reference to Figures. Each Figure is schematically illustrated by appropriately omitting, exaggerating, and the like for convenience in explanation.

Example 1

[0038] In Example 1, an example in which the resin is sprinkled while moving the drop point of the resin in a spiral fashion will be described.

[0039] In FIG. 1, an example of the usage pattern of the release film in Example 1 is schematically shown. FIG. 1(A) is a plan view. FIG. 1(B) is a cross sectional view of FIG. 1(A) viewed from the line I-I'. As shown in FIG. 1, this usage pattern includes a release film 11, a frame 12, and a film fixing base 13. The release film 11, the frame 12, and the film fixing base 13 are each circular. The release film 11 is placed and fixed on the film fixing base 13. The frame 12 is placed on the outer edge of the release film 11. The release film 11 is interposed between the frame 12 and the film fixing base 13. That is, the frame 12 is placed on the film fixing base 13 via the release film 11. The release film 11, the frame 12, and the film fixing base 13 are arranged concentrically. Such an arrangement forms a resin containing

portion enclosed by the inner periphery of the frame 12 and the top surface of the release film 11. Furthermore, the inside of the frame 12 on the release film 11 serves as a resin-sprinkling area.

[0040] In FIG. 2, the outline of the resin-sprinkling apparatus in Example 1 is schematically shown. FIG. 2(A) is a plan view. FIG. 2(B) is a cross sectional view of FIG. 2(A) viewed from the line II-II'. The apparatus shown in FIG. 2 is an example of the resin-sprinkling apparatus of the present invention. As shown in FIG. 2, this apparatus includes the film fixing base 13, a film fixing base movement means (not shown) for moving or rotating the film fixing base 13 in the horizontal direction, a resin supply means 14, and a linear feeder 15 as main components. In FIG. 2, the release film 11 and the frame 12 are placed on the film fixing base 13 in the state shown in FIG. 1. In the inside of the resin supply means 14, resin granules 16 are contained. The linear feeder 15 is attached to the resin supply means 14. The linear feeder 15 is gutter-shaped or cylindrical and includes a path (groove or hole) for the resin granules 16. It is possible to drop the resin granules 16 on the release film 11 from a resin supply port at the tip of the linear feeder 15. For example, by vibrating the resin supply means 14 together with the linear feeder 15, it is possible to move the resin granules 16 in the resin supply means 14 toward the tip of the linear feeder 15 and to drop them from the resin supply port. That is, the resin supply means 14 and the linear feeder 15 correspond to the "resin drop means" dropping resin on the release film. In FIG. 2, as can be seen from the figure, the resin granules 16 are dropped on the inside of the frame 12 on the release film 11, i.e., the resin granules 16 are dropped on the resin-sprinkling area. In this manner, the resin granules 16 are supplied to the resin containing portion enclosed by the inner periphery of the frame 12 and the top surface of the release film 11.

[0041] Furthermore, in the apparatus of FIG. 2, it is possible to freely move or rotate the film fixing base 13 in the horizontal direction by the film fixing base movement means. By moving or rotating the film fixing base 13

together with the release film 11 by the film fixing base movement means, the drop point of the resin granule 16 can be relatively moved or rotated relative to the release film 11. Thereby, for example, the drop point of the resin granule 16 can be moved in the direction substantially coincident with the circumferential direction of the release film 11. That is, the film fixing base movement means corresponds to the "drop point movement means" moving the drop point of the resin in the direction substantially coincident with the circumferential direction of the release film.

[0042] In the resin-sprinkling method of Example 1, using the apparatus of FIG. 2, the resin granules 16 are sprinkled while moving the drop point of the resin granule 16 in a spiral fashion concentric with the release film 11. In FIG. 3, the movement locus of the drop point of the resin granule 16 in the resin-sprinkling method of Example 1 is schematically shown. FIG. 3 is a plan view showing the state in which the frame 12 is placed on the release film 11 as in FIG. 1(A) and FIG. 2(A). As shown in FIG. 3, the drop of the resin granule 16 (not shown in FIG. 3) is started from the center 101 of the release film 11. Then, the drop point of the resin granule 16 is moved such that the drop point draws a locus 102 (indicated by arrow) in a spiral fashion concentric with the resin-sprinkling area at the inside of the frame 12. That is, the drop point is moved from the center 101 toward the outer edge of the release film 11 while moving the drop point in the direction substantially coincident with the circumferential direction of the resin-sprinkling area. At this time, the resin supply means 14 and the linear feeder 15 are kept stationary. As described above, by the film fixing base movement means, the film fixing base 13 is moved together with the release film 11 so as to relatively move the drop point of the resin granule 16 relative to the release film 11. In this manner, the resin granules 16 are sprinkled on the inside of the frame 12 (the resin-sprinkling area) on the release film 11.

[0043] Here, in terms of sprinkling the resin granules 16 more uniformly with a constant amount, it is preferable to sprinkle the resin granules 16

unicursally such that the locus 102 of the resin drop point is not interrupted along the way.

[0044] In the present invention, for moving the drop point of the resin, the drop point itself may be moved without moving the release film. For example, in FIG. 2, it is also possible to move the drop point of the resin by moving the resin supply means 14 and the linear feeder 15 without moving the film fixing base 13. However, as described above, it is preferable to move the film fixing base 13 together with the release film 11 so as to relatively move the drop point of the resin granule 16 relative to the release film 11. The reason is as follows: if the resin supply means 14 and the linear feeder 15 are kept stationary, it prevents development of the unevenness in a resin-sprinkling amount (supply amount) for each drop point due to the vibration or the like because of the movement of the resin supply means 14 and the linear feeder 15.

[0045] In the resin-sprinkling method of the present invention, in terms of maintaining the resin-sprinkling amount (supply amount) for each drop point constant as much as possible, as described above, it is preferable to maintain the moving speed of the drop point of the resin substantially constant. Therefore, as described above, it is preferable to slow down the angular speed of the movement of the drop point of the resin as reaching the outer edge from the center of the resin-sprinkling area. That is, in FIG. 3, it is preferable to move the drop point so as to draw the locus 102 by slowing down the angular speed of the movement of the drop point of the resin granule 16 as reaching the outer edge from the center 101 of the release film 11. In the resin-sprinkling method of the present invention, there is no particular limitation on the moving speed of the drop point of the resin. For example, it is preferable to control the angular speed of the movement of the drop point such that the moving speed of the drop point of the resin is maintained substantially constant within a numerical range.

[0046] Furthermore, in the resin-sprinkling method of the present invention,

it is possible to start the sprinkling of the resin from the center and move toward the outer edge of the resin-sprinkling area or to start the sprinkling of the resin from the outer edge and move toward the center. For example, in FIG. 3, the drop of the resin granules 16 may be started from the outer edge of the inside of the frame 12 (the resin-sprinkling area) toward the center 101 of the release film 11 while moving the drop point in the direction substantially coincident with the circumferential direction of the release film 11. However, as described above, it is preferable to move the drop point of the resin from the center toward the outer edge of the resin-sprinkling area while moving the drop point of the resin in the direction substantially coincident with the circumferential direction of the resin-sprinkling area. This is because it is preferable to slow down the angular speed of the movement of the drop point of the resin as reaching the outer edge from the center of the resin-sprinkling area. That is, as the angular speed of the movement of the drop point of the resin (for example, the movement because of the movement of the release film) is increased, the resin already supplied (sprinkled) on the resin-sprinkling area is likely to move by the centrifugal force. The movement of the sprinkled resin by the centrifugal force may cause ununiformity in the amount of the resin on the resin-sprinkling area place by place. For preventing this ununiformity, it is preferable to move the drop point of the resin from the center toward the outer edge of the resin-sprinkling area and slow down the angular speed of the movement as reaching the outer edge.

[0047] Here, there are no particular limitations on the resin supply means 14 and the linear feeder 15, and the ones used in a general resin-encapsulation method for one or more electronic components can be used as they are or can be used after changing their designs as required. Examples of the resin supply means and the linear feeder used in a general resin-encapsulation method for one or more electronic components include input side distribution means 31a (feeder side measurement means 33,

hopper 34, and linear vibration feeder 35) shown in FIG. 1 of JP 2010-36542A and the like. Preferably, the resin supply means 14 is provided with, for example, a load cell for measurement. As described above, for example, by vibrating the resin supply means 14 together with the linear feeder 15, it is possible to move the resin granules in the resin supply means 14 toward the tip of the linear feeder 15 and to drop them from the resin supply port. In the linear feeder 15, while there is no particular limitation on the shape of the path for the resin granules, for example, if the bottom of the path is flat, the resin can easily be sprinkled uniformly with a constant amount.

[0048] Note here that, there is no particular limitation on the locus of the drop point of the resin granule 16, and it may be in a counterclockwise direction as the locus indicated by numeral 102 of FIG. 3 or may be in a clockwise direction. In the case of drawing the locus 102 in a counterclockwise direction as shown in FIG. 3 by the movement of the film fixing base 13, the film fixing base 13 is caused to be rotated in a clockwise direction.

[0049] As described above, it is preferable to control the movement of the drop point of the resin granule 16 by a computer program. Thereby, for example, the resin granules 16 can be sprinkled more uniformly with a constant amount, and a predetermined amount (not too much and not too little) of the resin granule 16 can be sprinkled from the start to end of the locus 102. For the same reason, in the resin-sprinkling method of the present invention, even in the case where the locus of the drop point of the resin is different from the one shown in FIG. 3, it is preferable to control the movement of the drop point of the resin granule 16 by a computer program.

[0050] Next, after sprinkling the resin granules 16 on the resin-sprinkling area on the release film 11 (resin-sprinkling step), one or more electronic components are encapsulated with the sprinkled resin granules 16 on the release film 11 (resin-encapsulation step). There is no particular limitation on the resin-encapsulation step. The resin-encapsulation step may be

performed according to, for example, a general resin-encapsulation method or may be performed according to, for example, the resin-encapsulation method disclosed in JP 2010-36542A.

[0051] Note here that, in the present invention, the shape of the resin-sprinkling area is not necessarily a perfect circle and can be a substantial circle, although a perfect circle is ideal. Examples of the substantial circle include an ellipse, an ellipse that is nearly a perfect circle, and polygons (for example, hexagon, octagon, and decagon). Ideally, the length of the minor axis (shortest diameter) and the length of the major axis (longest diameter) of the resin-sprinkling area are the same (i.e., the resin-sprinkling area is a perfect circle). Moreover, there is no particular limitation on the shape of the release film, and the release film may be a perfect circle, a substantial circle, or any other shapes (for example, square, rectangle, etc.). From the viewpoint of easy handling of the release film at the time of performing the resin-sprinkling method of the present invention and the like, the release film is preferably a substantial circle or a perfect circle. Hereinafter, the "diameter" of the resin-sprinkling area, the release film, or the like indicates the major axis unless otherwise noted.

[0052] There is no particular limitation on the size of the release film 11. As described above, the present invention is particularly adequate to, for example, resin-sprinkling on a large release film. In the present invention, there is no particular limitation on the diameter of the area (inside of frame 12 in FIG. 3) to which resin is sprinkled on the release film 11. As an example, the diameter of the resin-sprinkling area may be, for example, 300 mm.

[0053] In the present invention, there is no particular limitation on the form of the resin. As described above, for example, the resin may be in the form of granule, powder, liquid, or paste. The resin is preferably in the form of granule or powder and is particularly preferably in the form of granule as in Example 1. There are no particular limitations on the types of the resin,

and the types of the resin may be, for example, thermoplastic resins or thermosetting resins. Moreover, for example, the resin may be at least one selected from the group consisting of transparent resins, translucent resins, and opaque resins.

[0054] According to the present invention, as described above, it is possible to supply resin to a large circular area uniformly with a constant amount. For example, it is possible to supply a correctly measured constant amount of resin to the circular area (resin-sprinkling area) with a uniform thickness in a planarized manner, i.e., it is possible to sprinkle a constant amount of resin per unit time. Thereby, for example, one or more resin-encapsulated electronic components mounted on a large circular substrate can be produced. That is, for example, the present invention can be applied to the production of a plurality of resin-encapsulated electronic components from a resin-encapsulated substrate (molded substrate) having a large circular substrate.

Example 2

[0055] Next, another Example of the present invention will be described.

[0056] In Example 2, the resin-sprinkling area is separated into a plurality of virtual areas, and sprinkling of the resin is performed for each of the virtual areas on the resin-sprinkling area. The virtual area is an area enclosed by the outer periphery, the center, and the radiuses of the resin-sprinkling area. The sprinkling of the resin within the virtual area is performed by moving the drop point of the resin in a serpentine manner within the virtual area from the center toward the outer edge of the resin-sprinkling area or from the outer edge toward the center of the resin-sprinkling area. Except for this, Example 2 can be performed in the same manner as in Example 1.

[0057] In FIG. 4, the movement locus of the drop point of the resin granule 16 in the resin-sprinkling method of Example 2 is schematically shown. FIG. 4 is a plan view showing the state in which the frame 12 is placed on the

release film 11 as in FIG. 1(A) and FIG. 2(A). As shown in FIG. 4, the resin-sprinkling area is separated into eight virtual areas 103, and the resin granules 16 are sprinkled for each of the virtual areas. As shown in FIG. 4, the virtual areas 103 are each an area enclosed by the outer periphery, the center, and the radiuses of the resin-sprinkling area. The locus of the movement of the drop point of the resin granule 16 is indicated by a serpentine arrow 104. As shown in FIG. 4, the sprinkling of the resin granules 16 for each virtual area 103 is performed by moving the drop point of the resin granule 16 in a serpentine manner (zigzag manner) within the virtual area 103 from the center toward the outer edge of the resin-sprinkling area along the arrow 104. Here, contrary to FIG. 4, the drop point of the resin granule 16 can be moved from the outer edge toward the center of the resin-sprinkling area. However, for the same reason as described in Example 1 (for preventing movement of sprinkled resin by centrifugal force), it is preferable to move the drop point of the resin granule 16 from the center toward the outer edge of the resin-sprinkling area. When the sprinkling of the resin granules 16 with respect to one virtual area 103 is finished in this manner, the resin granules 16 are sprinkled on another virtual area in the same manner as described above. In this manner, by sprinkling the resin granules 16 on all of the virtual areas one by one, the resin granules 16 are sprinkled on the whole resin-sprinkling area.

[0058] As in Example 2, when the resin-sprinkling area is separated into a plurality of virtual areas and sprinkling of the resin is performed for each of the virtual areas, the resin-sprinkling amount (supply amount) for each drop point can be set more uniformly. Specifically, for example, in the case where the movement of the drop point of the resin is controlled by a computer program, it allows easier control and allows the resin-sprinkling amount (supply amount) for each drop point to be kept more uniformly. This makes it easier to supply resin within the resin-sprinkling area uniformly with a constant amount. The number of the virtual areas is eight in FIG. 4.

However, the number of the virtual areas is not limited thereto and can be any number. For example, the number of the virtual areas may be four to eight.

[0059] Also in Example 2, for the same reason as described in Example 1, it is preferable to maintain the moving speed of the drop point of the resin substantially constant. Therefore, as described above, it is preferable to slow down the angular speed of the movement of the drop point of the resin as reaching the outer edge from the center of the resin-sprinkling area. There are no particular limitations on the specific numerical values of the moving speed of the drop point of the resin and the angular speed of the movement of the resin, and, for example, the numerical values are the same as those in Example 1.

Example 3

[0060] Next, yet another Example of the present invention will be described. In Example 3, an example of the production apparatus for a resin-molded article of the present invention and the production method for one or more resin-encapsulated electronic components (resin-molded article) using the same will be described.

[0061] In the plan view of FIG. 5, the configuration of the production apparatus for a resin-molded article of Example 3 is schematically shown. The production apparatus for a resin-molded article shown in FIG. 5 is an apparatus for producing one or more resin-encapsulated electronic components. As shown in FIG. 5, in this apparatus, a release film cutting unit (release film cutting means) 510, a resin-sprinkling means (resin-sprinkling unit) 520, a resin-encapsulation means (resin-molding unit, molding unit, or resin-encapsulation unit) 530, and a transfer means (transfer unit) 540 are arranged in this order from the right side. These units are separately arranged as independent units, and they are detachable to the adjacent units.

[0062] By the release film cutting unit (release film cutting means) 510, a

circular release film can be cut out and separated from a long release film. As shown in FIG. 5, the release film cutting unit 510 includes a film fixing base placement means 511, a rolled release film 512, and a film gripper 513. On the top surface of the film fixing base placement means 511, the film fixing base 13 shown in FIGs. 1 and 2 (not shown in FIG. 5) is placed. As shown in FIG. 5, the tip of the release film can be drawn from the rolled release film 512, the top surface of the film fixing base 13 placed on the film fixing base placement means 511 can be covered with the release film, and the release film can be fixed on the film fixing base 13. The film gripper 513 allows the drawing of the release film from the rolled release film 512 as well as the fixation of the tip of the release film drawn from the rolled release film 512 at the side opposite to the rolled release film 512 in relation to the film fixing base placement means 511. On the film fixing base placement means 511, the circular release film 11 can be made by cutting the release film by a cutter (not shown). The release film cutting unit 510 includes a waste material disposal means (not shown). The waste material disposal means is a means for disposing a waste material, i.e., a release film remaining after cutting and separating the circular release film 11.

[0063] The resin-sprinkling unit (resin-sprinkling means) 520 includes the resin-sprinkling apparatus shown in Example 1 or Example 2, a resin loader 521, and an aftertreatment means 522. The resin-sprinkling apparatus includes the release film 11, the frame 12, the film fixing base 13, the resin supply means 14, and the linear feeder 15 as described in Examples 1 and 2. Since FIG. 5 is a plan view (overhead view) as same as in FIG. 2, the film fixing base 13 cannot be seen and is not shown. In FIG. 5, the resin-sprinkling apparatus further includes a film fixing base movement means 523. On the film fixing base movement means 523, the film fixing base 13 and the release film 11 are placed. By moving or rotating the film fixing base movement means 523 in the horizontal direction, it is possible to move or rotate the film fixing base 13 placed on the film fixing base

movement means 523 together with the release film 11. In FIG. 5, the film fixing base movement means 523 is the same component as the film fixing base placement means 511 and can be moved between the release film cutting unit 510 and the resin-sprinkling unit 520. The resin loader 521 and the aftertreatment means 522 are formed integrally. In the state where the resin granules 16 (not shown in FIG. 5) are supplied on the release film 11 (on the resin containing portion) attracted by the undersurface of the frame (circular frame) 12, the circular frame 12 and the release film 11 can be attached by engaging using the resin loader 521. Then, in that state, resin granules can be set in the lower die cavity for compression molding that will be described below in the resin-encapsulation unit (molding unit) 530 in the state where the release film 11 is covered with the resin granules.

[0064] As shown in FIG. 5, the resin-encapsulation unit (molding unit) 530 includes a die (molding die) 531. The die 531 includes an upper die and a lower die (not shown) as main components, and a lower die cavity 532 is circular as shown in FIG. 5. The die 531 is further provided with an upper die substrate set portion (not shown) and a cavity bottom surface member for resin pressurization (not shown). In the resin-encapsulation unit (molding unit) 530, by performing resin-encapsulation of one or more electronic components (for example, semiconductor chip) mounted on the not-yet-resin-encapsulated substrate (not-yet-molded substrate) that will be described below in encapsulation resin (resin package) in the lower die cavity, a resin-encapsulated substrate (molded substrate) can be formed.

[0065] The transfer means (transfer unit) 540 allows transfer of one or more electronic components (component to be resin-encapsulated) before resin-encapsulation together with a substrate and transfer of one or more resin-encapsulated electronic components (resin-encapsulated molded article) after resin-encapsulation. As shown in FIG. 5, the transfer means (transfer unit) 540 includes a substrate loader 541, rails 542, and a robot arm 543. The rails 542 stick out from the transfer means (transfer unit) 540 and reach

the areas of the resin-encapsulation unit 530 and the resin-sprinkling unit 520. On the substrate loader 541, a substrate 544 can be placed. The substrate 544 may be a not-yet-resin-encapsulated substrate (not-yet-molded substrate) 544a or a resin-encapsulated substrate (molded substrate) 544b. The substrate loader 541 and the resin loader 521 (aftertreatment means 522) can be moved on the rails 542 among the resin-sprinkling unit 520, the resin-encapsulation unit 530, and the transfer unit 540. As shown in FIG. 5, the transfer unit 540 further includes substrate containing portions and is capable of containing the not-yet-resin-encapsulated substrate (not-yet-molded substrate) 544a and the resin-encapsulated substrate (molded substrate) 544b respectively. On the not-yet-molded substrate 544a, one or more electronic components (not shown, for example, semiconductor chip) are mounted. On the molded substrate 544b, one or more resin-encapsulated electronic components (resin-encapsulated molded article) is formed by encapsulating the electronic component(s) with resin (encapsulation resin) 16b. The robot arm 543 can be used, for example, as follows. That is, first, by flipping the not-yet-molded substrate 544a taken out from the containing portion for the not-yet-molded substrate 544a over, the not-yet-molded substrate 544a can be placed on the substrate loader 541 with the electronic component(s) mounted side down. Second, by taking out the molded substrate 544b from the substrate loader 541 and flipping the molded substrate 544b over, the molded substrate 544b can be contained in the containing portion for the molded substrate with the encapsulation resin 16b side up.

[0066] The production method for the resin-encapsulated electronic component(s) (resin-molded article) using the production apparatus for a resin-molded article shown in FIG. 5 can be performed, for example, as follows.

[0067] First, in the release film cutting unit (release film cutting means) 510, as described above, by the film gripper 513, the tip of the release film is

drawn from the rolled release film 512, the top surface of the film fixing base 13 placed on the film fixing base placement means 511 is covered with the release film, and the release film is fixed on the film fixing base 13. In that state, as described above, the circular release film 11 is made by cutting the release film by a cutter (not shown). A waste material, i.e. a release film remaining after cutting and separating the circular release film 11 is disposed by a waste material disposal means (not shown).

[0068] Next, the film fixing base placement means 511 (film fixing base movement means 523) is moved to the position below the resin supply port of the linear feeder 15 in the resin-sprinkling unit 520 together with the film fixing base 13 (not shown) and the release film 11 placed on the film fixing base placement means 511 (film fixing base movement means 523). Then, the circular frame 12 is placed on the release film 11 and the release film 11 is attracted by and fixed at the undersurface of the circular frame 12. In this state, on the release film 11 in the circular frame 12, resins (for example, resin granules 16) are sprinkled. The sprinkling of the resin can be performed, for example, as described in Example 1 or 2. In this case, the movement of the drop point of the resin can be performed by moving (or rotating) the film fixing base movement means 523 together with the film fixing base 13 (not shown) and the release film 11 (circular frame 12) placed on the film fixing base movement means 523.

[0069] Next, the release film 11 (and resin sprinkled on circular frame 12) is moved from the film fixing base movement means 523 and is held by the resin loader 521 together with the circular frame 12. The movement of the release film 11 from the film fixing base movement means 523 to the resin loader 521 can be performed by holding the circular frame 12 including the release film 11 (resin) by a holding means (not shown) of the resin loader 521.

[0070] Next, as described above, the not-yet-molded substrate 544a taken out from the containing portion for the not-yet-molded substrate 544a is flipped over by the robot arm 543. Thereby, the not-yet-molded substrate

544a is placed on the substrate loader 541 with the electronic component(s) mounted side down and is transferred into the resin-encapsulation unit 530. At this time, the not-yet-molded substrate 544a is set at the die surface of the upper die (die 531). Next, the resin loader 521 that holds the circular frame 12 (including release film 11 and resin) is moved on the rails 542 together with the aftertreatment means 522 that is integrally formed with the resin loader 521 and is transferred into the resin-encapsulation unit 530. At this time, by placing the circular frame 12 (resin) on which the release film 11 is fixed on the die surface of the lower die (die 531), the lower die cavity 532 having a circular opening is covered with the release film 11, and the resin can be supplied into the lower die cavity 532. Thereafter, the resin loader 521 in the state of holding the circular frame 12 is moved to the resin-sprinkling unit 520 side. Then, the circular frame 12 is placed on the release film 11 placed on the film fixing base 13 in the resin-sprinkling unit 520, and resin is again sprinkled on the release film 11 in the circular frame 12.

[0071] Next, the resin is melted, and further, in the resin-encapsulation unit 530, the die 531 (upper die and lower die) is clamped. Thereby, one or more electronic components mounted on the not-yet-molded substrate 544a set at the upper die are in the state of being soaked in resin in the lower die cavity 532, and the resin in the lower die cavity 532 can be pressurized by the cavity bottom surface member. Then, by solidifying the resin in the die 531 (lower die cavity 532), the electronic component(s) is encapsulated (resin-molded) with solidified resin 16b. Thereby, the resin-encapsulated substrate 544b (molded substrate, resin-encapsulated electronic component(s)) is formed. Next, by unclamping the die 531 (upper die and lower die), the resin-encapsulated substrate 544b is taken out by the substrate loader 541 and is transferred to and contained at the transfer unit 540 side. Furthermore, after taking out the resin-encapsulated substrate (molded substrate, resin-encapsulated electronic component(s)) 544b from the die 531

by the substrate loader 541, the substrate set portion of the upper die is cleaned using an upper die surface cleaner (not shown) of the aftertreatment means 522. In parallel with this or by shifting the timing, the release film that is no longer required can be taken out from the lower die surface using a release film removal means (not shown) of the aftertreatment means 522.

[0072] Alternatively, the substrate loader 541 on which the resin-encapsulated substrate 544b (resin-encapsulated electronic component(s)) is placed may be transferred from the resin-encapsulation unit 530 to the transfer unit 540. In this case, as described above, the resin-encapsulated substrate (molded substrate, resin-encapsulated electronic component(s)) 544b is taken out from the substrate loader 541 and is flipped over by the robot arm 543. Thereby, the resin-encapsulated substrate (molded substrate, resin-encapsulated electronic component(s)) 544b is contained in the containing portion for the resin-encapsulated substrate (molded substrate, resin-encapsulated electronic component(s)) with the encapsulation resin 16b side up. In this manner, the resin-encapsulated electronic component(s) (resin-molded article) can be produced.

[0073] Here, in the production apparatus for a resin-molded article of the present invention, further, a controller may control each of the components. That is, the production apparatus for a resin-molded article of the present invention may work as a hand-operated machine or may work as a fully automatic machine by controlling each of the components by the controller.

[0074] Furthermore, there is no particular limitation on the arrangement of the units of the production apparatus for a resin-molded article of the present invention. However, as shown in FIG. 5, the transfer unit that supplies a substrate and the resin-sprinkling unit that sprinkles resin on a release film are preferably arranged facing each other with the resin-encapsulation unit (molding unit) being interposed therebetween. Such an arrangement can restrict fine powders of resin granules from being in contact with a substrate.

Particularly, adhesion of fine powders of resin granules to a not-yet-molded (not-yet-resin-encapsulated) substrate may cause molding defects. Moreover, adhesion of fine powders of resin granules to a molded (resin-encapsulated) substrate may give a deleterious effect on the following steps.

[0075] In the production apparatus for a resin-molded article shown FIG. 5, as described above, the transfer unit 540 that supplies a substrate and the resin-sprinkling unit 520 that sprinkles resin on a release film are arranged facing each other with the molding unit (resin-encapsulation unit) 530 being interposed therebetween. Furthermore, the release film cutting unit 510 that makes a circular release film is arranged at the outside of the resin-sprinkling unit 520. This production apparatus for a resin-molded article is a separated-type production apparatus for a resin-molded article in which the units are arranged separately. As described above, there is no particular limitation on the arrangement of the units of the production apparatus for a resin-molded article of the present invention, and the arrangement may be different from that shown in FIG. 5. For example, a configuration in which a needed amount of molding units (resin-encapsulation units) are detachably arranged can be employed. Furthermore, the release film cutting unit (circular release film formation unit), the resin-sprinkling unit, and the transfer unit (substrate unit) may be arranged at the one side of the resin-encapsulation unit. In this case, the release film unit, the resin-sprinkling unit, and the substrate unit serve as a master unit, and the resin-encapsulation unit serves as a slave unit (master-slave type). In this case, a needed number of molding units (resin-encapsulation units) can be arranged in order. Furthermore, the release film cutting unit, the resin-sprinkling unit, and the transfer unit (substrate unit) may be integrated. Moreover, the release film cutting unit, the resin-sprinkling unit, and the transfer unit (substrate unit) may be integrated as one molding unit, and the whole of the integrated components may work singly as a production apparatus for a resin-molded article (for

example, compression molding apparatus).

[0076] In the case where plural molding units (resin-encapsulation units) are arranged between the transfer unit (substrate unit) and the resin-sprinkling unit and in the case where plural molding units (resin-encapsulation units) are arranged in order with respect to the master unit, the following arrangement is preferable. That is, the molding units are arranged along the extending direction of the rails that are used at the time when the components including the substrate loader, the resin loader, and the aftertreatment means are moved. Further, the units of the production apparatus for a resin-molded article of the present invention are detachable with one another using, for example, coupling means such as a bolt, a nut, and the like or an appropriate positioning means. Moreover, the production apparatus for a resin-molded article of the present invention may have a configuration in which a molding unit (resin-encapsulation unit) is detachable to another molding unit (resin-encapsulation unit). This makes it possible to increase or decrease the number of the molding units (resin-encapsulation units) later on.

[0077] In FIG. 5, the production apparatus for one or more resin-encapsulated electronic components of the present invention and the production method for the resin-encapsulated electronic component(s) using the same were described. However, the uses of the resin-sprinkling method, the resin-molding method, the resin-sprinkling apparatus, the resin-molding apparatus, and the production apparatus for a resin-molded article of the present invention are not limited to the production of the resin-encapsulated electronic component(s) and can be applied to the production of any other resin-molded articles. For example, the present invention can be applied to the production of resin products of optical components such as lenses, optical modules, and light guide plates, and the like by compression molding.

[0078] The present invention is not limited to the aforementioned Examples; and arbitrary and appropriate combinations, changes, or selective adoption

thereof can be made as necessary without departing from the spirit and scope of the present invention.

[0079] The invention may be embodied in other forms without departing from the spirit or essential characteristics thereof. The embodiments disclosed in this application are to be considered in all respects as illustrative and not limiting. The scope of the invention is indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are intended to be embraced therein.

Explanation of Reference Numerals

[0080]

11 release film

12 frame

13 film fixing base

14 resin supply means

15 linear feeder

16 resin granule

16b resin

t

101 center of resin-sprinkling area

102, 104 locus of drop point of resin granule 16

103 virtual area on resin-sprinkling area

CLAIMS

1. A production apparatus for a resin-molded article using an upper die, a lower die facing to the upper die, and a lower die cavity formed on the lower die with at least a resin material used as a material, comprising:

a molding unit to which a molding die comprising at least the upper die and the lower die is attached;

a resin supply unit that supplies the resin material to a resin containing portion;

a transfer unit that transfers at least the resin-molded article comprising a solidified resin molded from the resin material in the lower die cavity;

a first loader that supplies the resin material to the molding die;

a second loader that is provided in the transfer unit and transfers at least the resin-molded article;

rails provided across the transfer unit, the molding unit, and the resin supply unit;

a containing portion for the resin-molded article that is provided in the transfer unit and configured to contain the resin-molded article;

a robot arm that is provided in the transfer unit and takes out the resin-molded article from the second loader and places the resin-molded article in the containing portion for the resin-molded article;

a resin supply means that is provided in the resin supply unit and supplies the resin material to the resin containing portion; and

a controller that controls at least clamping and unclamping operations of the molding die, a moving operation of the first loader, a moving operation of the second loader, and an operation of the

robot arm, wherein

viewed along a first direction of clamping and unclamping the molding die, the transfer unit, the molding unit, and the resin supply unit are aligned,

the first loader and the second loader are attached to the rails in such a manner that the first loader and the second loader can be moved on the rails, and

the robot arm takes out the resin-molded article from the second loader, flips the resin-molded article over, moves the resin-molded article to the containing portion for the resin-molded article, and places the resin-molded article in the containing portion for the resin-molded article.

2. A production apparatus for a resin-molded article using an upper die, a lower die facing to the upper die, and a lower die cavity formed on the lower die with at least a resin material used as a material, comprising:

a molding unit to which a molding die comprising at least the upper die and the lower die is attached;

a resin supply unit that supplies the resin material to a resin containing portion;

a transfer unit that transfers at least the resin-molded article comprising a solidified resin molded from the resin material in the lower die cavity;

a first loader that supplies the resin material to the molding die;

a second loader that is provided in the transfer unit and transfers at least the resin-molded article;

rails provided across the transfer unit, the molding unit, and the resin supply unit;

a containing portion for the resin-molded article that is provided in the transfer unit and configured to contain the resin-molded article;

a robot arm that is provided in the transfer unit and takes out the resin-molded article from the second loader and places the resin-molded article in the containing portion for the resin-molded article;

a resin supply means that is provided in the resin supply unit and supplies the resin material to the resin containing portion; and

a controller that controls at least clamping and unclamping operations of the molding die, a moving operation of the first loader, a moving operation of the second loader, and an operation of the robot arm, wherein

viewed along a first direction of clamping and unclamping the molding die, the transfer unit, the molding unit, and the resin supply unit are aligned,

the first loader and the second loader are attached to the rails in such a manner that the first loader and the second loader can be moved on the rails,

the robot arm takes out the resin-molded article from the second loader, flips the resin-molded article over, moves the resin-molded article to the containing portion for the resin-molded article, and places the resin-molded article in the containing portion for the resin-molded article,

viewed along the first direction, the resin material is supplied along a continuous line by relatively moving the resin supply means and the resin containing portion along the continuous line,

viewed along the first direction, the resin containing portion has a circular shape, and

viewed along the first direction, the continuous line is a spiral within the circular shape concentric with the circular shape.

3. A production apparatus for a resin-molded article using an upper die, a lower die facing to the upper die, and a lower die cavity formed on the lower die with at least a resin material used as a material, comprising:

a molding unit to which a molding die comprising at least the upper die and the lower die is attached;

a resin supply unit that supplies the resin material to a resin containing portion;

a transfer unit that transfers at least the resin-molded article comprising a solidified resin molded from the resin material in the lower die cavity;

a first loader that supplies the resin material to the molding die;

a second loader that is provided in the transfer unit and transfers at least the resin-molded article;

rails provided across the transfer unit, the molding unit, and the resin supply unit;

a containing portion for the resin-molded article that is provided in the transfer unit and configured to contain the resin-molded article;

a robot arm that is provided in the transfer unit and takes out the resin-molded article from the second loader and places the resin-molded article in the containing portion for the resin-molded article;

a resin supply means that is provided in the resin supply unit and supplies the resin material to the resin containing portion; and

a controller that controls at least clamping and unclamping operations of the molding die, a moving operation of the first loader, a moving operation of the second loader, and an operation of the robot arm, wherein

viewed along a first direction of clamping and unclamping the molding die, the transfer unit, the molding unit, and the resin supply unit are aligned,

the first loader and the second loader are attached to the rails in such a manner that the first loader and the second loader can be moved on the rails,

the robot arm takes out the resin-molded article from the second loader, flips the resin-molded article over, moves the resin-molded article to the containing portion for the resin-molded article, and places the resin-molded article in the containing portion for the resin-molded article,

viewed along the first direction, the resin material is supplied along a continuous line by relatively moving the resin supply means and the resin containing portion along the continuous line,

viewed along the first direction, the resin containing portion has a circular shape,

the resin containing portion is separated into plural virtual areas within the circular shape,

viewed along the first direction, each of the virtual areas has a sector shape, and

viewed along the first direction, the continuous line is a continuous line along a direction combining a direction along a circumferential direction of the circular shape and a direction along a radial direction of the circular shape within the virtual area.

4. The production apparatus according to any one of claims 1 to 3, wherein

the robot arm has a front end part,

viewed along the first direction, the front end part of the robot arm can be moved in the first direction, a second direction

perpendicular to the first direction including a direction approaching the second loader and a direction departing from the second loader, and a third direction perpendicular to the first direction including a direction approaching the containing portion for the resin-molded article and a direction departing from the containing portion for the resin-molded article, respectively,

the front end part of the robot arm is rotatable on an axis along a longitudinal direction of an arm part extending to the front end part in the robot arm, and

the front end part of the robot arm is configured to fix at least the resin-molded article.

5. The production apparatus according to any one of claims 1 to 3, wherein

a not-yet-molded substrate is used as a material in addition to the resin material, and

the front end part of the robot arm is configured to further fix the not-yet-molded substrate,

the robot arm takes out the not-yet-molded substrate from a containing portion for the not-yet-molded substrate, flips the not-yet-molded substrate over, moves the not-yet-molded substrate to the second loader, and places the not-yet-molded substrate on the second loader.

6. The production apparatus according to any one of claims 1 to 3, wherein

the resin supply means supplies the resin material along the first direction.

7. The production apparatus according to any one of claims 1 to

3, wherein

the resin supply means supplies the resin material along a direction perpendicular to the first direction.

8. The production apparatus according to any one of claims 1 to 3, wherein

the resin material is in a form of granule, powder, liquid, or paste.

9. The production apparatus according to claim 1, wherein

viewed along the first direction, the resin material is supplied along a continuous line by relatively moving the resin supply means and the resin containing portion along the continuous line.

10. The production apparatus according to claim 9, wherein

viewed along the first direction, the resin containing portion has a circular shape,

viewed along the first direction, the continuous line is a spiral within the circular shape concentric with the circular shape.

11. The production apparatus according to claim 9, wherein

viewed along the first direction, the resin containing portion has a circular shape,

the resin containing portion is separated into plural virtual areas within the circular shape,

viewed along the first direction, each of the virtual areas has a sector shape, and

viewed along the first direction, the continuous line is a continuous line along a direction combining a direction along a

circumferential direction of the circular shape and a direction along a radial direction of the circular shape within the virtual area.

12. The production apparatus according to any one of claims 1 to 3, wherein

viewed along the first direction, the transfer unit, the molding unit, and the resin supply unit are aligned.

13. The production apparatus according to claim 12, wherein

viewed along the first direction, one or plural molding units are detachably aligned between the transfer unit and the resin supply unit.

14. The production apparatus according to claim 12, wherein

viewed along the first direction, the transfer unit and the resin supply unit are aligned as a master unit, and

one or plural molding units are detachably aligned with respect to the master unit.

15. The production apparatus according to claim 12, wherein

viewed along the first direction, the transfer unit, the resin supply unit, and the molding unit are aligned as a master unit, and

one or plural molding units are detachably aligned with respect to the molding unit of the master unit.

16. The production apparatus according to claim 12, wherein

plural molding units are aligned, and

one molding unit is detachable to another molding unit.

17. A production method for a resin-molded article using an upper

die, a lower die facing to the upper die, and a lower die cavity formed on the lower die with at least a resin material used as a material, comprising steps of:

providing a resin supply unit that supplies the resin material to a resin containing portion;

providing a transfer unit that transfers at least the resin-molded article comprising a solidified resin molded from the resin material in the lower die cavity;

providing a first loader that supplies the resin material to the molding die;

providing a second loader that is provided in the transfer unit and transfers at least the resin-molded article;

providing a containing portion for the resin-molded article that is provided in the transfer unit and configured to contain the resin-molded article;

providing a robot arm that is provided in the transfer unit and takes out the resin-molded article from the second loader and places the resin-molded article in the containing portion for the resin-molded article;

providing a resin supply means that is provided in the resin supply unit and supplies the resin material to the resin containing portion;

supplying the resin material to the resin containing portion using the resin supply means;

clamping the molding die;

molding a solidified resin by solidifying the resin material in the lower die cavity in a state where the molding die is clamped;

unclamping the molding die;

transferring the resin-molded article to the transfer unit using the second loader;

taking out the resin-molded article from the second loader using the robot arm;

flipping the resin-molded article over using the robot arm;

moving the resin-molded article to the containing portion for the resin-molded article using the robot arm; and

placing the resin-molded article in the containing portion for the resin-molded article using the robot arm, wherein

in the step of supplying the resin material, viewed along a first direction of clamping and unclamping the molding die, the resin material is supplied along a continuous line by relatively moving the resin supply means and the resin containing portion along the continuous line.

18 The production method according to claim 17, wherein

viewed along the first direction, the resin containing portion has a circular shape.

19 The production method according to claim 18, wherein

viewed along the first direction, the continuous line is a spiral within the circular shape concentric with the circular shape.

20 The production method according to claim 18, wherein

the resin containing portion is separated into plural virtual areas within the circular shape,

viewed along the first direction, each of the virtual areas has a sector shape, and

viewed along the first direction, the continuous line is a continuous line along a direction combining a direction along a circumferential direction of the circular shape and a direction along a radial direction of the circular shape within the virtual area.