

## DESCRIPTION

Title of Invention:

RESIN MATERIAL SUPPLY APPARATUS, RESIN MOLDING APPARATUS, AND  
METHOD FOR MANUFACTURING RESIN MOLDED PRODUCT

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Technical Field

**[0001]** The present invention relates to techniques of a resin material supply apparatus, a resin molding apparatus, and a method for manufacturing a resin molded product.

Related Art

10 **[0002]** Patent Document 1 relates to a resin material supply apparatus including a first accommodating unit configured to accommodate a granular or powdery resin material, and a second accommodating unit configured to receive and temporarily accommodate the resin material accommodated in the first accommodating unit, and allow the resin material to fall from an outlet of a resin material supply passage via the resin material supply passage while measuring the resin  
15 material. A lower portion of the second accommodating unit is provided with a vibration applying unit configured to apply vibration to the second accommodating unit, and a measuring unit configured to measure a weight of the resin material in the second accommodating unit. By applying vibration to the second accommodating unit with the vibration applying unit, the resin material can be caused to fall from an outlet of the second accommodating unit to supply the resin  
20 material to a resin material transfer tray. In addition, while the vibration applying unit applies vibration to the second accommodating unit, the weight of the resin material supplied to the resin material transfer tray can be measured by measuring the weight of the second accommodating unit with the measuring unit.

Related Art Document

25 Patent Document

**[0003]** Patent Document 1: Japanese Patent Application Laid-Open No. 2018-27670

## SUMMARY OF INVENTION

### Technical Problem

**[0004]** Here, in a general resin material supply apparatus, as described in Patent Document 1,  
5 because the vibration applying unit and the measuring unit are provided at a lower portion of the second accommodating unit, a certain height difference (drop) is formed between the second accommodating unit and the resin material transfer tray disposed below the second accommodating unit. For this reason, the resin material fallen from the second accommodating unit may collide with the resin material transfer tray and bounce up high, and may attach to an  
10 edge of the resin material transfer tray or scatter around the resin material transfer tray. As a result, the yield of resin molded products may decrease.

**[0005]** The present invention has been made in consideration of the situation described above, and a problem to be solved is to provide a resin material supply apparatus, a resin molding apparatus, and a method for manufacturing a resin molded product that are capable of suppressing  
15 a decrease in the yield of resin molded products.

### Solution to Problem

**[0006]** The problem to be solved by the present invention is as described above, and to solve the problem, a resin material supply apparatus according to the present invention includes: a table capable of supporting a transfer unit, the transfer unit being capable of holding and transferring a  
20 resin material; a resin accommodating unit configured to accommodate the resin material; a resin supply unit configured to supply the resin material supplied from the resin accommodating unit to the transfer unit supported by the table; an oscillation unit provided at an upper portion of the resin supply unit and configured to supply the resin material from the resin supply unit to the transfer unit by vibrating the resin supply unit; and a measuring unit provided at a lower portion of the  
25 table and capable of measuring the resin material supplied to the transfer unit.

**[0007]** In addition, a resin molding apparatus according to the present invention includes the

above resin material supply apparatus.

**[0008]** In addition, a method for manufacturing a resin molded product according to the present invention is a method for manufacturing a resin molded product using the above resin molding apparatus and includes: a step of supplying the resin material to the transfer unit using the resin material supply apparatus; a step of transporting the resin material to a molding die using the transfer unit; and a step of performing mold clamping of the molding die.

#### Effects of Invention

**[0009]** According to the present invention, a decrease in the yield of resin molded products can be suppressed.

#### BRIEF DESCRIPTION OF THE DRAWINGS

**[0010]** [FIG. 1] is a schematic plan view illustrating an overall configuration of a resin molding apparatus according to an embodiment.

[FIG. 2] is a schematic front view illustrating a configuration of a compression molding module according to the embodiment.

[FIG. 3] is a schematic front cross-sectional view illustrating a configuration of a resin material supply apparatus according to the embodiment.

[FIG. 4] is a schematic front cross-sectional view illustrating the resin material supply apparatus replenishing a granular resin to a trough.

#### DESCRIPTION OF THE EMBODIMENTS

**[0011]** In the following, directions indicated by an arrow U, an arrow D, an arrow L, an arrow R, an arrow F, and an arrow B shown in the drawings will be defined as an upward direction, a downward direction, a leftward direction, a rightward direction, a forward direction, and a rearward direction, respectively, for description.

**[0012]** <Overall Configuration of Resin Molding Apparatus 1>

First, the configuration of a resin molding apparatus 1 according to the present embodiment will be described with reference to FIG. 1 and FIG. 2. The resin molding apparatus 1 performs resin molding according to a compression molding method. The resin molding apparatus 1 is capable of performing resin sealing on an electronic element such as a semiconductor chip mounted to a pre-resin sealing substrate Sa, which is an object to be molded, and manufacturing a resin molded product. As the pre-resin sealing substrate Sa, a semiconductor substrate such as a silicon wafer, a metal substrate, a glass substrate, a ceramic substrate, or a resin substrate may be used. In addition, the pre-resin sealing substrate Sa may or may not have wirings applied thereto. The shape of the pre-resin sealing substrate Sa is not particularly limited, and may be formed into, for example, a rectangular shape, a circular shape, or the like.

**[0013]** The resin molding apparatus 1 illustrated in FIG. 1 mainly includes a resin supply module 2, a compression molding module 3, a substrate supply and accommodating module 4, a control unit 5, and the like. In the present embodiment, an example is illustrated in which the resin molding apparatus 1 includes three compression molding modules 3 (3A, 3B, and 3C). The resin supply module 2, the three compression molding modules 3, and the substrate supply and accommodating module 4 are arranged side by side in the left-right direction. The resin supply module 2, the compression molding modules 3, and the substrate supply and accommodating module 4 are each detachable from the other modules. In addition, the number of each module may be increased or decreased as appropriate according to need.

**[0014]** The substrate supply and accommodating module 4 includes a first accommodating section 43 configured to accommodate a substrate S (pre-resin sealing substrate Sa) to which a chip before resin sealing is mounted, a second accommodating section 44 configured to accommodate a substrate S (resin-sealed substrate Sb) after resin sealing, a substrate placement section 41 configured to transfer the pre-resin sealing substrate Sa and the resin-sealed substrate Sb, and a substrate loader 42 configured to transport the pre-resin sealing substrate Sa and the

resin-sealed substrate Sb. The resin-sealed substrate Sb is an embodiment of a resin molded product according to the present invention. The substrate placement section 41 moves in the front-rear direction within the substrate supply and accommodating module 4. The substrate loader 42 is configured to be movable in the front-rear direction and the left-right direction across the substrate supply and accommodating module 4 and each of the compression molding modules 3.

**[0015]** In addition, the substrate supply and accommodating module 4 includes an inspection mechanism (not illustrated). The inspection mechanism inspects a region where a chip is present on the pre-resin sealing substrate Sa. The inspection mechanism inspects whether a chip is actually present on the pre-resin sealing substrate Sa using a laser displacement meter or the like, and stores sites where the chip is present and sites where the chip is not present. The configuration of the inspection mechanism is not particularly limited. For example, the inspection mechanism may photograph the pre-resin sealing substrate Sa with a visible light camera or the like, and inspect the region where the chip is present on the pre-resin sealing substrate Sa based on the captured image.

**[0016]** Each compression molding module 3 illustrated in FIG. 1 and FIG. 2 includes a molding die M (a lower die LM and an upper die UM), and a mold clamping mechanism 35 configured to perform mold clamping and mold opening of the upper die UM and the lower die LM by raising and lowering the lower die LM. The upper die UM is disposed above the lower die LM and is disposed to face the lower die LM in the up-down direction. The lower die LM is disposed to be capable of being raised and lowered in the up-down direction. A lower die cavity MC to which a release film F and a granular resin R are supplied is formed in the lower die LM. The granular resin R is an embodiment of a resin material according to the present invention. The specific configuration of the compression molding module 3 will be described later.

**[0017]** The resin supply module 2 illustrated in FIG. 1 includes a release film supply mechanism configured to supply a release film F, a cleaning mechanism 24 configured to clean a lower

surface and inner lateral surfaces of a frame body 23, a resin loader 26 configured to transport the frame body 23, and a resin material supply apparatus 100 configured to feed a granular resin R into an inner side of the frame body 23 disposed on the release film F. The resin material supply apparatus 100 includes a table 190 on which the release film F and the frame body 23 are placeable.

5 The resin loader 26 is configured to be movable in the front-rear direction and the left-right direction across the resin supply module 2 and each of the compression molding modules 3.

**[0018]** The control unit 5 is disposed at any position of the resin molding apparatus 1 (in the illustrated example, in the substrate supply and accommodating module 4). The control unit 5 controls the operations of the respective units described above to perform resin sealing on the  
10 electronic element mounted to the pre-resin sealing substrate Sa and obtain a resin-sealed substrate Sb.

**[0019]** <Configuration of Compression Molding Module 3>

As illustrated in FIG. 2, the compression molding module 3 in the present embodiment mainly includes a lower fixed plate 31, a flat plate member 32, an upper fixed plate 33, a movable  
15 platen 34, a mold clamping mechanism 35, a lower heater 36, an upper heater 37, a lower die holder 38, an upper die holder 39, and a molding die M.

**[0020]** The upper fixed plate 33 is disposed above the lower fixed plate 31. The lower fixed plate 31 and the upper fixed plate 33 are connected by a pair of flat plate members 32 disposed to be opposed to each other. The lower fixed plate 31 and the upper fixed plate 33 may also be  
20 connected by four tie bars (columnar members) in place of the flat plate members 32.

**[0021]** The movable platen 34 is disposed between the lower fixed plate 31 and the upper fixed plate 33. The movable platen 34 is movable upward and downward along the flat plate members 32. The mold clamping mechanism 35 for moving the movable platen 34 upward and downward is disposed on the lower fixed plate 31. A ball screw mechanism, a hydraulic cylinder, a toggle  
25 mechanism, or the like may be used as the mold clamping mechanism 35. The mold clamping mechanism 35 is capable of performing mold clamping of the molding die M by moving the

movable platen 34 upward. The mold clamping mechanism 35 is capable of performing mold opening of the molding die M by moving the movable platen 34 downward.

[0022] The upper die holder 39 for attaching the upper die UM is provided on a lower surface of the upper fixed plate 33. The upper heater 37 is provided inside the upper die holder 39. The upper die UM is attached to a lower surface of the upper die holder 39. A substrate S (pre-resin sealing substrate Sa) having a chip and the like mounted thereto is attached to a lower surface of the upper die UM.

[0023] The lower die holder 38 for attaching the lower die LM is provided on an upper surface of the movable platen 34. The lower heater 36 is provided inside the lower die holder 38. The lower die LM having the lower die cavity MC formed therein is attached to an upper surface of the lower die holder 38.

[0024] A release film F is adsorbed and held to the lower die cavity MC by a suction mechanism (not illustrated). Accordingly, the granular resin R supplied onto the release film F by the resin material supply apparatus 100 is accommodated in the lower die cavity MC. By melting the granular resin R in the lower die cavity MC with the lower heater 36 and clamping the molding die M with the mold clamping mechanism 35, resin sealing of the pre-resin sealing substrate Sa can be performed. Accordingly, a resin-sealed substrate Sb (resin molded product) can be obtained.

[0025] <Method for Manufacturing Resin Molded Product>

Hereinafter, a method for manufacturing a resin molded product using the resin molding apparatus 1 configured as described above will be described. The control unit 5 is capable of manufacturing a resin molded product by controlling operations of the respective units of the resin molding apparatus 1.

[0026] First, in the substrate supply and accommodating module 4 illustrated in FIG. 1, a pre-resin sealing substrate Sa is sent out from the first accommodating section 43 to the substrate placement section 41. Next, the pre-resin sealing substrate Sa on the substrate placement section

41 is transferred to the substrate loader 42. At this time, a region where a chip or the like is present on the pre-resin sealing substrate Sa is inspected by the inspection mechanism (not illustrated). The control unit 5 calculates in advance a target supply amount of the granular resin R to be supplied into the frame body 23, a target supply position of the granular resin R in the frame body 23, and a supply trajectory of the granular resin R to be supplied into the frame body 23, based on an inspection result (such as the presence or absence of a chip on the pre-resin sealing substrate Sa) obtained by the inspection mechanism. The substrate loader 42 transports the pre-resin sealing substrate Sa to the compression molding module 3 and mounts the pre-resin sealing substrate Sa to the upper die UM. Thereafter, the substrate loader 42 moves to the substrate supply and accommodating module 4.

**[0027]** Next, in the resin supply module 2, the release film F supplied from the release film supply mechanism 25 to the table 190 is cut to a predetermined size. Next, the resin loader 26 receives the frame body 23 cleaned by the cleaning mechanism 24. The resin loader 26 places the frame body 23 onto the release film F adsorbed to the table 190. The release film F and the frame body 23 form a transfer unit for transferring the granular resin R. Thereafter, the resin loader 26 retreats from above the table 190.

**[0028]** Next, the granular resin R in the target supply amount is supplied onto the release film F inside the frame body 23 by the resin material supply apparatus 100. A specific configuration of the resin material supply apparatus 100 will be described later.

**[0029]** Next, the resin loader 26 receives the release film F and the frame body 23 which are placed on the table 190 and onto which the granular resin R has been supplied. The resin loader 26 transports the release film F and the frame body 23 to the compression molding module 3 and places the release film F and the frame body 23 on the lower die LM. With the release film F adsorbed to the lower die cavity MC by the suction mechanism (not illustrated), the granular resin R is accommodated in the lower die cavity MC. The frame body 23 is returned to the cleaning mechanism 24 by the resin loader 26. The granular resin R in the lower die cavity MC is melted

by the lower heater 36.

**[0030]** Next, in the compression molding module 3 illustrated in FIG. 2, the lower die LM is moved upward by the mold clamping mechanism 35 to perform mold clamping of the upper die UM and the lower die LM. Accordingly, the chip and the like on the pre-resin sealing substrate Sa are immersed in the melted granular resin R (molten resin).

**[0031]** After a period of time, with the molten resin cured, resin molding is performed on the pre-resin sealing substrate Sa, and a resin-sealed substrate Sb (resin molded product) is obtained. After the resin cures, the lower die LM is moved downward to perform mold opening of the upper die UM and the lower die LM.

**[0032]** Next, the substrate loader 42 illustrated in FIG. 1 moves to the compression molding module 3 and receives the resin-sealed substrate Sb. The substrate loader 42 moves to the substrate supply and accommodating module 4 and places the resin-sealed substrate Sb on the substrate placement section 41. The resin-sealed substrate Sb placed on the substrate placement section 41 is transferred to the second accommodating section 44 and accommodated therein. By performing such resin molding in parallel in multiple compression molding modules 3, resin molded products can be manufactured efficiently.

**[0033]** <Resin Material Supply Apparatus 100>

Hereinafter, the resin material supply apparatus 100 of the resin supply module 2 will be described in detail with reference to FIG. 3 and FIG. 4.

**[0034]** The resin material supply apparatus 100 illustrated in FIG. 3 and FIG. 4 mainly includes a stocker 110, a first oscillation unit 120, a trough 130, a second oscillation unit 140, an accommodated amount sensor 150, a chute 160, a dust collection mechanism 170, a shutter 180, a table 190, and a measuring unit 200.

**[0035]** In FIG. 3, the granular resin R is indicated by hatching. In addition, in FIG. 3, cross-sections of each member are illustrated to show the inside of the resin material supply apparatus 100; however, hatching indicating the cross-sections of each member is omitted to distinguish from

the granular resin R. In addition, for convenience, in FIG. 3, the stocker 110 and the accommodated amount sensor 150 are illustrated in the vicinity of the table 190; however, in practice, as illustrated in FIG. 4, the stocker 110 and the like are disposed at a position horizontally separated from the table 190 to some extent. The shutter 180 is disposed in the vicinity of the chute 160.

**[0036]** The stocker 110 accommodates the granular resin R and supplies the granular resin R to the trough 130. The stocker 110 is an embodiment of a resin accommodating unit according to the present invention. The stocker 110 mainly includes an accommodating unit 111, a supply unit 112, and an opening 113.

**[0037]** The accommodating unit 111 is a box-shaped portion configured to accommodate the granular resin R. The accommodating unit 111 is formed in a hollow shape such that the granular resin R is accommodatable therein. An opening (not illustrated) for supplying the granular resin R to the inside is formed in an upper portion of the accommodating unit 111. The granular resin R is supplied (replenished) to the accommodating unit 111 at appropriate timing.

**[0038]** The supply unit 112 is a portion configured to supply the granular resin R accommodated in the accommodating unit 111 to the opening 113. The supply unit 112 is a portion extending in the horizontal direction (left-right direction in FIG. 3) from the accommodating unit 111, and is formed in a hollow shape such that the granular resin R is movable therein. For example, the supply unit 112 is formed in a tubular shape having a rectangular cross-section. The supply unit 112 is formed to extend laterally (leftward in the illustrated example) from a lower portion of one lateral surface of the accommodating unit 111.

**[0039]** The opening 113 is a portion configured to allow the granular resin R supplied via the supply unit 112 to fall downward. The opening 113 is formed in a hollow shape such that the granular resin R is movable therein. For example, the opening 113 is formed in a tubular shape having a rectangular cross-section. The opening 113 is connected to a distal end of the supply unit 112 extending from the accommodating unit 111, and is opened downward.

**[0040]** The first oscillation unit 120 serves for discharging the granular resin R from the stocker 110. The first oscillation unit 120 is provided at a lower portion of the stocker 110. Specifically, the first oscillation unit 120 is provided to be in contact with a bottom surface of the stocker 110. The first oscillation unit 120 is capable of vibrating the stocker 110. By vibrating the stocker 110, the first oscillation unit 120 is capable of moving the granular resin R in the accommodating unit 111 to the supply unit 112 and causing the granular resin R to fall (discharge) downward from the opening 113.

**[0041]** The trough 130 accommodates the granular resin R and supplies the granular resin R to the release film F disposed on the table 190. The trough 130 is an embodiment of a resin supply unit according to the present invention. The trough 130 mainly includes an accommodating unit 131, a supply unit 132, and an opening 133.

**[0042]** The accommodating unit 131 is a portion configured to accommodate the granular resin R. The accommodating unit 131 is formed in a hollow shape such that the granular resin R is accommodatable therein. An opening 131a for supplying the granular resin R to the inside is formed in an upper portion of the accommodating unit 131. The granular resin R from the stocker 110 is supplied (replenished) to the accommodating unit 131.

**[0043]** The supply unit 132 is a portion configured to supply the granular resin R accommodated in the accommodating unit 131 to the opening 133. The supply unit 132 is a portion extending in the horizontal direction (left-right direction in FIG. 3) from the accommodating unit 131, and is formed in a hollow shape such that the granular resin R is movable therein. For example, the supply unit 132 is formed in a tubular shape having a rectangular cross-section. The supply unit 132 is formed to extend laterally (leftward in the illustrated example) from a lower portion of one lateral surface of the accommodating unit 131.

**[0044]** The opening 133 is a portion configured to allow the granular resin R supplied via the supply unit 132 to fall downward. The opening 133 is formed in a hollow shape such that the granular resin R is movable therein. For example, the opening 133 is formed in a tubular shape

having a rectangular cross-section. The opening 133 is connected to a distal end of the supply unit 132 extending from the accommodating unit 131, and is opened downward.

**[0045]** The second oscillation unit 140 serves for discharging the granular resin R from the trough 130. The second oscillation unit 140 is an embodiment of an oscillation unit according to the present invention. The second oscillation unit 140 is provided at an upper portion of the trough 130. More specifically, the second oscillation unit 140 is disposed at a position higher than a lowermost portion of the trough 130. In the present embodiment, because a lower end of the opening 133 is the lowermost position of the trough 130, the second oscillation unit 140 is disposed at a position higher than the lower end of the opening 133. In addition, the second oscillation unit 140 is preferably disposed at a position higher than bottom surfaces of the accommodating unit 131 and the supply unit 132. In the present embodiment, the second oscillation unit 140 is placed on an upper surface of the supply unit 132 and is provided to be in contact with the upper surface of the supply unit 132. The second oscillation unit 140 is capable of vibrating the trough 130. By vibrating the trough 130, the second oscillation unit 140 is capable of moving the granular resin R in the accommodating unit 131 to the supply unit 132 and causing the granular resin R to fall (discharge) downward from the opening 133.

**[0046]** The accommodated amount sensor 150 serves for measuring an amount of the granular resin R accommodated in the trough 130. The accommodated amount sensor 150 is an embodiment of an accommodated amount measuring unit according to the present invention. As the accommodated amount sensor 150, a sensor capable of measuring the amount of the granular resin R accommodated in the trough 130 without contacting the trough 130 and the granular resin R accommodated in the trough 130 is preferably used. In the present embodiment, a distance measuring sensor capable of measuring a distance to an object in a non-contact manner is used as the accommodated amount sensor 150. The accommodated amount sensor 150 is disposed in the vicinity of the opening 113 of the stocker 110. The accommodated amount sensor 150 measures a distance from above the accommodating unit 131 to an upper surface of the granular resin R

accommodated in the accommodating unit 131, when the granular resin R is supplied from the stocker 110 to the trough 130. Based on the distance from the accommodated amount sensor 150 to the upper surface of the granular resin R accommodated in the accommodating unit 131, the amount of the granular resin R accommodated in the trough 130 can be measured.

5 **[0047]** The chute 160 guides the granular resin R from the trough 130 to the release film F disposed on the table 190. The chute 160 is an embodiment of a guide unit according to the present invention. The chute 160 is formed in a tubular shape with both upper and lower ends opened. An inlet 161 opened upward is formed at the upper end of the chute 160. The inlet 161 is formed in a shape into which the opening 133 of the trough 130 is insertable. A supply port  
10 162 opened downward is formed at the lower end of the chute 160. The supply port 162 is formed in a shape suitable for spreading the granular resin R onto the release film F (inner side of the frame body 23), for example, with a rectangular cross-section. An inclined surface is formed as needed inside the chute 160 to smoothly guide the granular resin R from the inlet 161 formed at the upper end to the supply port 162 formed at the lower end.

15 **[0048]** The dust collection mechanism 170 serves for collecting dust (fine powder) of the granular resin R via the chute 160. The dust collection mechanism 170 mainly includes a dust collection duct 171, a first gate valve 172, a second gate valve 173, and the like.

**[0049]** The dust collection duct 171 is a member connected to the chute 160 and forming a flow path for air. The dust collection duct 171 is formed by a tubular member that is at least partially  
20 flexible. One end of the dust collection duct 171 is connected to a midway portion of the chute 160. The other end side of the dust collection duct 171 is branched into a first duct 171a and a second duct 171b.

**[0050]** The first gate valve 172 and the second gate valve 173 are capable of partitioning (blocking) the flow path for air. The first gate valve 172 is provided at a midway portion of the  
25 first duct 171a. By opening and closing the first gate valve 172, whether air can flow in the first duct 171a is switchable. The second gate valve 173 is provided at a midway portion of the second

duct 171b. By opening and closing the second gate valve 173, whether air can flow in the second duct 171b is switchable.

**[0051]** Although not illustrated in the drawings, the first duct 171a and the second duct 171b are connected to suction devices capable of suctioning air and filters capable of collecting dust. In addition, an amount of air suctioned via the first duct 171a is set to be greater than an amount of air suctioned via the second duct 171b.

**[0052]** With such a configuration, in the case of opening the first gate valve 172 and closing the second gate valve 173, the air inside the chute 160 can be suctioned via the first duct 171a with a relatively large (strong) suction force. On the other hand, in the case of opening the second gate valve 173 and closing the first gate valve 172, the air inside the chute 160 can be suctioned via the second duct 171b with a relatively small (weak) suction force.

**[0053]** The trough 130, the second oscillation unit 140, and the chute 160 described above are integrally movable in the horizontal direction by a moving mechanism (not illustrated). Hereinafter, the trough 130, the second oscillation unit 140, and the chute 160 which are integrally movable will be referred to as a movable unit UN. Because a part of the dust collection duct 171 is flexible, the dust collection duct 171 is capable of flexing when the movable unit UN moves. Accordingly, the dust collection duct 171 does not impede movement of the movable unit UN.

**[0054]** In addition, the chute 160 is capable of being moved up and down relatively with respect to the trough 130 by a moving mechanism (not illustrated). By lowering the chute 160, the supply port 162 of the chute 160 can be lowered to a position lower than an upper end of the frame body 23, as shown in FIG. 3. In addition, by raising the chute 160, the supply port 162 of the chute 160 can be lifted to a position higher than the upper end of the frame body 23, as shown in FIG. 4.

**[0055]** When supplying the granular resin R from the trough 130 to the release film F placed on the table 190, the granular resin R can be spread over the entire area of the frame body 23 by moving the movable unit UN in the horizontal direction along a movement path corresponding to the shape of the frame body 23. At this time, as shown in FIG. 3, by lowering the chute 160 to a

position lower than the upper end of the frame body 23, bouncing of the granular resin R can be suppressed.

**[0056]** In addition, as shown in FIG. 4, when supplying the granular resin R from the stocker 110 to the trough 130, the movable unit UN moves such that the accommodating unit 131 of the trough 130 is located below the opening 113 of the stocker 110. Hereinafter, such a position of the movable unit UN will be referred to as a replenishment position. When the movable unit UN moves from above the table 190 to the replenishment position, interference between the chute 160 and the frame body 23 can be avoided by raising the chute 160.

**[0057]** The shutter 180 shown in FIG. 4 reduces a flow path area of air flowing through the supply port 162 of the chute 160. With the chute 160 rising, the shutter 180 moves to be located immediately below the supply port 162 of the chute 160. The shutter 180 is movable using a drive mechanism such as a motor. The shutter 180 is formed, for example, into a flat plate shape that covers the supply port 162 in a bottom view. The shutter 180 is disposed to form a slight gap between the shutter 180 and the supply port 162. A flow path area of air formed by such a gap is set to be smaller than an opening area of the supply port 162.

**[0058]** The table 190 shown in FIG. 3 supports the release film F and the frame body 23. The table 190 is capable of adsorbing and holding the release film F by a suction mechanism (not illustrated).

**[0059]** The measuring unit 200 serves for measuring the granular resin R on the release film F placed on the table 190. The measuring unit 200 is provided at a lower portion of the table 190 and is capable of measuring the weight of the table 190. More specifically, the measuring unit 200 is disposed at a position lower than an upper surface of the table 190 (a surface on which the release film F is placed). In the present embodiment, the measuring unit 200 is provided on a lower surface of the table 190. Because the weights of the table 190 and the frame body 23 and the release film F placed on the table 190 are known, the weight of the granular resin R supplied onto the release film F can be measured by subtracting the weights of the table 190, the frame body

23, and the release film F from a measured value of the measuring unit 200.

**[0060]** Hereinafter, the operation of the resin material supply apparatus 100 configured as described above will be described.

**[0061]** First, as shown in FIG. 3, the case of supplying the granular resin R to the release film F will be described.

**[0062]** In the case of supplying the granular resin R to the release film F, the second oscillation unit 140 vibrates the trough 130 in a state in which the supply port 162 of the chute 160 is located above the release film F. Accordingly, the granular resin R accommodated in the accommodating unit 131 is supplied to the opening 133 via the supply unit 132. The granular resin R supplied to the opening 133 falls into the chute 160 via the inlet 161, is guided by the inner surface of the chute 160, and falls from the supply port 162. Accordingly, the granular resin R is supplied onto the release film F. By moving the movable unit UN in the horizontal direction along a pre-calculated supply trajectory while vibrating the trough 130, the granular resin R can be spread over an entire area within the frame body 23.

**[0063]** While the granular resin R is being supplied onto the release film F, the suction device (not illustrated) of the dust collection mechanism 170 is activated. In addition, in such a case, the second gate valve 173 is opened and the first gate valve 172 is closed. Accordingly, the air inside the chute 160 can be suctioned via the second duct 171b with a relatively small suction force. By suctioning the air inside the chute 160, dust (fine powder) that has risen from the release film F via the supply port 162 can be collected inside the chute 160. The dust collected inside the chute 160 is recovered by a filter (not illustrated) of the dust collection mechanism 170.

**[0064]** In addition, the weight of the granular resin R supplied onto the release film F can be measured by the measuring unit 200. With the granular resin R in the target supply amount supplied onto the release film F, the second oscillation unit 140 stops. Accordingly, an appropriate amount of the granular resin R can be supplied onto the release film F. Upon stop of the second oscillation unit 140, the suction device (not illustrated) of the dust collection mechanism

170 is also stopped.

**[0065]** Herein, in the present embodiment, the second oscillation unit 140 is provided at an upper portion of the trough 130. In addition, the measuring unit 200 for measuring the weight of the granular resin R supplied to the release film F is provided at a lower portion of the table 190 rather than at the trough 130. Accordingly, a vertical interval (height difference) between the trough 130 and the table 190 can be reduced. In addition, a vertical interval (height difference) between the inlet 161 and the supply port 162 of the chute 160 can be reduced. In this manner, by reducing the height difference between the trough 130 and the table 190 (the inlet 161 and the supply port 162 of the chute 160), a falling distance of the granular resin R can be reduced, and bouncing of the granular resin R fallen onto the release film F can be suppressed. Accordingly, scattering of the granular resin R to undesirable sites (for example, the inner surfaces and the upper surface of the frame body 23, and the surroundings of the frame body 23) can be suppressed, and a yield of the resin molded products can be improved.

**[0066]** In addition, in the present embodiment, the dust collection mechanism 170 suctions dust from the supply port 162 of the chute 160 into the chute 160. Therefore, an airflow directed from outside to inside the chute 160 is generated, and dust rising to the outer side of the chute 160 can be suppressed. Accordingly, scattering of the granular resin R to undesirable sites can be suppressed, and the yield of the resin molded products can be improved. In addition, in a conventional apparatus such as that described in Patent Document 1, dust collection is not performed inside the chute 160, and thus adhesion of dust (resin) to the inner walls of the frame body 23 cannot be suppressed. For this reason, when a resin material transfer tray moves, along the movement path thereof, the resin adhering to the frame body 23 may fall onto sites where resin adhesion is undesirable, such as onto the molding die M. In contrast, in the present embodiment, dust collection is performed inside the chute 160, and adhesion of resin to the inner walls of the frame body 23 is suppressed, so resin does not fall onto the movement path of the resin material transfer tray.

[0067] In addition, in a configuration such as that of the present embodiment in which the dust collection mechanism 170 suctions the air inside the chute 160, the trough 130 may sway due to the influence of the airflow generated inside the chute 160. However, in the present embodiment, since the weight of the granular resin R supplied to the release film F is measured by the measuring unit 200 provided at the table 190 rather than at the trough 130, the weight of the granular resin R can be measured with high accuracy even if the trough 130 sways. In addition, in a conventional apparatus such as that described in Patent Document 1, the granular resin R adhering inside the chute 160 and the granular resin R that bounces after being discharged from the trough 130 and is not supplied onto the release film F are measured as the supplied granular resin R; however, in the present embodiment, such a situation does not occur, and the weight of the granular resin R can be measured with higher accuracy.

[0068] Next, as shown in FIG. 4, the case where the granular resin R is replenished to the trough 130 will be described.

[0069] In the case where the granular resin R accommodated in the trough 130 decreases to a certain extent, the granular resin R is replenished from the stocker 110 to the trough 130. The remaining amount of the granular resin R accommodated in the trough 130 may be calculated, for example, based on a cumulative total of the supply amount of the granular resin R measured by the measuring unit 200.

[0070] In the case of replenishing the granular resin R from the stocker 110 to the trough 130, first, the chute 160 rises relatively with respect to the trough 130, and the supply port 162 is lifted to a position higher than the upper end of the frame body 23. At the same time, the shutter 180 moves to a position immediately below the supply port 162 at the lower end of the chute 160.

[0071] Next, the movable unit UN moves to below the stocker 110 (replenishment position). With the movable unit UN moved to the replenishment position, the accommodated amount sensor 150 is located above the accommodating unit 131 (opening 131a) of the trough 130.

[0072] Next, the first oscillation unit 120 causes the stocker 110 to vibrate. Accordingly, the

granular resin R accommodated in the accommodating unit 111 is supplied to the opening 113 via the supply unit 112. The granular resin R supplied to the opening 113 falls from the opening 113 into the accommodating unit 131 of the trough 130. Accordingly, the granular resin R is replenished to the accommodating unit 131 of the trough 130.

5   **[0073]** During replenishment of the granular resin R to the trough 130, the suction device (not illustrated) of the dust collection mechanism 170 is activated. In addition, in such a case, the first gate valve 172 is opened and the second gate valve 173 is closed. Accordingly, the air inside the chute 160 can be suctioned with a relatively large suction force via the first duct 171a. By suctioning the air inside the chute 160 with such a strong suction force, the granular resin R  
10   adhering to the inner surface of the chute 160 can be collected. Accordingly, it is possible to prevent fall-off of the granular resin R adhering inside the chute 160 to unintended sites and prevent a decrease in the yield.

**[0074]** In particular, in the present embodiment, the flow path area of air flowing through the supply port 162 is reduced by the shutter 180. Therefore, the flow velocity of the air suctioned  
15   from outside the chute 160 into the chute 160 via the supply port 162 can be increased, and the granular resin R adhering to the inner surface of the chute 160 can be effectively collected.

**[0075]** Although one embodiment of the present invention has been described above, the present invention is not limited to the above embodiment, and appropriate modifications are possible within the scope of the technical concept of the invention described in the claims.

20   **[0076]** For example, the configuration (shape, arrangement, number, etc.) of each unit of the resin molding apparatus 1 described in the present embodiment is not particularly limited and may be freely changed.

**[0077]** In addition, in the present embodiment, it has been described as an example that the chute 160 alone moves up and down, and the shutter 180 is disposed; however, the present invention is  
25   not limited thereto. For example, it is also possible that the entire movable unit UN including the chute 160 moves up and down, and the shutter 180 is disposed. Accordingly, the position of the

shutter 180 is switchable between a position opposed to the supply port 162 of the chute 160 and a position retracted from the supply port 162.

**[0078]** In addition, in the present embodiment, the release film F and the frame body 23 have been illustrated as an example of the transfer unit for transporting the resin material (granular resin R); however, the present invention is not limited thereto. For example, a tray-shaped member on which the resin material is placeable may also be used as the transfer unit.

**[0079]** In addition, in the present embodiment, the first gate valve 172 and the second gate valve 173 have been illustrated as an example of a configuration for switching the air volume of the dust collection mechanism 170; however, the present invention is not limited thereto, and the air volume may be switched by any configuration. For example, it is also possible to switch the air volume by providing a flow control valve at a midway portion of one duct and controlling the flow control valve.

**[0080]** In addition, in the present embodiment, it has been described as an example that a distance measuring sensor is used as the accommodated amount sensor 150 for measuring the amount of the granular resin R accommodated in the trough 130; however, the present invention is not limited thereto, and the amount of the granular resin R may be measured according to any method. For example, various other non-contact sensors, load cells, or the like may also be used. In addition, the amount (for example, weight) of the granular resin R accommodated in the stocker 110 may be measured, and the amount of the granular resin R accommodated in the trough 130 may be measured (estimated) based on the decrease in the amount of the granular resin R accommodated in the stocker 110 (the amount of the granular resin R replenished to the trough 130).

**[0081]** In addition, in the present embodiment, it has been described as an example that the granular resin R fallen from the trough 130 is guided to the release film F by the chute 160; however, the present invention is not limited thereto. For example, it is also possible to supply the granular resin R directly from the trough 130 to the release film F without using the chute 160.

**[0082]** In addition, in the present embodiment, it has been described as an example that the granular resin R is supplied onto the release film F while moving the movable unit UN (the trough 130 and the like); however, the present invention is not limited thereto. For example, it is also possible to adopt a configuration in which the table 190 is also moved in addition to the movable unit UN, or a configuration in which the table 190 alone is moved.

**[0083]** <Supplementary Notes>

A resin material supply apparatus 100 of a first aspect of the present disclosure includes:  
a table 190 capable of supporting a transfer unit (release film F and frame body 23), the transfer unit being capable of holding and transferring a resin material (granular resin R);

a resin accommodating unit (stocker 110) configured to accommodate the resin material;  
a resin supply unit (trough 130) configured to supply the resin material supplied from the resin accommodating unit to the transfer unit supported by the table 190;

an oscillation unit (second oscillation unit 140) provided at an upper portion of the resin supply unit and configured to supply the resin material from the resin supply unit to the transfer unit by vibrating the resin supply unit; and

a measuring unit 200 provided at a lower portion of the table 190 and capable of measuring the resin material supplied to the transfer unit.

According to the resin material supply apparatus 100 of the first aspect of the present disclosure, a decrease in the yield of resin molded products can be suppressed. That is, by providing the second oscillation unit 140 at the upper portion of the trough 130 and providing the measuring unit 200 at the lower portion of the table 190, it is no longer required to dispose the second oscillation unit 140 and the measuring unit 200 between the trough 130 and the table 190. Accordingly, the falling distance of the granular resin R supplied from the trough 130 to the release film F on the table 190 can be reduced, and bouncing of the granular resin R fallen onto the release film F can be suppressed. Accordingly, scattering of the granular resin R to undesirable sites can be suppressed, and the yield of the resin molded products can be improved.

**[0084]** In the resin material supply apparatus 100 of a second aspect according to the first aspect of the present disclosure,

the resin supply unit includes:

an accommodating unit 131 configured to accommodate the resin material supplied from

5 the resin accommodating unit;

an opening 133 configured to allow the resin material to fall; and

a supply unit 132 configured to supply the resin material from the accommodating unit to the opening, and

the oscillation unit is provided on an upper surface of the supply unit.

10 According to the resin material supply apparatus 100 of the second aspect of the present disclosure, the falling distance of the granular resin R supplied from the trough 130 to the release film F on the table 190 can be reduced.

**[0085]** The resin material supply apparatus 100 of a third aspect according to the second aspect of the present disclosure further includes:

15 an accommodated amount measuring unit (accommodated amount sensor 150) capable of measuring an amount of the resin material accommodated in the accommodating unit in a non-contact manner.

According to the resin material supply apparatus 100 of the third aspect of the present disclosure, it is not required to provide a measuring device for measuring the granular resin R at  
20 the trough 130, and thus the falling distance of the granular resin R supplied from the trough 130 to the release film F on the table 190 can be reduced.

**[0086]** The resin material supply apparatus 100 of a fourth aspect according to the first to third aspects of the present disclosure further includes:

a guide unit (chute 160) configured to guide the resin material from the resin supply unit  
25 to the transfer unit; and

a dust collection mechanism 170 configured to perform dust collection at a midway

portion of the guide unit.

According to the resin material supply apparatus 100 of the fourth aspect of the present disclosure, a decrease in the yield of the resin molded products can be suppressed. That is, when performing dust collection with the dust collection mechanism 170, an airflow directed toward inside the chute 160 is generated, and thus the dust of the granular resin R can be prevented from rising to the outer side of the chute 160. Accordingly, scattering of the granular resin R to undesirable sites can be suppressed, and the yield of the resin molded products can be improved.

**[0087]** In the resin material supply apparatus 100 of a fifth aspect according to the fourth aspect of the present disclosure,

the dust collection mechanism 170 is configured to:

perform dust collection at a first air volume in a case where the resin material is being supplied from the resin supply unit to the transfer unit by the oscillation unit, and

perform dust collection at a second air volume greater than the first air volume in a case where the resin material is being supplied from the resin accommodating unit to the resin supply unit.

According to the resin material supply apparatus 100 of the fifth aspect of the present disclosure, in the case where the granular resin R is being supplied to the release film F, dust collection is performed at the relatively small first air volume, and thus the table 190 and the trough 130 can be prevented from being affected by the airflow. Accordingly, the supply of the granular resin R by the second oscillation unit 140 and the measurement of the granular resin R by the measuring unit 200 can be performed with high accuracy. In addition, in the case where the granular resin R is being replenished from the stocker 110 to the trough 130, dust collection is performed at the relatively large second air volume, and thus the granular resin R adhering inside the chute 160 can be collected. In such a case, the table 190 and the trough 130 are not adversely affected by the airflow.

**[0088]** In the resin material supply apparatus 100 of a sixth aspect according to the fifth aspect

of the present disclosure,

the guide unit includes a supply port 162 configured to allow the resin material to fall to the transfer unit, and

the resin material supply apparatus 100 further includes a shutter 180 configured to reduce a flow path area of air flowing through the supply port 162 in a case where the dust collection mechanism 170 performs dust collection at the second air volume.

According to the resin material supply apparatus 100 of the sixth aspect of the present disclosure, in the case where dust collection is performed at the second air volume, a flow velocity of air flowing through the supply port 162 can be increased. Accordingly, the granular resin R adhering to the inner surface of the chute 160 can be effectively collected.

**[0089]** In the resin material supply apparatus 100 of a seventh aspect according to the first to sixth aspects of the present disclosure,

the resin supply unit is movable between a position at which the resin supply unit is capable of supplying the resin material to the transfer unit and a position (replenishment position) at which the resin supply unit is capable of receiving the resin material from the resin accommodating unit.

According to the resin material supply apparatus 100 of the seventh aspect of the present disclosure, in the case where the granular resin R needs to be replenished to the trough 130, the trough 130 can be moved to the replenishment position. In such a case, since the table 190 provided with the measuring unit 200 does not need to move, a load accompanying the movement can be prevented from being applied to the measuring unit 200.

**[0090]** A resin molding apparatus 1 of an eighth aspect of the present disclosure includes:

the resin material supply apparatus 100 according to any one of the first to seventh aspects.

According to the resin molding apparatus 1 of the eighth aspect of the present disclosure, a decrease in the yield of resin molded products can be suppressed.

**[0091]** A method for manufacturing a resin molded product of a ninth aspect of the present

disclosure is a method for manufacturing a resin molded product using the resin molding apparatus 1 of the eighth aspect, and includes:

a step of supplying the resin material to the transfer unit using the resin material supply apparatus 100;

- 5 a step of transporting the resin material to a molding die M using the transfer unit; and  
a step of performing mold clamping of the molding die M.

According to the method for manufacturing a resin molded product of the ninth aspect of the present disclosure, a decrease in the yield of the resin molded products can be suppressed.

#### Reference Signs List

- 10 **[0092]** 1 resin molding apparatus  
2 resin supply module  
3 compression molding module  
4 substrate supply and accommodating module  
5 control unit  
15 23 frame body  
24 cleaning mechanism  
25 release film supply mechanism  
26 resin loader  
31 lower fixed plate  
20 32 flat plate member  
33 upper fixed plate  
34 movable platen  
35 mold clamping mechanism  
36 lower heater  
25 37 upper heater  
38 lower die holder

|    |      |                                 |
|----|------|---------------------------------|
|    | 39   | upper die holder                |
|    | 41   | substrate placement section     |
|    | 42   | substrate loader                |
|    | 43   | first accommodating section     |
| 5  | 44   | second accommodating section    |
|    | 100  | resin material supply apparatus |
|    | 110  | stocker                         |
|    | 111  | accommodating unit              |
|    | 112  | supply unit                     |
| 10 | 113  | opening                         |
|    | 120  | first oscillation unit          |
|    | 130  | trough                          |
|    | 131  | accommodating unit              |
|    | 131a | opening                         |
| 15 | 132  | supply unit                     |
|    | 133  | opening                         |
|    | 140  | second oscillation unit         |
|    | 150  | accommodated amount sensor      |
|    | 160  | chute                           |
| 20 | 161  | inlet                           |
|    | 162  | supply port                     |
|    | 170  | dust collection mechanism       |
|    | 171  | dust collection duct            |
|    | 171a | first duct                      |
| 25 | 171b | second duct                     |
|    | 172  | first gate valve                |

|    |     |                                    |
|----|-----|------------------------------------|
|    | 173 | second gate valve                  |
|    | 180 | shutter                            |
|    | 190 | table                              |
|    | 200 | measuring unit                     |
| 5  | B   | rearward direction                 |
|    | D   | downward direction                 |
|    | F   | forward direction/release film     |
|    | L   | leftward direction                 |
|    | LM  | lower die                          |
| 10 | M   | molding die                        |
|    | MC  | lower die cavity                   |
|    | R   | rightward direction/granular resin |
|    | S   | substrate                          |
|    | Sa  | pre-resin sealing substrate        |
| 15 | Sb  | resin-sealed substrate             |
|    | U   | upward direction                   |
|    | UM  | upper die                          |
|    | UN  | movable unit                       |

## CLAIMS

[Claim 1] A resin material supply apparatus comprising:

a table capable of supporting a transfer unit, the transfer unit being capable of holding and transferring a resin material;

5 a resin accommodating unit configured to accommodate the resin material;

a resin supply unit configured to supply the resin material supplied from the resin accommodating unit to the transfer unit supported by the table;

an oscillation unit provided at an upper portion of the resin supply unit and configured to supply the resin material from the resin supply unit to the transfer unit by vibrating the resin  
10 supply unit; and

a measuring unit provided at a lower portion of the table and capable of measuring the resin material supplied to the transfer unit.

[Claim 2] The resin material supply apparatus as claimed in claim 1, wherein

the resin supply unit comprises:

15 an accommodating unit configured to accommodate the resin material supplied from the resin accommodating unit;

an opening configured to allow the resin material to fall; and

a supply unit configured to supply the resin material from the accommodating unit to the opening, and

20 the oscillation unit is provided on an upper surface of the supply unit.

[Claim 3] The resin material supply apparatus as claimed in claim 2, further comprising:

an accommodated amount measuring unit capable of measuring an amount of the resin material accommodated in the accommodating unit in a non-contact manner.

[Claim 4] The resin material supply apparatus as claimed in any one of claims 1 to 3,

25 further comprising:

a guide unit configured to guide the resin material from the resin supply unit to the

transfer unit; and

a dust collection mechanism configured to perform dust collection at a midway portion of the guide unit.

[Claim 5] The resin material supply apparatus as claimed in claim 4, wherein

5 the dust collection mechanism is configured to:

perform dust collection at a first air volume in a case where the resin material is being supplied from the resin supply unit to the transfer unit by the oscillation unit, and

perform dust collection at a second air volume greater than the first air volume in a case where the resin material is being supplied from the resin accommodating unit to the resin supply  
10 unit.

[Claim 6] The resin material supply apparatus as claimed in claim 5, wherein

the guide unit comprises a supply port configured to allow the resin material to fall to the transfer unit, and

the resin material supply apparatus further comprises a shutter configured to reduce a  
15 flow path area of air flowing through the supply port in the case where the dust collection mechanism performs dust collection at the second air volume.

[Claim 7] The resin material supply apparatus as claimed in any one of claims 1 to 6, wherein

the resin supply unit is movable between a position at which the resin supply unit is  
20 capable of supplying the resin material to the transfer unit and a position at which the resin supply unit is capable of receiving the resin material from the resin accommodating unit.

[Claim 8] A resin molding apparatus comprising:

the resin material supply apparatus as claimed in any one of claims 1 to 7.

[Claim 9] A method for manufacturing a resin molded product, which is a method for  
25 manufacturing a resin molded product using the resin molding apparatus as claimed in claim 8, the method for manufacturing a resin molded product comprising:

a step of supplying the resin material to the transfer unit using the resin material supply apparatus;

a step of transporting the resin material to a molding die using the transfer unit; and

a step of performing mold clamping of the molding die.