

DESCRIPTION

RESIN POWDER COLLECTING MEMBER, PLUNGER UNIT, RESIN MOLDING
APPARATUS, AND METHOD FOR PRODUCING RESIN MOLDED PRODUCT

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TECHNICAL FIELD

[0001] The present invention relates to a resin powder collecting member, a plunger unit, a resin molding apparatus, and a method for producing a resin molded product.

BACKGROUND ART

10 [0002] In the production of resin molded products, transfer molding is a widely used method.

[0003] In the transfer molding, a mechanism for collecting resin waste may be used in order to reduce contamination of the apparatus by the resin waste. For example, in Patent Literature 1, as shown in FIGs. 1 to 4, a container (20) for containing resin waste is provided at an intermediate position between the distal end and the proximal end of the plunger (5) through a spring (26),
15 and the resin waste in the container (20) is sucked and removed by a removing unit (33). The removing unit (33) is composed of an air pressure-feeding mechanism (34) and a suction and discharge mechanism (35). Here, the resin waste is a residual waste (residue) that is caused when the resin material in the pot is pushed out into the cavity by the plunger and is not transferred to the outside of the pot but enters the sliding portion between the inner surface of the pot and the
20 plunger. The resin waste becomes resin powder dropping from a gap between a pot of a molding die for transfer molding and a plunger.

Citation List

Patent Literature

[0004]

25 Patent Literature 1: Japanese Patent No. 4836901

SUMMARY OF INVENTION

Technical Problem

[0005] However, in order to reduce the contamination of the apparatus due to resin powder such as resin waste more efficiently, it is necessary to consider the collection of the resin powder
30 by another configuration.

[0006] With the foregoing in mind, it is an object of the present invention to provide a resin powder collecting member, a plunger unit, a resin molding apparatus, and a method for producing a resin molded product, which can efficiently reduce contamination of the apparatus due to resin powder dropping from a gap between a pot of a molding die for transfer molding
35 and a plunger.

Solution to Problem

[0007] In order to achieve the above object, the present invention provides a resin powder collecting member used to collect resin powder dropping from a gap between a pot of a molding die for transfer molding and a plunger, including: a roof portion; and a side wall portion, wherein the resin powder collecting member can be disposed on an upper part of a plunger unit to which the plunger is attached, the resin powder can be collected in a space surrounded by the roof portion and the side wall portion, the roof portion has a plunger attachment portion insertion through hole for inserting the plunger attachment portion of the plunger unit and a resin powder dropping through hole for dropping the resin powder into the space, and an upper surface of the roof portion is inclined in a concave shape from the plunger attachment portion insertion through hole and the opposite side of the plunger attachment portion insertion through hole toward the resin powder dropping through hole.

[0008] The present invention also provides a plunger unit for transfer molding, including: the resin powder collecting member according to the present invention.

[0009] The present invention also provides a resin molding apparatus, including: the plunger unit according to the present invention; and a molding die for resin molding.

[0010] The present invention also provides a method for producing a resin molded product, including: molding a resin material using the resin molding apparatus according to the present invention.

Advantageous Effects of Invention

[0011] According to the present invention, it is possible to provide a resin powder collecting member, a plunger unit, a resin molding apparatus, and a method for producing a resin molded product, which can efficiently reduce contamination of the apparatus due to resin powder dropping from a gap between a pot of a molding die for transfer molding and a plunger.

BRIEF DESCRIPTION OF DRAWINGS

[0012] [FIG. 1] FIG. 1 is a diagram showing an example of a resin powder collecting member of the present invention. In FIG. 1, (a) is a plan view, (b) is a bottom view, (c) is a side view, (d) is a cross-sectional view taken along I-I' of (a), (e) is a perspective view viewed from an obliquely upward direction, and (f) is a perspective view viewed from an obliquely downward direction.

[FIG. 2] FIG. 2 is a diagram showing an example of a plunger unit of the present invention. In FIG. 2, (a) is a perspective view, (b) is a perspective view viewed from a direction different from that of (a), (c) is a left side view, (d) is a front view, (e) is a right side view, (f) is a cross-sectional view taken along III-III' of (d), and (g) is a cross-sectional view taken along II-II' of (c).

[FIG. 3] FIGs. 3A and 3B are cross-sectional views schematically showing a mechanism of resin powder collection using the resin powder collecting member of FIG. 1 and the plunger unit of FIG. 2.

[FIG. 4] FIG. 4 is a cross-sectional view showing an example of the structure of the resin powder collecting member of the present invention.

[FIG. 5] FIG. 5 is a cross-sectional view showing a partial configuration of an example of the resin molding apparatus of the present invention.

[FIG. 6] FIG. 6 is a cross-sectional view schematically showing another example of the structure of the resin powder collecting member of the present invention and a mechanism of resin powder collection by a plunger unit using the same.

[FIG. 7] FIG. 7 is a diagram showing an example of a plunger unit that does not include a resin powder collecting member. In FIG. 7, (a) is a perspective view, (b) is a perspective view viewed from a direction different from that of (a), (c) is a left side view, (d) is a front view, (e) is a cross-sectional view taken along V-V' of (d), and (g) is a cross-sectional view taken along IV-IV' of FIG. (c).

DESCRIPTION OF EMBODIMENTS

[0013] The present invention is described in more detail below with reference to examples. The present invention, however, is not limited by the following description.

[0014] In the resin powder collecting member of the present invention, for example, the resin powder dropping through hole may have a slit shape.

[0015] In the resin powder collecting member of the present invention, for example, when projection is performed on an attachment surface where the resin powder collecting member is attached to the plunger unit, a distance from an end of the plunger attachment portion insertion through hole side to the resin powder dropping through hole may be longer than a distance from an end of the side wall portion side to the resin powder dropping through hole.

[0016] In the resin powder collecting member of the present invention, for example, a sealing material for preventing the resin powder from dropping may be provided around the plunger attachment portion insertion through hole.

[0017] The plunger unit of the present invention may further include, for example, a plunger attachment portion; and a hole through which the plunger attachment portion can move up and down, wherein a sealing material for preventing resin powder from dropping may be provided around the hole.

[0018] The resin molding apparatus of the present invention may further include, for example, a suction mechanism for sucking inside a space surrounded by the roof portion and the side wall portion.

[0019] The method for producing a resin molded product of the present invention may further include discarding the resin powder collected in the space surrounded by the roof portion and the side wall portion to an outside of the resin molding apparatus.

[0020] In the method for producing a resin molded product of the present invention, for example, the resin molding apparatus of the present invention may be a resin molding apparatus including the suction mechanism, and the discarding the resin powder may be performed while stopping suction by the suction mechanism.

[0021] In the present invention, transfer molding is used as the resin molding method as described above.

[0022] In the present invention, the "molding die" is, for example, a metal die, but is not limited thereto, and may be, for example, a ceramic die or the like.

[0023] In the present invention, a resin molded product is not particularly limited, and may be, for example, a resin molded product obtained by simply molding a resin or a resin molded product obtained by resin encapsulating a component such as a chip. In the present invention, a resin molded product may be, for example, an electronic component or the like. The electronic component is not particularly limited, and may be any electronic component being any component such as a chip or a wire encapsulated in a resin. The chip is not particularly limited, and examples thereof include an IC, an LED chip, a semiconductor chip, or a chip such as a semiconductor element for power control.

[0024] In the present invention, a resin material before molding and a resin after molding are not particularly limited, and may be, for example, a thermosetting resin such as an epoxy resin or a silicone resin, or a thermoplastic resin. Further, the resin material before molding and the resin after molding may be a composite material containing a thermosetting resin or a thermoplastic resin in a part. In the present invention, the resin material before molding may be in the form of, for example, a granular resin, a liquid resin, a sheet-like resin, a tablet-like resin, a powder-like resin, or the like. Note that, in the present invention, the liquid resin may be liquid at ordinary temperature, or the liquid resin may also include a molten resin which is to be melted by heating to become liquid.

[0025] In the present invention, an object to be resin molded is not particularly limited, and may be, for example, a substrate. In the present invention, for example, a component (e.g., a chip, a flip-chip, or the like) mounted on a substrate (object to be molded) may be resin encapsulated (resin molded) to produce a resin molded product.

[0026] Examples of the present invention will be described below with reference to the drawings. Each drawing is schematically illustrated by appropriately omitting, exaggerating, and the like for convenience of description.

Examples

[0027] In the present example, an example of a resin powder collecting member, a plunger unit, a resin molding apparatus, and a production method of a resin molded product of the present invention will be described.

[0028] FIG. 1 shows an example of a resin powder collecting member of the present invention. In FIG. 1, (a) is a plan view, (b) is a bottom view, (c) is a side view, (d) is a cross-sectional view taken along I-I' of (a), (e) is a perspective view viewed from an obliquely upward direction, and (f) is a perspective view viewed from an obliquely downward direction.

[0029] As shown in FIG. 1, a resin powder collecting member 100 includes a roof portion 110 and a side wall portion 120. In the resin powder collecting member 100, the roof portion 110 and the side wall portion 120 are integrally formed. As will be described below, the resin powder collecting member 100 can be disposed on the upper part of the plunger unit. As will be described below, the resin powder dropping from the gap between the pot of the molding die for transfer molding and the plunger can be collected in the space 121 surrounded by the roof portion 110 and the side wall portion 120. The roof portion 110 has a plunger attachment portion insertion through hole 101 for inserting a plunger attachment portion of a plunger unit, which will be described below, and a resin powder dropping through hole 102 for dropping the resin powder into the space 121. As shown in (a) and (b) of FIG. 1, the resin powder collecting member 100 has a rectangular shape when viewed from above or below, and nine plunger attachment portion insertion through holes 101 are arranged in series along the center of the roof portion 110 in the longitudinal direction. While the number of the plunger attachment portion insertion through holes 101 is nine in FIG. 1, the number of the plunger attachment portion insertion through holes is not limited thereto and the roof portion may have any number of plunger attachment portion insertion through holes. There are two resin powder dropping through holes 102, and the two slit-shaped resin powder dropping through holes 102 are disposed along the longitudinal direction of the roof portion 110 so as to sandwich the nine plunger attachment portion insertion through holes 101 arranged in series. While the number of the resin powder dropping through holes 102 is two in FIG. 1, the number of the resin powder dropping through holes is not limited thereto and the roof portion may have any number of resin powder dropping through holes. Further, while the resin powder dropping through hole 102 has a slit shape in FIG. 1, the shape of the resin powder dropping through hole is not limited thereto and the resin powder dropping through hole may have any shape. The upper surface of the roof portion 110 is inclined in a convex shape (mountain shape) from the resin powder dropping through hole 102 toward the plunger attachment portion insertion through hole 101, and is inclined in a concave shape (valley shape) from the plunger attachment portion insertion through

hole 101 and the opposite side of the plunger attachment portion insertion through hole 101 toward the resin powder dropping through hole 102. Thereby, the resin powder dropping from the gap between the pot of the molding die for transfer molding and the plunger is not easily dropped from the gap between the plunger attachment portion insertion through hole 101 and the plunger attachment portion but is easily dropped into the space 121 from the resin powder dropping through hole 102. More specifically, in the roof portion 110, the convex portion 111 is formed along the center in the longitudinal direction, and two concave portions 112 are formed so as to sandwich the convex portion 111. The plunger attachment portion insertion through holes 101 are disposed along the convex portion 111, each resin powder dropping through hole 102 is disposed at each concave portion 112. Further, two resin powder collecting member attachment portions 103 are formed at both ends of the center of the roof portion 110 in the longitudinal direction so as to sandwich the nine plunger attachment portion insertion through holes 101 arranged in series. The resin powder collecting member attachment portion 103 has a through hole penetrating from the upper surface to the lower surface of the roof portion 110, and the resin powder collecting member 100 can be attached to the plunger unit main body by screwing or the like through the through hole, as will be described below. Note that the resin powder collecting member attachment portion 103 is optional in the resin powder collecting member of the present invention, and the resin powder collecting member may or may not include the resin powder collecting member attachment portion 103, and the resin powder collecting member attachment portion 103 may have any form, any number, any arrangement position, and the like. However, from the viewpoint of facilitating the fixing of the resin powder collecting member of the present invention to the plunger unit body, the resin powder collecting member of the present invention preferably includes a resin powder collecting member attachment portion.

[0030] FIG. 2 shows an example of a plunger unit of the present invention. In FIG. 2, (a) is a perspective view, (b) is a perspective view viewed from a direction different from that of (a), (c) is a left side view, (d) is a front view, (e) is a right side view, (f) is a cross-sectional view taken along III-III' of (d), and (g) is a cross-sectional view taken along II-II' of (c). While (f) and (g) of FIG. 2 are cross-sectional views, for the sake of simplifying of the illustration, hatching is omitted as appropriate. The same applies to the cross-sectional views shown in FIG. 3 and below.

[0031] As shown in FIG. 2, a plunger unit 200 includes a plunger unit body 210 as a main component. A cover member 220 made of rubber is fixed to the upper surface of the plunger unit main body 210. The periphery of the plunger attachment portion 201 in the plunger unit body 210 is covered with the cover member 220, and thereby the resin powder is prevented from entering a drive portion (inside a hole 211 shown in FIG. 2) of the plunger attachment portion

201. Further, the plunger unit 200 includes the resin powder collecting member 100 of the present invention described with reference to FIG. 1. The resin powder collecting member 100 is disposed at an upper part of the plunger unit 200. More specifically, the resin powder collecting member 100 is fixed to the upper surface of the cover member 220 by screwing by the plunger unit attachment portion 103 described with reference to FIG. 1. A suction member 130 is attached to one end of the resin powder collecting member 100. The suction member 130 is hollow inside, and the hollow communicates with the space 121 surrounded by the roof portion 110 and the side wall portion 120 of the resin powder collecting member 100. The suction member 130 has a suction hole 131 and can suck the inside of the space 121 of the resin powder collecting member 100 via the suction hole 131 by a suction mechanism described below. The plunger unit body 210 has nine substantially cylindrical plunger attachment portions 201. Further, the plunger unit main body 210 has a hole 211 at the upper part thereof, and the hole 211 penetrates to the upper surface of the cover member 220. The plunger attachment portion 201 is movable up and down inside the hole 211, and the upper part of the plunger attachment portion 201 protrudes from the upper surface of the cover member 220. As shown in (f) and (g) of FIG. 2, a spring (elastic member) 212 is disposed inside the hole 211. The plunger attachment portion 201 is placed on the spring 212, and the spring 212 is expandable and contractible together with the up and down movement of the plunger attachment portion 201. Further, a rod-shaped lever 202 is attached to the left end of the plunger unit main body 210, and a spherical knob 203 is attached to the distal end of the lever 202.

[0032] FIG. 3A is a cross-sectional view schematically showing a mechanism of resin powder collection in the resin molding apparatus of the present invention including the plunger unit 200 of FIG. 2. The cross-sectional view of FIG. 3A is an enlarged view of the upper part of the cross-sectional view as in (f) of FIG. 2. That is, FIG. 3A is a cross-sectional view showing a state of being cut in a direction perpendicular to the direction in which the plunger attachment portions 201 are aligned and at the position of the diameter of the plunger attachment portion insertion through hole 101. The space 121 in the resin powder collecting member 100 is connected to the suction mechanism 800 via a suction passage 801, and the inside of the space 121 can be sucked by the suction mechanism 800 to reduce the pressure. The suction passage 801 communicates with the inside of the space 121 via the suction member 130 and the suction hole 131 (not shown in FIG. 3A) described in FIG. 2. The suction mechanism 800 is not particularly limited, and may be, for example, a suction pump, a vacuum pump, or the like. The resin molding apparatus further includes a plunger, a pot, and a molding die, which are not shown in FIG. 3A. The plunger is attached to the upper end of the plunger attachment portion 201. The plunger can move up and down inside the pot in response to the up and down movement of the plunger

attachment portion 201. The pot can contain a resin material. By raising the plunger, the resin material inside the pot can be supplied into the molding die to be resin-molded. The configuration of the plunger, the pot, and the molding die is not particularly limited, and may be, for example, the same as that of a general resin molding apparatus for transfer molding.

5 [0033] With reference to FIG. 3A, a method for producing a resin molded product of the present invention using the resin molding apparatus of the present invention and an example of resin powder collection will be described. First, molding a resin material using a resin molding apparatus is performed. The molding a resin material is not particularly limited, and can be performed, for example, in the same manner as in general transfer molding. As described above,
10 by raising the plunger, the resin material inside the pot can be supplied into the molding die, whereby the molding a resin material can be performed to produce a resin molded product. In the molding a resin material, the resin powder 10a drops from the gap between the plunger and the pot onto the roof portion 110 of the resin powder collecting member 100 as shown in FIG. 3A. As described above, the upper surface of the roof portion 110 is inclined in a convex shape
15 (mountain shape) toward the plunger attachment portion insertion through hole 101, and is inclined in a concave shape (valley shape) toward the resin powder dropping through hole 102. That is, with reference to the upper surface of the roof portion 110, the resin powder dropping through hole 102 is at the lowest level. Therefore, the resin powder 10a drops toward the resin powder dropping through hole 102 as shown in FIG. 3A. Further, the resin powder 10a drops
20 from the resin powder dropping through hole 102 into the space 121 of the resin powder collecting member 100. At this time, the inside of the space 121 is sucked by the suction mechanism to be reduced in pressure, so that the resin powder 10a is easily dropped into the space 121, and the collection of the resin powder 10a can be easily performed. In the present invention, the suction mechanism 800 is optional. Suction by the suction mechanism 800 is also
25 optional and may or may not be performed. However, as described above, it is preferable to perform suction by the suction mechanism 800 because it makes the collection of the resin powder 10a easier. In addition, the timing at which suction is performed by the suction mechanism 800 is not particularly limited. For example, it is preferable to suck the inside of the space 121 in advance by the suction mechanism 800 to reduce the pressure before performing the
30 molding a resin material. Further, the reduced pressure in the space 121 by the suction is preferably maintained until the completion of the molding a resin material. Note that the resin powder 10a in the space 121 is collected by suction by the suction mechanism 800. Further, in the method for producing a resin molded product, after the molding a resin material, discarding the resin powder 10a collected by the suction mechanism 800 from the space 121 of the resin
35 powder collecting member 100 to the outside of the resin molding apparatus may be further

performed. The discarding a resin powder may be performed while stopping the suction by the suction mechanism 800. The discarding the resin powder may be performed automatically, for example, and the method is not particularly limited. For example, the resin powder 10a collected by the suction mechanism 800 from the inside of the space 121 may be sucked and removed by a suction mechanism (not shown) different from the suction mechanism 800. In this case, in order to keep the collecting force high, the suction by the suction mechanism 800 is preferably performed while stopping the suction by another suction mechanism for removing the resin powder 10a.

[0034] A cross-sectional view of FIG. 3B shows a variation of FIG. 3A. The plunger unit 200 shown in FIG. 3B is the same as the plunger unit 200 shown in FIG. 3A except that it includes sealing materials (O-rings) 701 and 702 for preventing resin powder from dropping. As shown in FIG. 3B, the O-ring 701 is provided around a hole 211 of the plunger unit body 210 and the cover member 220 (a hole through which the plunger attachment portion 201 can move up and down). The O-ring 701 can further reduce the resin powder 10a from dropping into the hole 211. The O-ring 702 constitutes a part of the resin powder collecting member 100. The resin powder collecting member 100 of FIG. 3B is the same as the resin powder collecting member 100 of FIGs. 1, 2 and 3A, except that it includes the O-ring 702. As shown in FIG. 3B, the O-ring 702 is provided around the plunger attachment portion insertion through hole 101. The O-ring 702 can further reduce the resin powder 10a from dropping into the plunger attachment portion insertion through hole 101. The method for producing a resin molded product and the method for collecting the resin powder using the resin molding apparatus including the plunger unit of FIG. 3B are not particularly limited, and can be performed, for example, in the same manner as in FIG. 3A.

[0035] The configuration of the resin molding apparatus of the present invention is not particularly limited, except that it includes the plunger unit of the present invention and a molding die for resin molding, and the resin molding apparatus of the present invention may have any configuration. For example, the configuration of the resin molding apparatus of the present invention may be the same as that of a general resin molding apparatus for transfer molding, except that the plunger unit is the plunger unit of the present invention. For example, the resin molding apparatus of the present invention including the plunger unit 200 of FIG. 2 may further include a plunger, a pot, and a mold die, as described above. An example of the configuration of such a resin molding apparatus is shown in a cross-sectional view of FIG. 5. In FIG. 5, only the main part of the resin molding apparatus is shown. As shown in FIG. 5, the resin molding apparatus 1000 mainly includes a plunger unit 200, a base member 300, a plunger 400, a molding die including a lower die 500 and an upper die 600, and a lower die chase folder 510.

A space for disposing the plunger unit 200 is formed in the central part of the base member 300, and the plunger unit 200 is disposed in the space. The plunger 400 is attached to the upper end of the plunger attachment portion 201 of the plunger unit 200. The lower die chase folder 510 is placed on the base member 300. The lower die 500 is placed on the lower die chase folder 510.

Further, the upper die 600 is disposed on the upper part of the lower die 500. A die cavity 601 is formed on the die surface of the upper die 600 (the surface facing the lower die 500), and resin molding can be performed in the die cavity 601. A through hole 501 is formed in the lower die 500, and the through hole 501 serves as a pot for containing a resin material. The plunger 400 is movable up and down inside the through hole 501. By moving the lower die 500 up and down together with the base member 300 and the lower die chase folder 510, the lower die 500 and the upper die 600 can be clamped and opened. As shown in FIG. 5, the resin molding can be performed by bringing the upper surface of the lower die 500 and the die surface of the upper die 600 into contact with each other by clamping. More specifically, by raising the plunger 400 in this state, the resin material 10 in the through hole 501 (pot) can be injected into the die cavity 601 to be resin-molded. While the resin material 10 in FIG. 5 is a liquid resin, for example, the resin may be a resin that is liquid at room temperature or a resin that is melted by heating to be liquid. A method for producing a resin molded product and a method for collecting resin powder using the resin molding apparatus are not particularly limited, and can be performed as described with reference to FIG. 3A.

[0036] FIG. 7 shows an example of the configuration of a plunger unit that does not include a resin powder collecting member. In FIG. 7, (a) is a perspective view, (b) is a perspective view viewed from a direction different from that of (a), (c) is a left side view, (d) is a front view, (e) is a cross-sectional view taken along V-V' of (d), and (g) is a cross-sectional view taken along IV-IV' of (c). The plunger unit 200a shown in FIG. 7 is the same as the plunger unit 200 of FIG. 2 except that it does not include the resin powder collecting member 100 and the sucking member 130, and that it includes the cover member 220a instead of the cover member 220. The cover member 220a is the same as the cover member 220 of FIG. 2 except that it does not have a screw hole for attaching the resin powder-collecting member 100.

[0037] When the resin molded product is produced by using a plunger unit that does not include a resin powder collecting member as shown in FIG. 7, the resin powder dropped from the gap between the pot and the plunger is accumulated on the upper surface of the cover member 200. The resin powder accumulated on the upper surface of the cover member 200 needs to be manually cleaned and removed periodically. If the resin powder accumulated due to insufficient cleaning is dropped from the upper surface of the cover member 200 and enters an isobaric device portion in the plunger main body or a drive portion (in the hole 211 shown in

FIG. 7) of the plunger attachment portion 201, malfunction of the plunger may occur. Therefore, as described with reference to FIGs. 1 to 3, when the collecting member 100 of the present invention is used, it is possible to reduce the resin powder 10a from dropping from the upper surface of the cover member 200, so that it is possible to reduce the resin powder 10a from entering the isobaric device portion in the plunger body or the drive portion of the plunger attachment portion 201, and it is also possible to reduce the malfunction of the plunger. When the resin powder collecting member of the present invention is used, the resin powder does not need to be cleaned frequently as compared with the case where the resin powder collecting member is not provided as shown in FIG. 7. Therefore, according to the present invention, it is possible to efficiently collect the resin powder, and as a result, it is possible to efficiently produce the resin molded product. Further, according to the present invention, for example, as described above, the accumulated resin powder can be automatically removed by suction or the like. This allows the resin powder to be collected more efficiently.

[0038] Further, the resin powder collecting member of the present invention includes a roof portion as described above. Thus, at the upper end of the resin powder collecting member of the present invention, the part other than the plunger attachment portion insertion through hole and the resin powder dropping through hole can be always closed. As a result, for example, when suction or air pressure-feeding is performed, it is possible to reduce the resin powder contained in the resin powder collecting member from throwing up from the upper part to the outside of the collecting member. Thus, for example, it is also possible to collect the resin powder more efficiently than Patent Literature 1.

[0039] Further, with reference to the resin powder collecting member of the present invention, for example, as described above, when projection is performed on an attachment surface where the resin powder collecting member is attached to the plunger unit, the distance from the end of the plunger attachment portion insertion through hole side to the resin powder dropping through hole may be longer than the distance from the end of the side wall portion side to the resin powder dropping through hole. An example thereof is shown in a cross-sectional view of FIG. 4. FIG. 4 is a cross-sectional view showing only a part of the resin powder collecting member 100 and the plunger attachment portion 201 shown in (f) of FIG. 2 or FIG. 3A. As shown in FIG. 4, with reference to the resin powder collecting member 100, when projection is performed on the attachment surface 140 where the resin powder collecting member 100 is attached to the plunger unit main body 210, the distance l2 from the end of the plunger attachment portion insertion through hole 101 side to the resin powder dropping through hole 102 is longer than the distance l1 from the end of the side wall portion 120 to the resin powder dropping through hole 102. As a result, as shown in FIG. 4, the inclination angle ϕ of the inclined surface from the end of the

plunger attachment portion insertion through hole 101 side to the resin powder dropping through hole 102 is gentle. Therefore, it is possible to reduce the resin powder dropping in the vertical direction from the sliding gap in which the plunger slides (moves up and down) from dropping into the space 121 of the resin powder collecting member 100 from the gap between the plunger attachment portion 201 and the plunger attachment portion insertion through hole 101. As a result, the resin powder accumulated in the region X in the space 121 around the plunger attachment portion 201 can be reduced. Therefore, it is possible to reduce the resin powder from entering the hole 211 of the plunger unit body 210 and the cover member 220 (the hole in which the plunger attachment portion 201 can move up and down, see FIG. 2). Therefore, it is possible to further reduce the resin powder from entering the isobaric device portion in the plunger body or the drive portion of the plunger attachment portion 201 or the like, and it is possible to further reduce the malfunction of the plunger. Further, by using either one or both of the O-rings 701 and 702 of FIG. 3B, it is possible to further effectively reduce the resin powder from entering the hole 211 of the plunger unit body 210 and the cover member 220. With reference to the resin powder collecting member 100 of FIG. 4, as shown in FIG. 4, the relationship between the inclination angle θ of the inclined surface (outer inclined surface) from the end of the side wall portion 120 side to the resin powder dropping through hole 102 and the inclination angle ϕ of the inclined surface (inner inclined surface) from the end of the plunger attachment portion insertion through hole 101 side to the resin powder dropping through hole 102 is $\theta > \phi$. The relationship between the height t_1 from the bottom surface of the roof portion to the apex of the outer inclined surface and the height t_2 from the bottom surface of the roof portion to the apex of the inner inclined surface is $t_1 > t_2$. Furthermore, while only the size of the left half of the resin powder collecting member 100 is shown in FIG. 4, since it is bilaterally symmetrical, the right half is also the same size as the left half.

[0040] The structure, shape, production method, and the like of the resin powder collecting member of the present invention are not limited to the examples shown in FIGs. 1 to 4. For example, the resin powder collecting member 100 shown in FIGs. 1 to 4 can be produced by cutting a block-shaped metal material or the like. However, the resin powder collecting member of the present invention is not limited thereto, and may be produced by plastic working such as sheet metal working of bending a flat plate-like metal material, for example. The cross-sectional view of FIG. 6 shows an example of the structure of the resin powder collecting member of the present invention, and schematically shows the mechanism of the resin powder collecting by the plunger unit using the same. FIG. 6 is a view showing a state where the resin powder collecting member 100a of the present invention is attached to the plunger unit 200 of FIG. 2. FIG. 6 is the same as FIG. 3A except that the resin powder collecting member 100 is changed to the resin

powder collecting member 100a. Further, the method for producing the resin molded product using a resin molding apparatus including a plunger unit of FIG. 6 and the method for collecting resin powder are not particularly limited, and can be performed, for example, by the same method as described with reference to FIG. 3A. The resin powder collecting member 100a is the same as the resin powder collecting member 100 of FIGs. 1 to 4, except that it includes a roof portion 110a instead of the roof portion 110 and includes a side wall portion 120a instead of the side wall portion 120. The roof portion 110a is the same as the roof portion 110 except that it has a flat plate shape. The shape of the upper surface of the roof portion 110a is the same as the shape of the roof portion 110 of the resin powder collecting member 100. That is, the upper surface of the roof portion 110a is inclined in a convex shape (mountain shape) toward the plunger attachment portion insertion through hole 101 and inclined in a concave shape (valley shape) toward the resin powder dropping through hole 102, in the same manner as the roof portion 110. As a result, the resin powder 10a is easily dropped toward the resin powder dropping through hole 102. Further, with reference to the roof portion 110a of FIG. 6, as shown in FIG. 6, in the resin powder dropping through hole 102, the end of the outer side of the roof portion 110a (the side wall portion 120a side) enters below the end of the inner side (the plunger attachment portion insertion through hole 101 side). With such a configuration, the resin powder 10a that has entered the space 121 is less likely to come out of the resin powder dropping through hole 102. Further, the resin powder collecting member 100a can be produced by, for example, plastic working such as sheet metal working of bending a metal plate-like material as described above. More specifically, for example, the plunger attachment portion insertion through hole 101, the resin powder dropping through hole 102, and the like are formed by opening a hole in one flat plate-like metal material, and the roof portion 110a and the side wall portion 120a can be formed by bending the one flat plate-like metal material. Further, the method for producing the resin powder collecting member of the present invention is not limited to the block-shaped metal material cutting and the plastic working such as sheet metal working of bending the metal flat plate-shaped material, and the resin powder collecting member may be produced by any production method other than these.

[0041] While the present invention has been described with reference to the embodiments, the present invention is not limited to the above-described embodiments. For example, in the resin powder collecting member of the present invention, the number of the resin powder dropping through holes is not particularly limited as described above, and the resin powder collecting member may have any number of the resin powder dropping through holes. For example, in FIGs. 1 to 4 and 6, the slit-shaped (long hole-shaped) resin powder dropping through holes 102 are provided one by one on each of both sides of the plunger attachment portion insertion

through hole 101 so that the resin powder 10a is easily dropped from the resin powder dropping through hole 102. However, the present invention is not limited thereto, and for example, a plurality of resin powder dropping through holes may be provided on both sides of the plunger attachment portion insertion through holes. Further, while the resin powder collecting member of the present invention includes the roof portion and the side wall portion as described above, the bottom portion may be omitted. It is because, for example, as shown in FIGs. 2, 3, and 6, by fixing the resin powder collecting member 100 or 100a to the upper surface of the cover member 220, the upper surface of the cover member 220 functions as the bottom surface of the resin powder collecting member 100 or 100a. However, the present invention is not limited thereto, and for example, the resin powder collecting member may have a bottom surface.

[0042] Various combination, changes, and selections may be made freely and appropriately in the configuration and specifics of the present invention without departing from the scope of the present invention.

[0043] This application claims priority from Japanese Patent Application No. 2020-194737 filed on November 24, 2020. The entire subject matter of the Japanese Patent Applications is incorporated herein by reference.

Reference Signs List

[0044]

10: resin material

10a: resin powder

100, 100a: resin powder collecting member

101: plunger attachment portion insertion through hole

102: resin powder dropping through hole

103: plunger unit attachment portion

110, 110a: roof portion

111: convex portion of roof portion

112: concave portion of roof portion

120, 120a: side wall portion

121: space surrounded by roof portion and side wall portion

130: suction member

131: suction hole

140: attachment surface where resin powder collecting member 100 is attached to plunger unit body 210

200, 200a: plunger unit

201: plunger attachment portion

- 202: lever
- 203: knob
- 210: plunger unit body
- 211: hole
- 5 212: spring (elastic member)
- 220, 220a: cover member
- 300: base member
- 400: plunger
- 500: lower die
- 10 501 through hole (pot)
- 510: lower die chase folder
- 600: upper die
- 601: die cavity
- 701, 702: O-ring
- 15 800: suction mechanism
- 801: suction passage
- 1000: resin molding apparatus
- X: region within space 121 around plunger attachment portion 201

1. A resin powder collecting member used to collect resin powder dropping from a gap between a pot of a molding die for transfer molding and a plunger, comprising:
 - 5 a roof portion; and
 - a side wall portion, wherein
 - the resin powder collecting member can be disposed on an upper part of a plunger unit to which the plunger is attached,
 - the resin powder can be collected in a space surrounded by the roof portion and the side
 - 10 wall portion,
 - the roof portion has a plunger attachment portion insertion through hole for inserting the plunger attachment portion of the plunger unit and a resin powder dropping through hole for dropping the resin powder into the space, and
 - an upper surface of the roof portion is inclined in a concave shape from the plunger
 - 15 attachment portion insertion through hole and the opposite side of the plunger attachment portion insertion through hole toward the resin powder dropping through hole.
2. The resin powder collecting member according to claim 1, wherein
- 20 the resin powder dropping through hole has a slit shape.
3. The resin powder collecting member according to claim 1 or 2, wherein
- when projection is performed on an attachment surface where the resin powder collecting member is attached to the plunger unit, a distance from an end of the plunger attachment portion insertion through hole side to the resin powder dropping through hole is
- 25 longer than a distance from an end of the side wall portion side to the resin powder dropping through hole.
4. A plunger unit for transfer molding, comprising:
- 30 the resin powder collecting member according to any one of claims 1 to 3.
5. The plunger unit according to claim 4, further comprising:
- a plunger attachment portion; and
- a hole through which the plunger attachment portion can move up and down, wherein
- a sealing material for preventing resin powder from dropping is provided around the
- 35 hole.

- 6 A resin molding apparatus, comprising:
the plunger unit according to claim 4 or 5; and
a molding die for resin molding.
- 5
7. The resin molding apparatus according to claim 6, further comprising:
a suction mechanism for sucking inside a space surrounded by the roof portion and the
side wall portion.
- 10 8. A method for producing a resin molded product, comprising:
molding a resin material using the resin molding apparatus according to claim 6 or 7.
9. The method for producing a resin molded product according to claim 8, further
comprising:
- 15 discarding the resin powder collected in the space surrounded by the roof portion and
the side wall portion to an outside of the resin molding apparatus.
10. The method for producing a resin molded product according to claim 9, wherein
the resin molding apparatus is the resin molding apparatus according to claim 7, and
discarding the resin powder is performed while stopping suction by the suction
20 mechanism.