

DESCRIPTION

TITLE OF INVENTION:

5 Resin Supply Apparatus, Resin-Molded Product Manufacturing Apparatus, and
Method of Manufacturing Resin-Molded Product

TECHNICAL FIELD

[0001] The present disclosure relates to a resin supply apparatus, a resin-molded
product manufacturing apparatus, and a method of manufacturing a resin-molded
product.

10 BACKGROUND ART

[0002] As disclosed in Japanese Patent Laying-Open No. 2018-134846 (PTL 1), a resin
supply apparatus that supplies a resin material to a supply target has been known. The
apparatus described in PTL 1 includes a syringe, a nozzle, a plunger, and a pinch valve.
The pinch valve opens and closes the nozzle by pinching the nozzle. As the pinch
15 valve closes with stop of downward movement of the plunger, discharge of liquid resin
from the nozzle is stopped.

CITATION LIST

PATENT LITERATURE

[0003] PTL 1: Japanese Patent Laying-Open No. 2018-134846

20 SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0004] In a resin supply apparatus, as a pressing portion (a plunger or the like) stops
moving inside an accommodation portion (a syringe or the like) where resin is
accommodated, resin in the accommodation portion is no longer pressurized. Even
25 after the pressing portion stops moving, a resin material is kept discharged for a while
from a discharge portion (a nozzle or the like). A phenomenon of continued discharge
from the discharge portion after the pressing portion stops moving is also called "liquid
drip" or the like.

[0005] In the resin supply apparatus, a member called a chuck can be used. The

chuck is arranged as being in contact with a discharge portion so as to open and close an internal space in the discharge portion. The chuck is driven, for example, when liquid drip occurs, and it makes transition from an open state to a closed state to prevent a resin material from being kept supplied to a supply target.

5 [0006] When the chuck is closed, some of the resin material that adheres in the internal space of the discharge portion is extruded and supplied to the supply target. Furthermore, as the resin supply apparatus moves up and down, discharge of the resin material is promoted. A series of these operations is also called "liquid drain" or the like.

10 [0007] Bringing a weight of the resin material finally supplied to the supply target closer to a desired value leads to improvement in quality such as a dimension and a shape of a resin-molded product. It takes time to accurately know an amount of supply of the resin material by liquid drip and liquid drain and to bring the weight of the resin material finally supplied to the supply target closer to the desired value.

15 There is a demand for reducing the time required therefor to thereby improve productivity of the resin-molded product.

[0008] An object of the present specification is to disclose a resin supply apparatus, a resin-molded product manufacturing apparatus, and a method of manufacturing a resin-molded product, with which improvement in quality and productivity of the resin-

20 molded product can be contemplated.

SOLUTION TO PROBLEM

[0009] A resin supply apparatus that supplies a resin material to a supply target includes an accommodation portion where a resin material is accommodated, the accommodation portion including a discharge portion that discharges the resin material,

25 a pressing mechanism including a pressing portion to be inserted in the accommodation portion, the pressing mechanism extruding the resin material from the discharge portion as the pressing portion moves, a detector that detects a weight of the resin material extruded from the discharge portion and supplied over the supply target, an opening and closing mechanism including a chuck configured to form an open state and a

closed state, the opening and closing mechanism permitting the resin material extruded from the discharge portion to reach the supply target while the chuck is in the open state and disallowing the resin material extruded from the discharge portion to reach the supply target while the chuck is in the closed state, and a controller configured to control movement of the pressing portion and an opening and closing operation of the chuck. With a weight detected by the detector, of the resin material extruded from the discharge portion and supplied over the supply target being defined as a detection weight, the controller stops movement of the pressing portion when the detection weight becomes equal to or larger than a first prescribed value and changes the chuck from the open state to the closed state when the detection weight becomes equal to or larger than a second prescribed value after movement of the pressing portion is stopped.

[0010] A resin-molded product manufacturing apparatus includes the resin supply apparatus described above.

A method of manufacturing a resin-molded product by using the resin-molded product manufacturing apparatus described above includes supplying, by the resin supply apparatus, the resin material to a supply target and resin molding the supply target with the resin material.

ADVANTAGEOUS EFFECTS OF INVENTION

[0011] According to matters disclosed herein, a resin supply apparatus, a resin-molded product manufacturing apparatus, and a method of manufacturing a resin-molded product, with which improvement in quality and productivity of the resin-molded product can be contemplated, can be obtained.

BRIEF DESCRIPTION OF DRAWINGS

[0012] Fig. 1 is a diagram showing a functional block of a resin-molded product manufacturing apparatus 1000.

Fig. 2 is a cross-sectional view showing a state before clamping, of a molding portion 80 included in resin-molded product manufacturing apparatus 1000.

Fig. 3 is a cross-sectional view showing a state after clamping, of molding

portion 80 included in resin-molded product manufacturing apparatus 1000.

Fig. 4 is a diagram showing a flowchart of a method of manufacturing a resin-molded product by using resin-molded product manufacturing apparatus 1000.

5 Fig. 5 is a cross-sectional view showing a resin supply apparatus 100 included in resin-molded product manufacturing apparatus 1000.

Fig. 6 is a diagram showing a timing chart applied to a resin supply apparatus in a comparative example.

Fig. 7 is a flowchart showing each step of supply of resin performed by the resin supply apparatus in the comparative example.

10 Fig. 8 is a cross-sectional view showing a manner of supply of resin by a resin supply apparatus 100R in the comparative example.

Fig. 9 is a cross-sectional view showing a manner of supply of resin by resin supply apparatus 100R in the comparative example.

15 Fig. 10 is a cross-sectional view showing a manner of supply of resin by resin supply apparatus 100R in the comparative example.

Fig. 11 is a diagram showing a timing chart applied to the resin supply apparatus in an embodiment.

Fig. 12 is a flowchart showing each step of supply of resin performed by the resin supply apparatus in the embodiment.

20 Fig. 13 is a cross-sectional view showing a manner (first movement M1) of supply of resin by resin supply apparatus 100 in the embodiment.

Fig. 14 is a cross-sectional view showing a manner (second movement M2) of supply of resin by resin supply apparatus 100 in the embodiment.

25 Fig. 15 is a cross-sectional view showing a manner (liquid drip) of supply of resin by resin supply apparatus 100 in the embodiment.

Fig. 16 is a cross-sectional view showing a manner (liquid drain) of supply of resin by resin supply apparatus 100 in the embodiment.

DESCRIPTION OF EMBODIMENTS

[0013] An embodiment of the present disclosure will be described below. When the

number, an amount, or the like is mentioned in the embodiment which will be described below, the scope of the present disclosure is not necessarily limited to the number, the amount, or the like unless otherwise specified. Each constituent element is not necessarily essential to the present disclosure unless otherwise specified. The same or corresponding elements have the same reference characters allotted and redundant description may not be repeated.

[0014] [Resin-Molded Product Manufacturing Apparatus 1000]

Fig. 1 is a diagram showing a functional block of a resin-molded product manufacturing apparatus 1000. Fig. 2 is a cross-sectional view showing a state before clamping, of a molding portion 80 included in resin-molded product manufacturing apparatus 1000. Fig. 3 is a cross-sectional view showing a state after clamping, of molding portion 80 included in resin-molded product manufacturing apparatus 1000.

[0015] As shown in Fig. 1, resin-molded product manufacturing apparatus 1000 includes a substrate module 101, a press module 102, a discharge module 103, and a film module 104. A substrate 90 (Fig. 2) is carried out of substrate module 101 and a film 60 (Fig. 2) is carried out of film module 104. Discharge module 103 supplies a thermosetting resin material 13 over film 60. Press module 102 molds substrate 90 with resin using liquid resin material 13 supplied over film 60 (Fig. 3).

[0016] Substrate module 101, press module 102, discharge module 103, and film module 104 are described as different modules separate from one another in resin-molded product manufacturing apparatus 1000. Each module may be configured to be attachable to and removable from another module, and the number of modules may be increased or decreased. For example, two or three discharge modules 103 may be arranged between press module 102 and film module 104.

[0017] Resin-molded product manufacturing apparatus 1000 further includes conveyance mechanisms 91 and 92. Conveyance mechanism 91 conveys substrate 90 carried out of substrate module 101 to an upper mold (Fig. 2) of a molding die in a molding portion 80 (Fig. 2) of press module 102. Conveyance mechanism 92 conveys film 60 to which resin material 13 has been discharged in discharge module 103 to a

lower mold 87 (Fig. 2) of the molding die in molding portion 80 of press module 102. Conveyance mechanism 92 further conveys film 60 carried out of film module 104, on which resin material 13 is not located, to discharge module 103.

[0018] [Method of Manufacturing Resin-Molded Product]

5 Fig. 4 is a diagram showing a flowchart of a method of manufacturing a resin-molded product by using resin-molded product manufacturing apparatus 1000. Fig. 5 is a cross-sectional view showing a resin supply apparatus 100 included in resin-molded product manufacturing apparatus 1000. The method of manufacturing a resin-molded product will be described here and a detailed configuration and operations of resin supply apparatus 100 will be described later.

10 [0019] Referring to Figs. 1 to 5, in the method of manufacturing the resin-molded product, initially, resin supply apparatus 100 (Fig. 5) supplies resin material 13 over film 60 (step S101). For example, conveyance mechanism 92 conveys film 60 and a tray cover 54 (Fig. 5) in a form of a frame arranged on film 60 from film module 104 to discharge module 103.

15 [0020] Resin supply apparatus 100 of discharge module 103 then supplies resin material 13 over film 60 within tray cover 54. Details of this operation will be described later. Conveyance mechanism 91 then conveys substrate 90 from substrate module 101 to press module 102 and sets the substrate at a lower surface of upper mold 81 of the molding die in press module 102 (step S102).

20 [0021] Conveyance mechanism 91 sets film 60 to which resin material 13 has been supplied, at an upper surface of lower mold 87 (step S103). Conveyance mechanism 92 conveys, together with tray cover 54, film 60 to which resin material 13 has been supplied from discharge module 103 to press module 102 and sets film 60 on which resin material 13 is located, at the upper surface of lower mold 87 of the molding die in press module 102. Conveyance mechanism 92 conveys tray cover 54 to film module 104, without setting tray cover 54 within press module 102.

25 [0022] As shown in Fig. 2, in molding portion 80, a fixed platen 88 in a form of a block is supported by a tie bar or a holding frame. Upper mold 81 is set at a lower side of

fixed platen 88. A movable platen 86 is arranged under fixed platen 88. Lower mold 87 is set at an upper side of movable platen 86.

[0023] Lower mold 87 includes a bottom surface member 82, a side surface member 83, a plurality of elastic members 84, and a base plate 85. Lower mold 87 is provided with a recess recessed downward. Conveyance mechanism 92 sets film 60 at the upper surface of lower mold 87 such that resin material 13 on film 60 is located at a bottom surface of the recess. As shown in Fig. 2, conveyance mechanism 91 sets substrate 90 at a lower surface of upper mold 81.

[0024] Upper mold 81 and lower mold 87 are clamped by upward movement of lower mold 87 toward upper mold 81 (step S104). For example, a not-shown clamping mechanism moves movable platen 86 upward. Lower mold 87 thus moves upward toward upper mold 81. As movable platen 86 moves upward, initially, side surface member 83 in the form of the frame abuts on substrate 90 with film 60 being interposed.

[0025] Thereafter, upward movement of movable platen 86 continues. While upward movement of side surface member 83 remains stopped, bottom surface member 82 moves upward and the plurality of elastic members 84 contract. When a position of an upper surface of side surface member 83 reaches a predetermined position, movable platen 86 stops moving upward and clamping in step S104 ends.

[0026] After movement of lower mold 87 is stopped and clamping is performed, a temperature of the molding die is increased (step S105). Resin material 13 is thermosetting. Therefore, when the temperature of resin material 13 increases, resin material 13 is cured to become cured resin 18 (Fig. 3) (step S106). After standing-by until resin material 13 is cured, base plate 85 is moved downward to move lower mold 87 downward. The molds are thus opened and a resin-molded product in which the lower surface of substrate 90 is sealed with resin is manufactured (step S107).

[0027] Though an example where discharge module 103 of resin-molded product manufacturing apparatus 1000 shown in Fig. 1, the resin-molded product manufacturing apparatus including press module 102 where substrate 90 is set at upper

mold 81 and the resin-molded product is manufactured as shown, for example, in Figs. 2 and 3, includes resin supply apparatus 100 in the embodiment is described above, discharge module 103 of resin-molded product manufacturing apparatus 1000 shown in Fig. 1, the resin-molded product manufacturing apparatus including press module 102 where substrate 90 is set, for example, at lower mold 87 and the resin-molded product is manufactured, may include resin supply apparatus 100 in the embodiment above.

[0028] [Resin Supply Apparatus 100]

Referring to Fig. 5, resin supply apparatus 100 supplies liquid resin material 13 to a supply target such as film 60. Specifically, resin supply apparatus 100 includes, for example, a cartridge 10, a holding mechanism 20, a pressing mechanism 30, an opening and closing mechanism 40, a detector 50, a stage 52, and a controller 70.

[0029] (Cartridge 10)

Cartridge 10 includes a lid body 11, an accommodation portion 12, and resin material 13. In accommodation portion 12, resin material 13 is accommodated, and lid body 11 is arranged on a surface of resin material 13. Lid body 11 seals resin material 13 to prevent resin material 13 from leaking from accommodation portion 12. Accommodation portion 12 of cartridge 10 is arranged inside a cylindrical portion 23 of holding mechanism 20 which will be described later. At an end of accommodation portion 12, a discharge portion 12a is provided. Cartridge 10 discharges resin material 13 through discharge portion 12a.

[0030] (Detector 50)

Stage 52 is arranged under discharge portion 12a and film 60 conveyed from film module 104 is placed on stage 52. Tray cover 54 in the form of the frame is arranged on film 60. Resin material 13 is supplied to the inside of tray cover 54 on film 60. Detector 50 is connected to stage 52, and detects a weight of resin material 13 extruded from discharge portion 12a and supplied over film 60.

[0031] (Holding Mechanism 20)

Holding mechanism 20 includes a peripheral wall 21, a locking member 22, and cylindrical portion 23 and holds cartridge 10. A plurality of locking members 22 are

provided at an inner periphery of peripheral wall 21, and cylindrical portion 23 is locked by the plurality of locking members 22. Cartridge 10 is removably set inside cylindrical portion 23.

[0032] (Pressing Mechanism 30)

5 Pressing mechanism 30 includes a servo motor 31 and a pressing portion 32. Pressing portion 32 is inserted into accommodation portion 12 of cartridge 10 and arranged to be in contact with lid body 11. As pressing portion 32 moves, pressing portion 32 presses resin material 13 with lid body 11 being interposed to extrude resin material 13 from discharge portion 12a of cartridge 10.

10 [0033] (Opening and Closing Mechanism 40 and Controller 70)

 Opening and closing mechanism 40 includes a drive portion 41 and a pair of chucks 42 and 43. Chucks 42 and 43 are arranged to open and close the internal space in discharge portion 12a. Chucks 42 and 43 are configured to form the open state and the closed state, and switching between these states is made by the chucks being driven
15 by drive portion 41. Discharge portion 12a may be structured such that a tube made of a soft material is attached thereto, and chucks 42 and 43 may press the tube.

 [0034] Opening and closing mechanism 40 permits resin material 13 extruded from discharge portion 12a to reach film 60 while chucks 42 and 43 are in the open state and disallows resin material 13 extruded from discharge portion 12a to reach film 60 while
20 chucks 42 and 43 are in the closed state. Controller 70 is connected to servo motor 31, drive portion 41, and detector 50, and can control movement of pressing portion 32 and an opening and closing operation of chucks 42 and 43 in accordance with a value detected by detector 50.

 [0035] Prior to detailed description of the embodiment of the present disclosure, a
25 comparative example associated with the embodiment will be described below.

[0036] [Comparative Example]

 Fig. 6 is a diagram showing a timing chart applied to a resin supply apparatus in a comparative example. Fig. 7 is a flowchart showing each step of supply of resin performed by the resin supply apparatus in the comparative example. Figs. 8 to 10 are

each a cross-sectional view showing a manner of supply of resin by a resin supply apparatus 100R in the comparative example.

[0037] Resin supply apparatus 100R (Fig. 8) in the comparative example reads,

initially at time t0 (Fig. 6), a setting value (a prescribed weight and a prescribed time period) from a reference table or the like prepared in advance (step t101 in Fig. 7). At time t0, chucks 42 and 43 form the closed state.

[0038] The setting value of the "prescribed weight" herein is a value set as below.

The weight of resin material 13 extruded from discharge portion 12a and supplied over film 60 is detected as the detection weight by detector 50 and transmitted to controller

70. Pressing portion 32 starts moving and resin is supplied over film 60. At a time point when the weight of resin supplied over film 60 reaches the prescribed weight, movement of pressing portion 32 is stopped. The weight defined as a threshold value at which movement of pressing portion 32 is stopped is the "prescribed weight" herein.

The prescribed weight is set as appropriate to a desired value in consideration of a condition or the like of resin supply performed in the past.

[0039] Furthermore, the setting value of the "prescribed time period" herein is a value set as below. At a time point of lapse of the prescribed time period after movement of

pressing portion 32 is stopped, drive portion 41 changes chucks 42 and 43 from the open state to the closed state. For a period until drive portion 41 changes chucks 42

and 43 from the open state to the closed state after movement of pressing portion 32 is stopped (that is, for the prescribed time period), resin material 13 is kept supplied over

film 60 as liquid drip. The time period until drive portion 41 changes chucks 42 and 43 from the open state to the closed state after movement of pressing portion 32 is

stopped is the "prescribed time period" herein. The prescribed time period is set as

appropriate to a desired value in consideration of a condition or the like of resin supply performed in the past.

[0040] At time t1 (Fig. 6), movement of pressing portion 32 is started (step t102 in Fig. 7). An amount of movement (Fig. 6) of pressing portion 32 gradually increases from an amount of movement a1 and resin material 13 is extruded from discharge portion

12a. While resin material 13 has not reached film 60, a weight w1 does not change. At a time point of time t2, resin material 13 reaches film 60 and the weight starts to increase (a weight w2 and a weight w3).

[0041] At a time point of time t3 (Fig. 6), that is, at a time point when the detection weight detected by detector 50 becomes equal to or larger than the prescribed weight (YES in step t103 in Fig. 7), movement of pressing portion 32 is stopped (step t104). The amount of movement of pressing portion 32 substantially does not increase from an amount of movement a3. As shown in Fig. 9, even after movement of pressing portion 32 is stopped, resin material 13 is kept discharged as liquid drip from discharge portion 12a and the weight keeps increasing (weight w3 and a weight w4).

[0042] Referring to Fig. 10, at a time point of time t4 (Fig. 6), that is, at a time point of lapse of the prescribed time period after movement of pressing portion 32 is stopped (YES in step t105 in Fig. 7), drive portion 41 changes chucks 42 and 43 from the open state to the closed state (step t106). Resin material 13 is supplied as liquid drain (the resin material kept supplied to film 60 due to a liquid drain phenomenon) to film 60 also after chucks 42 and 43 are closed, and the weight keeps slightly increasing (weight w4 and a weight w5). As liquid drain stops, supply of resin is completed (time t5 in Fig. 6, step t107 in Fig. 7). Next supply of resin is performed as necessary for another film 60 (YES in step t108 in Fig. 7).

[0043] In the case of the comparative example above, the weight of resin material 13 supplied over film 60 is brought closer to the desired value by using the prescribed weight and the prescribed time period. The prescribed time period can be optimized in consideration of a condition or the like of resin supply performed in the past.

[0044] (Functions and Effects of Comparative Example)

In general, however, compressive characteristics of a liquid resin material vary depending on an environmental condition, and hence it is difficult to completely bring the amount of movement of pressing portion 32 in correspondence with the weight of discharged resin material 13. In addition, even when timing to stop pressing portion 32 is optimized in accordance with the value of the prescribed weight and timing to

close chucks 42 and 43 is optimized in accordance with the value of the prescribed time period, the weight of resin material 13 supplied to film 60 by liquid drip and liquid drain tends to vary due to a factor such as a physical property of the resin material.

[0045] Furthermore, bringing the weight of the resin material finally supplied to the supply target closer to the desired value by increasing or decreasing the "prescribed time period" tends to lead to a longer cycle time. In other words, though liquid drip occurs while pressing portion 32 is not moving, this time period is what is called a stand-by time period, in which an amount of supply of resin material 13 is small.

Therefore, it takes time to bring the amount of supply of resin material 13 closer to a target weight. Furthermore, a method of increasing or decreasing the "prescribed time period" can not necessarily control the weight of the resin material to a target value.

[0046] [Embodiment]

In contrast to the comparative example described above, in resin supply apparatus 100 in the embodiment, resin supply as will be described below is performed.

[0047] Fig. 11 is a diagram showing a timing chart applied to the resin supply apparatus in the embodiment. Fig. 12 is a flowchart showing each step of supply of resin performed by the resin supply apparatus in the embodiment. Figs. 13 to 16 are each a cross-sectional view showing a manner of supply of resin by resin supply apparatus 100 in the embodiment.

[0048] Resin supply apparatus 100 (Fig. 5) in the embodiment reads, initially at time T0 (Fig. 11), a setting value (a first prescribed value and a second prescribed value) from the reference table or the like prepared in advance (step T101 in Fig. 12). At time T0, chucks 42 and 43 form the closed state.

[0049] The setting value of the "first prescribed value" herein is a value set as below.

The weight of resin material 13 extruded from discharge portion 12a and supplied over film 60 is detected as the detection weight by detector 50 and transmitted to controller 70. Pressing portion 32 starts moving and resin is supplied over film 60. At a time point when the weight of resin supplied over film 60 reaches the first prescribed value, movement of pressing portion 32 is stopped. The weight defined as a threshold value

at which movement of pressing portion 32 is stopped is the "first prescribed value" herein. The first prescribed value is set as appropriate to a desired value in consideration of a condition or the like of resin supply performed in the past.

[0050] Furthermore, the setting value of the "first prescribed value" herein is a value

5 set as below. Resin material 13 is kept supplied as liquid drip over film 60 also after movement of pressing portion 32 is stopped. The weight of resin material 13 supplied over film 60 is detected as the detection weight by detector 50 and transmitted to controller 70. At a time point when the weight of resin supplied over film 60 reaches the second prescribed value, drive portion 41 changes chucks 42 and 43 from the open
10 state to the closed state. The weight defined as a threshold value at which drive portion 41 changes chucks 42 and 43 from the open state to the closed state is the "second prescribed value" herein. The second prescribed value is set as appropriate to a desired value in consideration of a condition or the like of resin supply performed in the past.

15 [0051] At time T1 (Fig. 11), movement of pressing portion 32 is started (step T102 in Fig. 12). The amount of movement of pressing portion 32 (Fig. 11) gradually increases from an amount of movement A1 and resin material 13 is extruded from discharge portion 12a. While resin material 13 has not reached film 60, a weight W1 does not vary. Since discharge portion 12a has not drawn a pattern on film 60, a
20 pattern path length does not increase (a length D1). At a time point of time T2, resin material 13 reaches film 60 and the weight starts to increase (a weight W2, a weight W4, and a weight W5). At a time point of time T3, discharge portion 12a starts to draw the pattern on film 60 and the pattern path length starts to increase (a length D3, a length D4, and a length D5, Fig. 13).

25 [0052] At time T5 (Fig. 11), that is, at a time point when the detection weight detected by detector 50 becomes equal to or larger than the first prescribed value (YES in step T103 in Fig. 12), movement of pressing portion 32 is stopped (step T104). At this time point, resin material 13 has reached weight W5.

[0053] In the present embodiment, pressing portion 32 is configured to perform first

movement M1 and second movement M2 before time T5. First movement M1 is started at time T1. At a time point of time T4 (Fig. 11), change from first movement M1 to second movement M2 is made, and second movement continues until time T5.

[0054] In other words, controller 70 (Fig. 13) controls pressing mechanism 30 to have pressing portion 32 perform first movement M1 and controls pressing mechanism 30 to have pressing portion 32 perform second movement M2 after first movement M1.

Detector 50 detects the weight of resin material 13 extruded from a discharge portion 14a and supplied over film 60 while at least second movement M2 of first movement M1 and second movement M2 is performed.

[0055] As to timing of switching from first movement M1 to second movement M2, for example, controller 70 desirably has pressing portion 32 perform second movement M2 after pressing portion 32 performs first movement M1 to move a predetermined distance L1 (Fig. 11) (an amount of movement A4).

[0056] Fig. 13 shows a manner of first movement M1 by pressing portion 32 and Fig. 14 shows a manner of second movement M2 by pressing portion 32. With the weight of resin material 13 extruded from discharge portion 12a and supplied over film 60 per unit time being defined as a reference weight, controller 70 may control pressing mechanism 30 such that the reference weight while pressing portion 32 is performing second movement M2 is smaller than the reference weight while pressing portion 32 is performing first movement M1. According to the configuration, an inclination of a straight line between weights W4 and W5 is smaller than an inclination of a straight line between weights W2 and W4.

[0057] At time T5 (Fig. 11), that is, at a time point when the detection weight detected by detector 50 becomes equal to or larger than the first prescribed value (YES in step T103 in Fig. 12), movement of pressing portion 32 is stopped (step T104). At this time point, resin material 13 has reached weight W5. The amount of movement of pressing portion 32 substantially does not increase from an amount of movement A5. As shown in Fig. 15, even after movement of pressing portion 32 is stopped, resin material 13 is kept discharged as liquid drip from discharge portion 12a and the weight

keeps increasing (weight W5 and a weight W6).

[0058] Referring to Fig. 16, at a time point of time T6 (Fig. 11), that is, at a time point when the detection weight detected by detector 50 becomes equal to or larger than the second prescribed value (YES in step T105 in Fig. 12), drive portion 41 changes
5 chucks 42 and 43 from the open state to the closed state (step T106). Even after chucks 42 and 43 are closed, resin material 13 is supplied as liquid drain (the resin material kept supplied to film 60 due to the liquid drain phenomenon) to film 60 and the weight keeps slightly increasing (weight W6 and a weight W7). As liquid drain stops, supply of resin is completed (time T7 in Fig. 11, step T107 in Fig. 12).

10 [0059] As shown in step T108 in Fig. 12, controller 70 obtains the detection weight after resin material 13 is no longer supplied over film 60 because of change of chucks 42 and 43 from the open state to the closed state, and changes at least one of the first prescribed value and the second prescribed value in accordance with a difference WD (Fig. 11) between the obtained value and a target weight value set in advance. The
15 resultant value is stored in a setting value table (Fig. 12). Next supply of resin is performed as necessary for another film 60 (YES in step T109 in Fig. 12).

[0060] (Functions and Effects of Embodiment)

In the case of the embodiment above, the weight of resin material 13 supplied over film 60 is brought closer to the desired value (target weight value) by using the
20 first prescribed value and the second prescribed value. In other words, with the weight detected by detector 50, of resin material 13 extruded from discharge portion 12a and supplied over film 60 being defined as the detection weight, while the detection weight is monitored in real time or every prescribed time period, pressing portion 32 is moved until the detection weight becomes equal to or larger than the first
25 prescribed value.

[0061] As stated in the description of the comparative example, bringing the weight of the resin material finally supplied to the supply target closer to the desired value by increasing or decreasing the "prescribed time period" tends to lead to a longer cycle time. In contrast, in the present embodiment, after movement of pressing portion 32 is

stopped, a discharge weight resulting from liquid drip is also monitored. With the detection weight being monitored in real time or every prescribed time period, when the detection weight becomes equal to or larger than the second prescribed value after movement of pressing portion 32 is stopped, chucks 42 and 43 are changed from the open state to the closed state. According to these configurations, variation in amount of supply due to the physical property of resin material 13 can be suppressed, accuracy of the weight of discharged resin can be improved, and a time period required for supply of resin can be reduced.

[0062] Controller 70 obtains the detection weight after resin material 13 is no longer supplied over film 60 because of change of chucks 42 and 43 from the open state to the closed state and changes at least one of the first prescribed value and the second prescribed value in accordance with the difference between the obtained value and the target weight value set in advance. In other words, by optimizing the first prescribed value and the second prescribed value in consideration of a condition or the like of resin supply performed in the past, an amount of discharged liquid resin can highly accurately be controlled, extension of the cycle time can be suppressed, and then improvement in quality and productivity of the resin-molded product can be contemplated.

[0063] In the present embodiment, with the weight of resin material 13 extruded from discharge portion 12a and supplied over film 60 per unit time being defined as the reference weight, controller 70 may control pressing mechanism 30 such that the reference weight while pressing portion 32 is performing second movement M2 is smaller than the reference weight while pressing portion 32 is performing first movement M1. According to the configuration, the inclination of the straight line between weights W4 and W5 is smaller than the inclination of the straight line between weights W2 and W4. According to the configuration, a pressure that remains in accommodation portion 12 after movement of pressing portion 32 is stopped can be lower (that is, the pressure that remains can be brought closer to the atmospheric pressure), supply of resin to be performed next can start from the pressure closer to the

atmospheric pressure, and for example, a desired amount of resin can more readily be supplied in an early stage of supply of resin to be performed next.

[0064] (As to Another Configuration)

When the weight becomes equal to or larger than the second prescribed value
5 with respect to the target weight value, an operation to close the chuck is performed. By optimizing the second prescribed value, for example, an interval G2 between time T6 and time T7 shown in Fig. 11 is consequently changed. Feedback to the second prescribed value may be given to calculate an optimal value by automatic calculation and to minimize an error.

10 [0065] Timing (an interval G4 between time T5 and time T7 shown in Fig. 11) to stop movement of pressing portion 32 is changed by changing the first prescribed value. Other than optimization of the first prescribed value and the second prescribed value in consideration of a condition or the like of resin supply performed in the past, for example, timing (an interval G1 between time T2 and time T3 shown in Fig. 11) to start
15 a patterning operation may be adjusted. Alternatively, an operation speed or the like of pressing portion 32 that moves an interval G3 shown in Fig. 11 in performing second movement M2 may be adjusted.

[0066] Alternatively, for example, with a time period for first movement M1 by pressing portion 32 being defined as a first time period C1 (Fig. 11) and with a time
20 period for second movement M2 by pressing portion 32 being defined as a second time period C2, controller 70 may control pressing mechanism 30 such that second time period C2 is shorter than first time period C1.

[0067] Alternatively, with a time period until controller 70 changes chucks 42 and 43 from the open state to the closed state after controller 70 stops movement of pressing
25 portion 32 being defined as a third time period C3 (Fig. 11), controller 70 may control pressing mechanism 30 and/or chucks 42 and 43 such that third time period C3 is shorter than second time period C2.

[0068] Though an embodiment of the present disclosure has been described above, it should be understood that the embodiment disclosed herein is illustrative and non-

restrictive in every respect. The scope of the present disclosure is defined by the terms of the claims and is intended to include any modifications within the scope and meaning equivalent to the terms of the claims.

REFERENCE SIGNS LIST

5 [0069] 10 cartridge; 11 lid body; 12 accommodation portion; 12a, 14a discharge portion; 13 resin material; 18 cured resin; 20 holding mechanism; 21 peripheral wall; 22 locking member; 23 cylindrical portion; 30 pressing mechanism; 31 servo motor; 32 pressing portion; 40 opening and closing mechanism; 41 drive portion; 42, 43 chuck; 50 detector; 52 stage; 54 tray cover; 60 film (supply target); 70 controller; 80 molding
10 portion; 81 upper mold; 82 bottom surface member; 83 side surface member; 84 elastic member; 85 base plate; 86 movable platen; 87 lower mold; 88 fixed platen; 90 substrate; 91, 92 conveyance mechanism; 100, 100R resin supply apparatus; 101 substrate module; 102 press module; 103 discharge module; 104 film module; 1000 resin-molded product manufacturing apparatus.

15

CLAIMS

[Claim 1] A resin supply apparatus that supplies a resin material to a supply target, the resin supply apparatus comprising:

- 5 an accommodation portion where a resin material is accommodated, the accommodation portion including a discharge portion that discharges the resin material;
- a pressing mechanism including a pressing portion to be inserted in the accommodation portion, the pressing mechanism extruding the resin material from the discharge portion as the pressing portion moves;
- 10 a detector that detects a weight of the resin material extruded from the discharge portion and supplied over the supply target;
- an opening and closing mechanism including a chuck configured to form an open state and a closed state, the opening and closing mechanism permitting the resin material extruded from the discharge portion to reach the supply target while the chuck
- 15 is in the open state and disallowing the resin material extruded from the discharge portion to reach the supply target while the chuck is in the closed state; and
- a controller configured to control movement of the pressing portion and an opening and closing operation of the chuck, wherein
- with a weight detected by the detector, of the resin material extruded from the
- 20 discharge portion and supplied over the supply target being defined as a detection weight, the controller
- stops movement of the pressing portion when the detection weight becomes equal to or larger than a first prescribed value, and
- changes the chuck from the open state to the closed state when the
- 25 detection weight becomes equal to or larger than a second prescribed value after movement of the pressing portion is stopped.

[Claim 2] The resin supply apparatus according to claim 1, wherein the controller obtains the detection weight after the resin material is no longer

supplied over the supply target because of change of the chuck from the open state to the closed state and changes at least one of the first prescribed value and the second prescribed value in accordance with a difference between an obtained value and a target weight value set in advance.

5

[Claim 3] The resin supply apparatus according to claim 1 or 2, wherein the controller controls the pressing mechanism to have the pressing portion perform first movement and controls the pressing mechanism to have the pressing portion perform second movement after the first movement, and

10 the detector detects the weight of the resin material extruded from the discharge portion and supplied over the supply target while at least the second movement of the first movement and the second movement is being performed.

[Claim 4] The resin supply apparatus according to claim 3, wherein
15 the controller has the pressing portion perform the second movement after the pressing portion moves a predetermined distance as a result of the first movement of the pressing portion.

[Claim 5] The resin supply apparatus according to claim 3 or 4, wherein
20 with the weight of the resin material extruded from the discharge portion and supplied over the supply target per unit time being defined as a reference weight, the controller controls the pressing mechanism such that the reference weight while the pressing portion is performing the second movement is smaller than the reference weight while the pressing portion is performing the first movement.

25

[Claim 6] The resin supply apparatus according to any one of claims 3 to 5, wherein

with a time period for which the pressing portion performs the first movement being defined as a first time period and with a time period for which the pressing

portion performs the second movement being defined as a second time period,
the controller controls the pressing mechanism such that the second time period
is shorter than the first time period.

5 [Claim 7] The resin supply apparatus according to claim 6, wherein
with a time period from stop of movement of the pressing portion by the
controller until the controller changes the chuck from the open state to the closed state
being defined as a third time period,

10 the controller controls the pressing mechanism and/or the chuck such that the
third time period is shorter than the second time period.

[Claim 8] A resin-molded product manufacturing apparatus comprising the
resin supply apparatus according to any one of claims 1 to 7.

15 [Claim 9] A method of manufacturing a resin-molded product by using the
resin-molded product manufacturing apparatus according to claim 8, the method
comprising:

supplying, by the resin supply apparatus, the resin material to a supply target;
and

20 resin molding the supply target with the resin material.