

DESCRIPTION

METHOD AND SYSTEM FOR COOLING RESIN-SEALED SUBSTRATE, SYSTEM
FOR CONVEYING SUCH SUBSTRATE, AND RESIN-SEALING SYSTEM

5

TECHNICAL FIELD

[0001]

The present invention relates to a method and system for cooling a resin-sealed
substrate produced by resin-sealing electronic parts or similar elements mounted on a
10 substrate, as well as a system for conveying such a substrate. The present invention also
relates to a system for resin-sealing electronic parts or similar elements mounted on a
substrate.

BACKGROUND ART

15 [0002]

A resin-sealing system having a mold composed of upper and lower dies has been
conventionally used for molding and resin-sealing electronic parts or similar elements
mounted on a substrate. Either the upper or lower die has a cavity for receiving an amount of
resin. In the resin-sealing process, a substrate having electronic parts or similar elements
20 mounted thereon is sandwiched between the upper and lower dies, with the electronic parts
or similar elements contained in the cavity, whereafter a resin material which has been
melted at high temperature is supplied into the cavity and cured. (Such a process is called
transfer molding.) After the resin material is cured, the resin-sealed substrate is conveyed
from the resin-sealing mold to a predetermined location designated for a post-process, such
25 as the storage of the substrate into a rack or the cutting of the substrate.

[0003]

Such a molding and resin-sealing process requires a system for conveying the substrate before or after the resin-sealing process. One example of such a conveying system is disclosed in Patent Document 1. This conveying system includes a horizontally movable
5 conveying plate which can be inserted into or removed from the space between the upper and lower dies, and a substrate carrier mounted in a hole of the conveying plate and movable vertically through the hole. On the upper side of the substrate carrier a substrate-setting section on which a substrate before the resin-sealing process can be set is provided, while on its lower side a substrate-holding section on which a resin-sealed substrate can be held is
10 provided. A suction-holding device for holding a resin-sealed substrate by suction is provided in the substrate-holding section on the lower-side of the substrate carrier.

[0004]

As already explained, the resin-sealing of electronic parts or similar elements is achieved by curing a resin that has been melted at high temperature. Therefore, the substrate
15 is still hot immediately after the resin-sealing process is completed. The thermal shrinkage factor of the resin material differs from that of the substrate material. Therefore, if a resin-sealed substrate that has been removed from the mold is left out in the air, the resin-sealed substrate is likely to be warped as a result of natural cooling. The warping of the resin-sealed substrate causes various problems. For example, a warped substrate cannot be
20 smoothly stored in the rack or correctly cut.

[0005]

As one solution to this problem, a warp prevention device is disclosed in Patent Document 2. This device has a heat-release plate provided inside the resin-sealing system. The warping of a molded and resin-sealed product is prevented by sandwiching the product
25 between the heat-release plate and the substrate-setting section and cooling it in this state.

BACKGROUND ART DOCUMENT

PATENT DOCUMENT

[0006]

5 Patent Document 1: JP-A 2010-105326

Patent Document 2: JP-A 3-129864

DISCLOSURE OF THE INVENTION

PROBLEM TO BE SOLVED BY THE INVENTION

10 [0007]

In the device described in Patent Document 2, it is necessary to hold the resin-sealed substrate in the sandwiched state by applying significant pressure from above and below for a certain period of time. This may cause undesirable effect on the product, such as damage to the electronic parts or similar elements in the resin-sealed portion or deformation of the
15 external shape of the resin-sealed substrate.

[0008]

The problem to be solved by the present invention is to provide a method and system for cooling a resin-sealed substrate produced by molding and resin-sealing a substrate with electronic parts or similar elements mounted thereon, which method or system is capable of
20 cooling the resin-sealed substrate while minimizing negative effect on the electronic parts or similar elements and also preventing warping of the substrate. The present invention also provides a system for conveying a resin-sealed substrate including the aforementioned cooling system, as well as a resin-sealing system including the same cooling system.

25 MEANS FOR SOLVING THE PROBLEMS

[0009]

A system for cooling a resin-sealed substrate according to the first aspect of the present invention aimed at solving the aforementioned problem is a substrate-cooling system for cooling a resin-sealed substrate produced by molding and resin-sealing electronic parts
5 mounted on a substrate by means of a resin-sealing mold, including:

a) a holder for holding the resin-sealed substrate;

b) an attracting device, provided in the holder, for attracting the resin-sealed substrate to the holder; and

c) a cooling member located at a position toward which the attracting device attracts
10 the resin-sealed substrate, the cooling member having a contact surface with which the resin-sealed substrate tightly contacts.

[0010]

In one mode of the system for cooling a resin-sealed substrate according to the first aspect of the present invention, the attracting device includes an air-sucking device for
15 drawing air from a space between the resin-sealed substrate and the contact surface of the cooling member.

[0011]

In another mode of the system for cooling a resin-sealed substrate according to the first aspect of the present invention:

20 the attracting device includes:

an elastic support, provided on the cooling member, for forming one or more closed spaces between the resin-sealed substrate and the contact surface by coming in contact with the resin-sealed substrate when the resin-sealed substrate is attracted; and

one or more through-holes each of which is provided in the cooling member
25 at a position within the aforementioned one or more closed spaces and which penetrates

through the cooling member in the thickness direction thereof; and

the air-sucking device draws air from the aforementioned one or more closed spaces through the aforementioned one or more through-holes.

[0012]

5 In still another mode of the system for cooling a resin-sealed substrate according to the first aspect of the present invention, the system further includes:

d) a cooling device for cooling the cooling member.

[0013]

In still another mode of the system for cooling a resin-sealed substrate according to
10 the first aspect of the present invention, the cooling device is an air blower for sending a flow of air to the cooling member.

[0014]

In still another mode of the system for cooling a resin-sealed substrate according to the first aspect of the present invention:

15 the cooling member has one or more grooves formed on the contact surface; and
the air blower supplies a flow of air into the aforementioned one or more grooves.

[0015]

In still another mode of the system for cooling a resin-sealed substrate according to the first aspect of the present invention, the cooling device includes a Peltier device attached
20 to the cooling member.

[0016]

In still another mode of the system for cooling a resin-sealed substrate according to the first aspect of the present invention, the contact surface of the cooling member is designed so that a resin-sealed portion of the resin-sealed substrate will be tightly contacted
25 thereto.

[0017]

The second aspect of the present invention provides a substrate-conveying system for conveying a resin-sealed substrate, which system is characterized by including any one of the aforementioned systems for cooling a resin-sealed substrate according to the first aspect of
5 the present invention.

[0018]

The third aspect of the present invention provides a resin-sealing system for molding and resin-sealing electronic parts mounted on a substrate, which system is characterized by including any one of the aforementioned systems for cooling a resin-sealed substrate
10 according to the first aspect of the present invention.

[0019]

The fourth aspect of the present invention provides a substrate-cooling method for cooling a resin-sealed substrate produced by molding and resin-sealing electronic parts mounted on a substrate by means of a resin-sealing mold, including the steps of:

15 a) holding the resin-sealed substrate; and

b) cooling the resin-sealed substrate by attracting the held resin-sealed substrate to a cooling member to make the resin-sealed substrate in tight contact with a contact surface of the cooling member.

[0020]

20 In one mode of the method for cooling a resin-sealed substrate according to the fourth aspect of the present invention, the step of cooling the resin-sealed substrate includes sending a flow of air to the cooling member.

[0021]

In another mode of the method for cooling a resin-sealed substrate according to the
25 fourth aspect of the present invention, the step of cooling the resin-sealed substrate includes

making a resin-sealed portion of the resin-sealed substrate in tight contact with the contact surface of the cooling member.

[0022]

In still another mode of the method for cooling a resin-sealed substrate according to the fourth aspect of the present invention, the step of cooling the resin-sealed substrate is carried out while the resin-sealed substrate is being conveyed.

EFFECT OF THE INVENTION

[0023]

In the method and system for cooling a resin-sealed substrate according to the present invention, the resin-sealed substrate is attracted to the contact surface of the cooling member so as to make the resin-sealed substrate in tight contact with the cooling member and thereby draw heat from the substrate. Therefore, the cooling process can be performed without allowing warping of the resin-sealed substrate due to the difference in the thermal shrinkage factor between the substrate and the resin. As compared to the conventional technique in which a strong pressure is applied to the resin-sealed substrate from above and below during the cooling process, the present technique can minimize negative effect on the molded and resin-sealed electronic parts.

In the present technique, if the substrate portion of the resin-sealed substrate is made in tight contact with the contact surface of the cooling member, the negative effect on the molded and resin-sealed electronic parts will be reduced to a greater extent. By contrast, if the resin-sealed portion of the resin-sealed substrate is made in tight contact with the contact surface of the cooling member, the cooling efficiency will be further improved since heat can be directly drawn from the resin-sealed portion in the hot state.

[0024]

When an air-sucking device for drawing air from the space between the resin-sealed substrate and the contact surface of the cooling member is provided, the contact between the resin-sealed substrate and the cooling member will be further tightened, whereby both the warp-preventing effect and the cooling efficiency will be improved. The contact between the resin-sealed substrate and the cooling member will be even more tightened when one or more closed spaces is formed between the resin-sealed substrate and the contact surface and the attracting device is designed so as to draw air drawn from the closed spaces by means of the air-sucking device.

Providing the cooling device will further improve the efficiency of cooling the resin-sealed substrate.

Furthermore, when the configuration of the system for cooling a resin-sealed substrate according to the present invention is used in a system for conveying a resin-sealed substrate or a system for molding and resin-sealing electronic parts mounted on a substrate, the obtained system can efficiently convey the resin-sealed substrate while cooling it or cool the resin-sealed substrate in a sequence of processes subsequent to the resin-sealing process.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025]

Fig. 1 is a diagram illustrating a process of resin-sealing electronic parts or similar elements mounted on a substrate.

Fig. 2 is a diagram schematically illustrating a process of conveying a resin-sealed substrate.

Fig. 3 is a diagram illustrating the structure of a suction unit used in the first embodiment of the present invention.

Fig. 4 is a diagram illustrating an operation of tightly contacting the upper surface

(contact surface) of a cooling member to the lower surface of the resin-sealed portion in the first embodiment.

Fig. 5 is a diagram illustrating the structure of a suction unit used in the second embodiment of the present invention.

5 Fig. 6 is a diagram illustrating an operation of tightly contacting the upper surface (contact surface) of a cooling member to the lower surface of the resin-sealed portion in the second embodiment.

Fig. 7 is a diagram illustrating the structure of one variation of the suction unit.

Fig. 8 is a diagram illustrating the structure of another variation of the suction unit.

10

BEST MODE FOR CARRYING OUT THE INVENTION

[0026]

The substrate-cooling system according to the present invention is a system for cooling a resin-sealed substrate produced by molding and resin-sealing electronic parts
15 mounted on a substrate by means of a resin-sealing mold. Before the description of the substrate-cooling system according to the present invention, a process of molding and resin-sealing electronic parts or similar elements on a substrate is described with reference to Fig. 1. The molding and resin-sealing process is performed by using a resin-sealing system having a mold consisting of upper and lower dies 11 and 12. In the system shown in Fig. 1,
20 the upper die 11 has a substrate-fixing mechanism, while the lower die 12 has a cavity 13 for receiving an amount of resin. Examples of the substrate-fixing mechanism include a mechanism for attracting the substrate 21 by suction from above, a mechanism for holding the substrate 21 by an engaging or hooking structure, and so on.

[0027]

25 In this resin-sealing system, initially, a substrate 21 with electronic parts 22 mounted

thereon is fixed to a substrate-fixing section of the upper die 11 (see Fig. 1(a)), while a resin material 23, which is in a liquid (or fluid) state at room temperature, is supplied into the cavity 13 of the lower die 12. Next, the temperature of the cavity 13 is increased, and the lower die 12 is raised to make its top surface come in contact with the bottom surface of the upper die 11 and press the two dies together (see Fig. 1(b)). This state is maintained for a few minutes to cure the resin inside the cavity 13. Thus, the molding and resin-sealing process by compression molding is completed and a product with the resin-sealed electronic parts 22 on the substrate 21 is obtained. After the molding and resin-sealing process is completed, the lower die 12 is moved downward, leaving the substrate 21 fixed on the upper die 11 as shown in Fig. 1(c). In the following description, the molded and resin-sealed substrate is referred to as the resin-sealed substrate 21A and the portion in which the electronic parts 22 are sealed with the cured resin is referred to as the resin-sealed portion 24 (see Fig. 1(d)). It should be noted that a solid material in a powdery or granular form may be used as the resin material 23, in which case the material will be melted when the temperature of the lower die 12 is increased.

[0028]

After the resin-sealing of the electronic parts or similar elements mounted on the substrate is completed, the resin-sealed substrate is removed from the resin-sealing system and conveyed for a post-process, such as the storage of the substrate into a rack or the cutting of the substrate. The following descriptions show specific embodiments in which a system for cooling a resin-sealed substrate according to the present invention is applied to a substrate-conveying system.

FIRST EMBODIMENT

25 [0029]

As shown in Fig. 2(a), the system for conveying a resin-sealed substrate according to the first embodiment includes a conveying plate 40 for conveying a resin-sealed substrate, a suction unit 30 provided on the conveyor plate 40, a conveying plate drive mechanism (not shown) for horizontally moving the conveying plate 40, and a suction unit drive mechanism
5 50 for vertically moving the suction unit 30.

[0030]

The structure of the suction unit 30 is described with reference to Fig. 3. Fig. 3(a) is a top view of the suction unit 30, and Fig. 3(b) is a sectional view of the suction unit 30 at line A-A'. The suction unit 30 includes a cooling member 31 and a frame-shaped elastic support
10 member 32 extending along the circumferential edge of the cooling member 31. The cooling member 31 is made of aluminum, which is a highly heat-conductive material having a sufficiently higher rigidity than the resin-sealed portion. The size of the cooling member 31 is approximately the same as that of the lower surface of the resin-sealed portion 24 of the resin-sealed substrate 21A. The upper surface of the cooling member 31 serves as a contact
15 surface with which the lower surface of the resin-sealed portion 24 tightly contacts. The cooling member 31 has a through-hole 33a penetrating in the thickness direction thereof. The elastic support member 32 is slightly projected upward from the upper surface (contact surface) of the cooling member 31. An air-sucking device 33c is connected to the through-hole 33a by an air-sucking channel 33b.

20 [0031]

An operation of the system for conveying a resin-sealed substrate according to the first embodiment is hereinafter described. After the resin-sealed substrate 21A is molded by the resin-sealing system, the conveying plate drive mechanism is operated to move the conveying plate 40 to a predetermined position between the upper die 11 and the lower die
25 12 (see Fig. 2(a)). This position is a position at which the contact surface of the cooling

member 31 faces the lower surface of the resin-sealed portion 24.

[0032]

Subsequently, the suction unit drive mechanism 50 is operated to raise the suction unit 30 to a level at which the upper face of the elastic support member 32 comes in contact with the lower surface of the resin-sealed portion 24 (Fig. 2(b)). As already stated, the elastic support member 32 is slightly projected upward from the contact surface of the cooling member 31. Therefore, the upper face of the elastic support member 32 comes in contact with the lower surface of the resin-sealed portion 24. As a result, a closed space surrounded by the contact surface of the cooling member 31, the elastic support member 32 and the lower surface of the resin-sealed portion 24 is formed (see Fig. 4(a)).

[0033]

In this state, the air-sucking device 33c is energized to draw air from the closed space through the through-hole 33a and the air-sucking channel 33b. In synchronization with the initiation of this air-sucking operation, the operation of holding the substrate 21 on the upper die 11 by the substrate-fixing mechanism is discontinued. For example, in the case where the substrate 21 is held on the upper die 11 by suction, the suction is discontinued. Then, the elastic support member 32 gradually and elastically changes its shape, allowing the resin-sealed substrate 21A to move from the upper die 11 to the cooling unit 30 until the lower surface of the resin-sealed portion 24 comes in tight contact with the contact surface of the cooling member 31 (see Fig. 4(b)). The elastic characteristics of the elastic support member 32, the extent of its projection from the contact surface, and the air-sucking strength of the air-sucking device 33c are adjusted beforehand so that the contact surface can be in tight contact with the lower surface of the resin-sealed portion 24 by the air-sucking operation. This adjustment may be preferably performed so as to maintain the inside of the closed space in a high vacuum state and thereby create an extremely tight contact between

the resin-sealed substrate 21A and the contact surface, although the maintenance of the closed space in a high vacuum state is not always necessary. After that, while maintaining such tight contact, the suction unit drive mechanism 50 is operated to lower the suction unit 30 (see Fig. 2(c)), after which the conveying plate drive mechanism is operated to move the resin-sealed substrate 21A to a predetermined location for a post-process or the like. During this process, the resin-sealed substrate 21A is maintained in the state of being in tight contact with the cooling member 31. In this manner, the present system can efficiently convey the resin-sealed substrate 21A while cooling the substrate without allowing its warping.

10 SECOND EMBODIMENT

[0034]

A system for conveying a resin-sealed substrate according to the second embodiment is hereinafter described. The difference from the first embodiment exists in the structure of the suction unit 30. The constructions of the conveying plate 40 and the suction unit drive mechanism 50 are the same as those of the first embodiment and therefore will not be described. Fig. 5(a) is a top view of the suction unit 30, and Fig. 5(b) is a sectional view of the suction unit 30 at line B-B'. The suction unit 30 includes a cooling member 31 and six elastic support members 32. The cooling member 31 has a contact surface with which the lower surface of the resin-sealed portion 24 tightly contacts, with six through-holes 33a penetrating in the thickness direction thereof. As shown in Fig. 5(b), the six elastic support members 32 are respectively provided for the six through-holes 32a. Each elastic support member 32 has a cylindrical part 32a inserted into the through-hole 33a and a bowl-shaped part 32b connected to the upper portion of the cylindrical part 32a. The cylindrical part 32a is tightly adhered to the inner wall of the through-hole 33a. The bowl-shaped part 32b, which is slightly projected upward from the contact surface of the cooling member 31, has a mouth at

its upper end and a hole leading to the cylindrical part 32a at its lower end. An air-sucking device 33c is connected to the through-holes 33a by an air-sucking channel 33b.

[0035]

An operation of the system for conveying a resin-sealed substrate according to the second embodiment is hereinafter described. The upper face of the elastic support member 32 is made to come in contact with the lower surface of the resin-sealed portion 24 by an operation similar to the first embodiment. Since the bowl-shaped part 32b of the elastic support member 32 is slightly projected from the contact surface of the cooling member 31, the upper face of the bowl-shaped part 32b comes in contact with the lower surface of the resin-sealed portion 24. As a result, a closed space surrounded by the bowl-shaped part 32b and the lower surface of the resin-sealed portion 24 is formed (see Fig. 6(a)).

[0036]

In this state, similar to the first embodiment, the air-sucking device 33c is energized to draw air from the closed spaces through the through-holes 33a and the air-sucking channel 33b. In synchronization with this, the operation of the substrate-fixing mechanism of the upper die 11 is discontinued. Then, the elastic support member 32 gradually and elastically changes its shape, allowing the resin-sealed substrate 21A to move from the upper die 11 to the cooling unit 30 until the lower surface of the resin-sealed portion 24 comes in tight contact with the contact surface of the cooling member 31 (see Fig. 6(b)). The elastic characteristics of the elastic support member 32, the extent of its projection from the contact surface, and the air-sucking strength of the air-sucking device 33c are adjusted beforehand in a manner similar to the first embodiment. Subsequently, the resin-sealed substrate 21A is conveyed to a predetermined location for a post-process by an operation similar to the first embodiment. In this manner, similarly to the first embodiment, the present system can efficiently convey the resin-sealed substrate 21A while cooling the substrate without

allowing its warping.

[0037]

As described previously, the system of the second embodiment uses six elastic support members 32 and draws air from each of the closed spaces formed by the bowl-shaped parts 32b of the elastic support members 32 and the lower surface of the resin-sealed portion 24. In this structure, the total capacity of the six closed spaces, to say nothing of the capacity of each of them, will be smaller than the capacity of the closed space of the first embodiment. Therefore, it is possible to reduce the time required for the resin-sealed portion 24 to come in contact with the cooling member 31 after the operation of drawing air from the closes spaces is initiated.

[0038]

It should be noted that any of the previous embodiments is a mere example and can be appropriately changed or modified within the spirit of the present invention. Although both of the previous embodiments were examples in which a system for cooling a resin-sealed substrate according to the present invention was used as a part of the substrate-conveying system, it is naturally possible to construct the system as an independent system for cooling a resin-sealed substrate.

In the previous embodiments, the resin-sealed substrate to be cooled was a product created by compression molding. It is also possible to use the system for cooling a resin-sealed substrate according to the present invention to cool a resin-sealed substrate produced by other molding methods, such as transfer molding.

Furthermore, the previous embodiments assumed the case of conveying a resin-sealed substrate from a resin-sealing system in which the substrate was fixed on the upper and the resin material is received by the lower die. In the case of conveying a resin-sealed substrate from a resin-sealing system in which the functions of the upper and

lower dies are reversed, the previously described systems can also be used by making the systems upside down.

In addition, the previously described systems may be modified so as to cool the substrate 21 rather than the resin-sealed substrate 24.

5 [0039]

In the previous embodiments, the heat conducted from the resin-sealed substrate to the cooling member was released by natural cooling. In addition to this, it is preferable to provide a cooling device for cooling the cooling member. The use of the cooling device improves the efficiency of releasing the heat conducted from the resin-sealed substrate to the cooling member and thereby enables the resin-sealed substrate to be more efficiently cooled. Examples of the cooling device include an air blower (e.g. a fan or vortex tube) for sending a flow of air to the cooling member, a Peltier device attached to the cooling member, and so on. When an air blower for sending a flow of air to the cooling member is used, the air may be supplied to the side of the cooling member opposite from the contact surface. A more preferable system is shown in Figs. 7(a) (top view) and 7(b) (sectional view at line C-C'), in which the cooling member 31 has grooves 34 formed on its contact surface and air is supplied through these grooves 34 between the lower surface of the resin-sealed portion 24 and the contact surface. This system can more efficiently cool the resin-sealed substrate. Forced cooling of the surface of the resin-sealed substrate that is not in contact with the cooling member may also be performed in addition to the cooling of the resin-sealed substrate through the cooling member.

[0040]

In the previous embodiment, a device for drawing air from the space between the resin-sealed substrate and the contact surface of the cooling member was used as the attracting device. In the case where the substrate is a metal-base substrate using a type of

25

steel as the base material, a device for magnetically attracting the resin-sealed substrate may be used.

Furthermore, the cooling member, which was made of aluminum in the previous embodiments, may be created from any material other than aluminum as long as the material is a highly heat-conductive material having a sufficiently higher rigidity than resin materials. [0041]

The cooling member shown in Fig. 3 had only one through-hole. It is possible to appropriately increase the number of the through-holes according to the size of the resin-sealed substrate to be attracted or other factors. Similarly, the number of the through-holes and the elastic support members of the cooling member shown in Fig. 5 may be appropriately changed.

In the example shown in Fig. 3, the elastic support member was provided in such a manner that it extended along the circumferential edge of the cooling member to form one closed space. Another possible structure of the suction unit is shown in Figs. 8(a) (top view) and 8(b) (sectional view at line D-D'), in which the unit is subdivided into smaller closed spaces and air is individually drawn from each closed space.

EXPLANATION OF NUMERALS

[0042]

20 11... Upper Die

12... Lower Die

13... Cavity

21... Substrate

21A... Resin-Sealed Substrate

25 22... Electronic Parts

- 23... Resin Material
- 24... Resin-Sealed Portion
- 30... Suction Unit
- 31... Cooling Member
- 5 32... Elastic Support Member
 - 32a... Cylindrical Part
 - 32b... Bowl-Shaped Part
 - 33a... Through-Hole
 - 33b... Air-sucking Channel
- 10 33c... Air-sucking Device
- 34... Groove
- 40... Conveying Plate
- 50... Suction Unit Drive Mechanism

CLAIMS

1. A substrate-cooling system for cooling a resin-sealed substrate produced by molding and resin-sealing electronic parts mounted on a substrate by means of a resin-sealing mold, characterized by comprising:

- a) a holder for holding the resin-sealed substrate;
- b) an attracting device, provided in the holder, for attracting the resin-sealed substrate to the holder; and
- c) a cooling member located at a position toward which the resin-sealed substrate is attracted by the attracting device, the cooling member having a contact surface with which the resin-sealed substrate tightly contacts.

2. The substrate-cooling system according to claim 1, characterized in that the attracting device comprises an air-sucking device for drawing air from a space between the resin-sealed substrate and the contact surface of the cooling member.

3. The substrate-cooling system according to claim 2, characterized in that: the attracting device comprises:

- an elastic support, provided on the cooling member, for forming one or more closed spaces between the resin-sealed substrate and the contact surface by coming in contact with the resin-sealed substrate when the resin-sealed substrate is attracted; and
- one or more through-holes each of which is provided in the cooling member at a position within the aforementioned one or more closed spaces and which penetrates through the cooling member in the thickness direction thereof; and
- the air-sucking device draws air from the aforementioned one or more closed spaces

through the aforementioned one or more through-holes.

4. The substrate-cooling system according to one of claims 1-3, characterized by further comprising:

5 d) a cooling device for cooling the cooling member.

5. The substrate-cooling system according to claim 4, characterized in that the cooling device is an air blower for sending a flow of air to the cooling member.

10 6. The substrate-cooling system according to claim 5, characterized in that:
the cooling member has one or more grooves formed on the contact surface; and
the air blower supplies a flow of air into the aforementioned one or more grooves.

7. The substrate-cooling system according to claim 4, characterized in that the
15 cooling device comprises a Peltier device attached to the cooling member.

8. The substrate-cooling system according to one of claims 1-7, characterized in that the contact surface of the cooling member is designed so that a resin-sealed portion of the resin-sealed substrate will be tightly contacted thereto.

20

9. A substrate-conveying system for conveying a resin-sealed substrate, characterized by comprising the substrate-cooling system according to one of claims 1-8.

10. A resin-sealing system for molding and resin-sealing electronic parts
25 mounted on a substrate, characterized by comprising the substrate-cooling system according

to one of claims 1-8.

11. A substrate-cooling method for cooling a resin-sealed substrate produced by molding and resin-sealing electronic parts mounted on a substrate by means of a resin-sealing mold, characterized by comprising the steps of:

a) holding the resin-sealed substrate; and

b) cooling the resin-sealed substrate by attracting the held resin-sealed substrate to a cooling member to make the resin-sealed substrate in tight contact with a contact surface of the cooling member.

10

12. The method for cooling a resin-sealed substrate according to claim 11, characterized in that the step of cooling the resin-sealed substrate comprises sending a flow of air to the cooling member.

13. The method for cooling a resin-sealed substrate according to claim 11 or 12, characterized in that the step of cooling the resin-sealed substrate includes making a resin-sealed portion of the resin-sealed substrate in tight contact with the contact surface of the cooling member.

14. The method for cooling a resin-sealed substrate according to one of claims 11-13, characterized in that the step of cooling the resin-sealed substrate is carried out while the resin-sealed substrate is being conveyed.

20