

[DESCRIPTION]

[Invention Title]

RESIN SEALING APPARATUS AND METHOD OF DETECTING
ABNORMALITY OF RESIN SEALING APPARATUS

[Technical Field]

The present invention relates to a resin sealing apparatus and a method of detecting abnormality of a resin sealing apparatus.

[Background Art]

In the related art, insert molding, which manufactures a resin sealed package by sealing an electronic component such as a semiconductor with resin, is carried out. In the insert molding, an electronic component, a substrate with electronic components, or the like is fixed in a mold, a cavity is filled with a molten resin, and the resin is cured, thereby integrating the substrate with electronic components or the like with a resin formed portion.

In addition, in some instances, a point at which an electronic component surface is not sealed with resin is set in accordance with the type of an electronic component such as a semiconductor sealed in the resin sealed package. For example, in a case in which the electronic component is a temperature sensor, a humidity sensor, or one of various types of sensors for a camera, a surface of an element is not covered by resin but is exposed to the outside.

Here, in a case in which the resin sealed package of which the surface of the element is exposed to the outside is manufactured by the insert molding, it is necessary to perform masking on the surface of the element when sealing the electronic component with resin, and for example, there is a method of bringing an exposing pin, which is retained by a spring, into contact with the surface of the element.

A through hole, which communicates with the cavity, is formed in the mold, the exposing pin is provided to be penetratively inserted into the through hole, and a tip of the exposing pin protrudes to the outside of the cavity.

In addition, the exposing pin is retained by the spring, and biased toward the surface of the element installed in the cavity. The exposing pin is configured to be extended and retracted while sliding along the through hole.

The tip of the exposing pin comes into contact with the surface of the element with appropriate pressure such that the surface of the element is masked, and the element is sealed with resin in this state, and as a result, a resin sealed package in which an exposed portion of the surface of the element is formed is manufactured.

In the resin sealing apparatus, in addition to the aforementioned exposing pin, there is a structure in which a through hole is provided in the mold and a pin is penetratively inserted into the through hole, and as an example, there is an ejector pin for releasing a molded product from the cavity.

The ejector pin is provided to be penetratively inserted into a through hole formed in the mold, and assumes two positions including a retracted position at normal times, and a protruding position when releasing a molded product. When releasing a molded product, the ejector pin is extruded toward the cavity by a pressing device, such that a tip of the ejector pin greatly protrudes, thereby releasing the molded product. In addition, at normal times, the ejector pin returns back to the retracted position by biasing force of a spring.

When the ejector pin is extended and retracted, foreign substances such as resin scraps are introduced into a gap formed by the movement of the pin, and as a result, the pin may not return back to the retracted position at normal times. Further, there is a problem in that the mold is operated in a state in which the ejector pin does not

appropriately return back to the retracted position, and as a result, a large number of defective molded resin sealed packages are produced.

In this situation, there is a mold which has attempted to detect a position of an ejector pin and thus detect abnormality, and for example, Patent Literature 1 discloses the mold.

In the mold disclosed in Patent Literature 1, a metallic plate is further mounted to a plate portion provided at a base end (root) of the ejector pin, and a position of the metallic plate is detected by a magnetic sensor.

[LITERATURE OF RELATED ART]

[Patent Literature]

[Patent Literature 1] Japanese Patent Application Laid-Open No. H07-060806.

[Disclosure]

[Technical Problem]

Here, in addition to the mold disclosed in Patent Literature 1, a mechanism for detecting abnormality of an ejector pin is present in a mold or a resin sealing apparatus in the related art for manufacturing a resin sealed package in which a surface of an element is exposed to the outside, but there is no configuration capable of appropriately detecting abnormality of an aforementioned exposing pin.

In more detail, resin flows from a cavity into a gap between the exposing pin and a through hole, and thus sliding resistance force is changed, and as a result, there is a problem in that a sliding defect of the exposing pin occurs. The gap between the exposing pin and the through hole has a small size of 10 μm or less, but fluidity of the resin is high, and as a result, it is difficult to avoid the inflow of the resin.

In addition, the sliding defect of the exposing pin occurs because of not only the inflow of the resin, but also the occurrence of metal scraps due to abrasion caused when

the exposing pin is extended and retracted over a long period of time, or an increase in frictional force caused by seizing.

The change in sliding resistance force between the exposing pin and an inner circumferential surface of the through hole has an effect on a load occurring when a tip of the exposing pin comes into contact with a surface of the element. For example, in some instances, pressing force, which brings the exposing pin into contact with the surface of the element, is excessively applied, thereby damaging the semiconductor element.

In addition, pressing force applied to the surface of the element by the exposing pin is reduced, or the exposing pin does not return back to a normal position after releasing a molded product, and as a result, there may be a problem in that the tip of the pin does not reach the surface of the element. As a result, in some instances, the resin is wrapped around an exposed portion of the surface of the element, which causes a defective molded resin sealed package.

To reduce the defective molded resin sealed package, there is a need for a mechanism capable of detecting whether a sliding defect of the exposing pin occurs. In particular, there is a need for a mechanism capable of appropriately evaluating a load when the tip of the exposing pin comes into contact with the surface of the element, and thus the exposing pin is pushed up toward the spring.

The present invention has been made in consideration of the aforementioned situations, and an object of the present invention is to a resin sealing apparatus and a method of detecting abnormality of a resin sealing apparatus which are capable of appropriately detecting a sliding defect of an exposing pin in respect to a resin sealed package in which an exposed portion is formed at a surface of an electronic component.

[Technical Solution]

To achieve the object, a resin sealing apparatus according to the present invention includes: a first mold including a main body which is formed with a hollow portion, a mold matching surface provided on the main body, a concave cavity portion provided at the mold matching surface to be filled with thermosetting resin, a first through hole which is continuously formed from the concave cavity portion and the hollow portion of the main body, a second through hole which is continuously formed from the hollow portion of the main body so as to be opposite to the first through hole of the main body, a pin flange portion which is disposed in the hollow portion of the main body and biased toward the first through hole by an elastic body, an exposing pin which is provided at the first through hole of the pin flange portion so as to be penetratively inserted into the first through hole, and configured to be extended and retracted while sliding along an inner circumferential surface of the first through hole, a to-be-detected pin which is provided at a side, opposite to the side at which the exposing pin of the pin flange portion is provided, so as to be penetratively inserted into the second through hole, and has a tip configured to protrude to the outside of the second through hole, and a detection sensor unit which is provided at a side opposite to the mold matching surface of the main body, and detects the protrusion of the tip of the to-be-detected pin from the second through hole; a second mold including a mold matching surface that interposes a base material with an electronic component in cooperation with the mold matching surface of the first mold; a mold drive unit which enables the first mold and the second mold to approach each other, and clamps the first mold and the second mold by allowing the first mold and the second mold to approach each other; and a load measuring loader which includes a detection loader main body that is disposed between the first mold and the second mold and approaches the mold matching surface of the first mold by the second mold pushed by the mold drive unit,

and a load sensor unit that is provided on the detection loader main body, and measures a load when the load sensor unit comes into contact with a tip of the exposing pin and pushes the exposing pin.

Here, the base material with the electronic component is interposed by the first mold which includes the mold matching surface provided on the main body, and the second mold which includes the mold matching surface that interposes the base material with the electronic component in cooperation with the mold matching surface of the first mold, and then the first mold and the second mold may be clamped.

In addition, a resin formed portion may be provided by the concave cavity portion which is provided at the mold matching surface to be filled with thermosetting resin.

In addition, the pin flange portion may be mounted in the first mold, and biasing force may be imparted to the pin flange portion, by the main body which is formed with the hollow portion, and the pin flange portion which is disposed in the hollow portion of the main body, and biased toward the first through hole by the elastic body.

In addition, the exposing pin is penetratively inserted into the first through hole, by the first through hole which is continuously formed from the concave cavity portion and the hollow portion of the main body, the exposing pin which is provided at the first through hole of the pin flange portion so as to be penetratively inserted into the first through hole, and the pin flange portion which is disposed in the hollow portion of the main body and biased toward the first through hole by the elastic body. In addition, biasing force of the elastic body may be applied to the exposing pin through the pin flange portion, or the tip of the exposing pin may be biased from the concave cavity portion in the protruding direction. As a result, it is possible to perform masking by

bringing the tip of the exposing pin into contact with the surface of the electronic component of the base material with the electronic component disposed in the concave cavity portion, and to expose the surface of the electronic component to the outside.

In addition, an appropriate load is applied to a member, which is in contact with the tip of the exposing pin, by the exposing pin which is configured to be extended and retracted while sliding along the inner circumferential surface of the first through hole, and the pin flange portion which is disposed in the hollow portion of the main body and biased toward the first through hole by the elastic body. That is, the load is force of the tip of the exposing pin pressing the surface of the electronic component of the base material with the electronic component. Further, the load means a load mainly configured by biasing force of the elastic body, and sliding resistance force generated between the exposing pin and the inner circumferential surface of the first through hole, which is changed as the first mold is used.

In addition, the exposing pin receives biasing force of the elastic body through the pin flange portion, and masking is enabled even in a case in which the type of the base material with the electronic component, which comes into contact with the tip of the exposing pin, varies, or a thickness of the resin formed portion varies. That is, the elastic body is extended and contracted to corresponds to a difference in size of the surface of the electronic component of the base material with the electronic component or a difference in thickness of the sealing formed portion, and as a result, it is possible to perform masking while imparting appropriate pressure to the surface of the electronic component.

The pin flange portion, the exposing pin, and the to-be-detected pin are integrated by the pin flange portion which is disposed in the hollow portion of the main body, the exposing pin which is provided at the first through hole of the pin flange

portion, and the to-be-detected pin which is provided at a side opposite to the side at which the exposing pin of the pin flange portion is provided. That is, a position of the to-be-detected pin is changed in accordance with a change in position according to the extension and retraction movements of the exposing pin. Further, the position of the exposing pin includes two positions including a standby position at which the tip of the exposing pin protrudes beyond the concave cavity portion, and a position at the time of resin sealing at which the surface of the electronic component of the base material with the electronic component comes into contact with the tip of the exposing pin and the tip of the exposing pin is pressed into the concave cavity portion. A position of the to-be-detected pin is changed corresponding to the standby position and the position at the time of resin sealing of the exposing pin.

In addition, the to-be-detected pin is penetratively inserted into the second through hole, and the tip of the to-be-detected pin may protrude to the outside of the main body, by the second through hole which is continuously formed from the hollow portion of the main body so as to be opposite to the first through hole of the main body, and the to-be-detected pin which is provided at a side, opposite to the side at which the exposing pin of the pin flange portion is provided, so as to be penetratively inserted into the second through hole, and has the tip configured to protrude to the outside of the second through hole. That is, for example, as described above, a position of the to-be-detected pin is changed in accordance with a change in position according to the extension and retraction movements of the exposing pin, and when the exposing pin is positioned at a position for resin sealing, the tip of the to-be-detected pin may protrude to the outside of the main body.

In addition, the protrusion of the tip of the to-be-detected pin may be detected, by the second through hole which is continuously formed from the hollow portion of the

main body so as to be opposite to the first through hole of the main body, the to-be-detected pin which is provided at a side, opposite to the side at which the exposing pin of the pin flange portion is provided, so as to be penetratively inserted into the second through hole, and has the tip configured to protrude to the outside of the second through hole, and the detection sensor unit which is provided at a side opposite to the mold matching surface of the main body, and detects the protrusion of the tip of the to-be-detected pin from the second through hole. In other words, it is possible to detect a position of the tip of the exposing pin by detecting a position of the tip of the to-be-detected pin. Since a position of the tip of the to-be-detected pin is detected, for example, it is possible to detect a state in which sliding resistance force applied to the exposing pin is increased, and the exposing pin is still at the position at the time of resin sealing without returning back to the standby position. In addition, here, the detected position at the time of resin sealing includes not only a position when the resin is actually injected, but also a position of the exposing pin when the load sensor unit to be described below comes into contact with the tip of the exposing pin and pushes the exposing pin.

In addition, the base material with the electronic component may be interposed between the mold matching surfaces of both of the molds, and then the molds may be clamped by the mold drive unit which enables the first mold and the second mold to approach each other, and clamps the molds by allowing the first mold and the second mold to approach each other.

A resin sealed package in which an electronic component is sealed with resin may be manufactured by setting the base material with the electronic component into the mold of the resin sealing apparatus according to the present invention, as described above, closing the molds by allowing both of the molds to approach each other by the

mold drive unit, filling the concave cavity portion with melted thermosetting resin, curing the thermosetting resin, separating the both of the molds by the mold drive unit, and performing die cutting.

In addition, the detection loader main body may approach the first mold by the detection loader main body which may be disposed between the first mold and the second mold, and may approach the mold matching surface of the first mold by the second mold pushed by the mold drive unit. That is, for example, the detection loader main body is disposed between the first mold and the second mold when the mold is opened, and the detection loader main body may approach the mold matching surface of the first mold.

In addition, a load may be measured, when the exposing pin is pushed, by the load measuring loader which includes the detection loader main body that may be disposed between the first mold and the second mold and may approach the mold matching surface of the first mold by the second mold pushed by the mold drive unit, and the load sensor unit that is provided on the detection loader main body, and measures a load when the load sensor unit comes into contact with the tip of the exposing pin and pushes the exposing pin. That is, force of the tip of the exposing pin pressing the surface of the electronic component of the base material with the electronic component may be measured. Further, the measurement by the load sensor unit is set to measure a load when the load sensor unit presses the exposing pin to a position to which the exposing pin is pressed and which is set in consideration of a situation in which a predetermined surface of the electronic component is sealed with resin. Therefore, it is possible to measure a load in consideration of sliding resistance force generated in a gap between the exposing pin and the inner circumferential surface of the first through hole which is changed as the first mold is used.

In addition, in a case in which when a load measured by the load sensor unit is out of a predetermined range, a signal, which indicates that the load is abnormal, is generated, it is possible to easily confirm abnormality of the load when the exposing pin is pushed, and as a result, it is possible to quickly stop an operation of the resin sealing apparatus. Further, the predetermined range of load, for example, may be considered as a range in which a lower limit value is a minimum load by which the resin is difficult to be wrapped around the exposed portion of the surface of the electronic component, and an upper limit value is a load which the surface of the electronic component may withstand without being damaged.

In addition, in a case in which when the detection sensor unit detects the protrusion of the tip of the to-be-detected pin from the second through hole, a signal, which indicates that the protrusion of the tip of the to-be-detected pin is detected, is generated, it is possible to easily confirm an abnormal state in which by a sliding defect, the exposing pin is still at the position at the time of resin sealing without returning back to the standby position, and as a result, it is possible to quickly stop an operation of the resin sealing apparatus.

In addition, a method of detecting abnormality of a resin sealing apparatus according to the present invention, which performs masking by biasing a tip of an exposing pin, which slides along an inner circumferential surface of a mold, by an elastic body, and bringing the tip of the exposing pin into contact with a surface of an electronic component of a base material with the electronic component disposed in a cavity portion of the mold, includes: a load measuring process of measuring a load when pushing the exposing pin into the mold by pressing one end of the exposing pin provided in the mold; and a detection process of detecting a position of the one end of the exposing pin after pressing the one end of the exposing pin provided in the mold.

Here, by the load measuring process of measuring a load when pushing the exposing pin into the mold by pressing the one end of the exposing pin provided in the mold, it is possible to measure a load when the exposing pin is pushed into the mold. That is, force of the tip of the exposing pin pressing the surface of the electronic component of the base material with the electronic component may be measured. Therefore, it is possible to measure a load in consideration of sliding resistance force generated in a gap between the exposing pin and the inner circumferential surface of the mold which is changed as the mold is used.

In addition, by the detection process of detecting a position of the one end of the exposing pin after pressing the one end of the exposing pin provided in the mold, it is possible to confirm a position of the exposing pin. For example, it is possible to detect a state in which sliding resistance force applied to the exposing pin is increased, and as a result, the exposing pin is still at the position at the time of resin sealing without returning back to the standby position.

In addition, in a case in which the detection process is performed after extracting a molded product, after resin sealing, from the mold, or after the load measuring process, it is possible to confirm whether the exposing pin, which has been pushed when performing resin sealing or when measuring a load by the load sensor, returns back to the standby position. In addition, the detection is performed for each timing, and as a result, it is possible to more easily detect a sliding defect of the exposing pin.

In addition, to achieve the object, a resin sealing apparatus according to the present invention includes: a first mold including a main body which is formed with a hollow portion, a mold matching surface which is provided on the main body, a concave cavity portion which is provided at the mold matching surface to be filled with

thermosetting resin, a first through hole which is continuously formed from the concave cavity portion and the hollow portion of the main body, a second through hole which is continuously formed from the hollow portion of the main body so as to be opposite to the first through hole of the main body, a pin flange portion which is disposed in the hollow portion of the main body and biased toward the first through hole by an elastic body, and an exposing pin which is provided at the first through hole of the pin flange portion so as to be penetratively inserted into the first through hole, and configured to be extended and retracted while sliding along an inner circumferential surface of the first through hole; a second mold including a mold matching surface that interposes a base material with an electronic component in cooperation with the mold matching surface of the first mold; a mold drive unit which enables the first mold and the second mold to approach each other, and clamps the first mold and the second mold by allowing the first mold and the second mold to approach each other; and a load measuring loader which includes a detection loader main body that is disposed between the first mold and the second mold and approaches the mold matching surface of the first mold by the second mold pushed by the mold drive unit, and a load sensor unit that is provided on the detection loader main body, and measures a load when the load sensor unit comes into contact with a tip of the exposing pin and pushes the exposing pin.

Here, the exposing pin integrated with the pin flange portion is penetratively inserted into the first through hole, by the first through hole which is continuously formed from the concave cavity portion and the hollow portion of the main body, the exposing pin which is provided at the first through hole of the pin flange portion so as to be penetratively inserted into the first through hole, and the pin flange portion which is disposed in the hollow portion of the main body and biased toward the first through hole

by the elastic body. In addition, biasing force of the elastic body may be applied to the exposing pin through the pin flange portion, and the tip of the exposing pin may be biased from the concave cavity portion in the protruding direction. As a result, it is possible to perform masking by bringing the tip of the exposing pin into contact with the surface of the electronic component of the base material with the electronic component disposed in the concave cavity portion, and to expose the surface of the electronic component to the outside.

In addition, an appropriate load is applied to a member, which is in contact with the tip of the exposing pin, by the exposing pin which is configured to be extended and retracted while sliding along the inner circumferential surface of the first through hole, and the pin flange portion which is disposed in the hollow portion of the main body and biased toward the first through hole by the elastic body. That is, the load is force of the tip of the exposing pin pressing the surface of the electronic component of the base material with the electronic component. Further, the load means a load mainly configured by biasing force of the elastic body, and sliding resistance force generated between the exposing pin and the inner circumferential surface of the first through hole, which is changed as the first mold is used.

In addition, a load may be measured, when the exposing pin is pushed, by the load measuring loader which includes the detection loader main body that may be disposed between the first mold and the second mold and may approach the mold matching surface of the first mold by the second mold pushed by the mold drive unit, and the load sensor unit that is provided on the detection loader main body, and measures a load when the load sensor unit comes into contact with the tip of the exposing pin and pushes the exposing pin. That is, force of the tip of the exposing pin pressing the surface of the electronic component of the base material with the electronic

component may be measured. Therefore, it is possible to measure a load in consideration of sliding resistance force generated between the exposing pin and the inner circumferential surface of the first through hole which is changed as the first mold is used.

[Advantageous Effects]

The resin sealing apparatus and a method of detecting abnormality of the resin sealing apparatus according to the present invention may appropriately detect whether a sliding defect of the exposing pin occurs in respect to the resin sealed package in which an exposed portion is formed at a surface of an electronic component.

[Description of Drawings]

FIG. 1 is a schematic cross-sectional view illustrating a structure of a mold of a resin sealing apparatus to which the present invention is applied.

FIG. 2 is a cross-sectional explanatory view illustrating a main part of a peripheral structure of a spring pin of the mold.

FIG. 3 is a schematic view illustrating a structure of a load measuring loader.

FIG. 4 is a schematic view illustrating a state in which the load measuring loader pushes up the spring pin.

FIG. 5 is a schematic view illustrating a movement of the load measuring loader when the load measuring loader is inserted between the molds.

FIG. 6 is a schematic view illustrating a disposition of an apparatus configuration of the resin sealing apparatus to which the present invention is applied.

FIG. 7 is a schematic view illustrating movements of respective devices at the periphery of a press apparatus.

FIG. 8 is a schematic view illustrating a state when resin sealing is performed.

FIG. 9 is a schematic view illustrating detection by a light shielding sensor after

a resin sealing process.

FIG. 10 is a schematic view illustrating a non-detected state by the detection of the light shield sensor after measuring a load.

FIG. 11 is a schematic view illustrating a detected state by the detection of the light shield sensor after measuring a load.

[Best Mode]

Hereinafter, an exemplary embodiment of the present invention will be described in more detail with reference to the drawings.

As illustrated in FIG. 1, a resin sealing mold 1, which is an example of a mold that constitutes a resin sealing apparatus according to the present invention, includes a first mold 2 and a second mold 3. The first mold 2 and the second mold 3 are used to manufacture a resin sealed package by operating the second mold 3 by a mold driving device (not illustrated), and closing the mold in a state in which a mold matching surface 4 and a mold matching surface 5 are matched with each other.

The first mold 2 includes an upper die set 6 and an upper mold chase 7. The upper die set 6 is a member which supports the upper mold chase 7 through a support pillar 8. The upper mold chase 7 includes a holder base 9 which is supported by the support pillar 8, and a cavity bar 10 which includes the mold matching surface 4.

The cavity bar 10 includes a cavity 11 into which resin is injected to the mold matching surface 4. The cavity 11 is a portion for manufacturing a molded product in conjunction with the mold matching surface 5 of a lower mold chase.

In addition, the cavity bar 10 includes a resin passageway 12 through which the resin is supplied into the cavity 11. The resin passageway 12 is a portion that serves as a path through which the resin is supplied from a pot 28 of the second mold 3 and the resin is supplied into the cavity 11.

A spring pin 13 is provided in the upper mold chase 7. In more detail, the spring pin 13 is disposed in a space and a through hole provided in the holder base 9, and a through hole provided in the cavity bar 10.

The spring pin 13 is a member which includes a tip that comes into contact with a surface of a sensor element of a substrate with the sensor element which is a base material with electronic components, and forms an exposed portion which is not sealed with resin. A detailed configuration of the spring pin 13 will be described with reference to separate drawings.

A light shielding sensor 14 is provided on an upper end surface of the holder base 9. The light shielding sensor 14 detects a tip of a to-be-detected pin 15 that constitutes the spring pin 13. A position of the tip of the to-be-detected pin 15 is changed in accordance with the extension and retraction movements of the spring pin 13. A position at which the light shielding sensor 14 performs the detection may be properly set in accordance with the type or the size of the substrate with the sensor.

Here, it is not necessary for the first mold 2 to necessarily include the cavity 11 and the spring pin 13, and for example, it may be acceptable if the second mold 3 is provided with a cavity and a spring pin for forming a resin formed portion of a molded product.

In addition, it is not necessary to necessarily operate the second mold 3 to clamp the first mold and the second mold, and a configuration in which the first mold 2 is operated may be adopted.

In addition, a sensor for detecting the tip of the to-be-detected pin 15 is not limited to the light shielding sensor 14, and it is acceptable as long as the sensor may detect the position of the tip of the to-be-detected pin 15. However, the light shielding sensor 14 may preferably be adopted as the sensor for detecting the tip of the to-be-

detected pin 15 because a position of the tip of the to-be-detected pin 15 may be detected with high precision, and a structure is simplified.

As illustrated in FIG. 1, the first mold 2 includes an ejector pin 16. The ejector pin 16 is a member for releasing a resin sealed package from the cavity 11 after forming the resin sealed package.

The ejector pin 16 is moved toward the cavity 11 by using an operation of opening and closing the second mold 3 by a mold opening and closing device (not illustrated), and a tip of the ejector pin 16 comes into contact with the resin sealed package, thereby releasing a molded product. A part of the ejector pin 16 is configured to be penetratively inserted into through holes provided in the holder base 9 and the cavity bar 10.

A base end (upper side in FIG. 1) of the ejector pin 16 is fixed to a pin plate 17, and the ejector pin 16 and the pin plate 17 are integrally extended and retracted. The pin plate 17 is biased, by a pressing device 19 provided on an ejector plate 18, in a direction in which the pin plate 17 moves away from the holder base 9.

As illustrated in FIG. 1, the second mold 3 includes a lower die set 20 and a lower mold chase 21. The lower die set 20 is a member which supports the lower mold chase 21 through a support pillar 22. The lower mold chase 21 includes a holder base 23 which is supported by the support pillar 22, and a cavity bar 24 which includes the mold matching surface 5.

The mold matching surface 5 of the cavity bar 24 comes into contact with the mold matching surface 4 of the upper mold chase 7, and the resin is injected into the cavity 11, such that a molded product is manufactured.

Here, in the resin sealing mold 1, the cavity 11 is formed only in the upper mold chase 7, and no cavity is formed in the lower mold chase 21, but a point at which the

cavity is formed is not limited thereto. For example, in accordance with a structure of a molded product, a cavity may be further provided in a region that corresponds to the cavity 11 of the lower mold chase 21.

Like the first mold 2, the second mold 3 includes an ejector pin 25. The ejector pin 25 is a member for releasing a resin sealed package from the cavity 24 after forming the resin sealed package.

The ejector pin 25 is moved toward the cavity 24 by using the operation of opening and closing the second mold 3 by the mold opening and closing device (not illustrated), thereby releasing a molded product. A part of the ejector pin 25 is configured to be penetratively inserted into through holes provided in the holder base 23 and the cavity bar 24.

A base end (lower side in FIG. 1) of the ejector pin 25 is fixed to a pin plate 26, and the ejector pin 25 and the pin plate 26 are integrally extended and retracted. The pin plate 26 is biased, by a pressing device 67 provided on an ejector plate 27, in a direction in which the pin plate 26 moves away from the holder base 23.

In addition, the pot 28 for accommodating a resin tablet made of, for example, epoxy-based thermosetting resin is formed in the lower mold chase 21.

The pot 28 is a portion for melting the thermosetting resin, and the pot 28 is configured such that the thermosetting resin melted in the pot 28 is extruded, by a plunger 29, toward the resin passageway 12 of the upper mold chase 7 in a state in which the first mold and the second mold are clamped.

A peripheral structure of the spring pin 13 of the resin sealing mold 1 will be described with reference to FIG. 2. FIG. 2 illustrates a state after an inloader transport a molding material to the resin sealing mold 1 before being clamped. A substrate 38 with sensor elements, which is subjected to the molding, is installed on the mold

matching surface 5 of the second mold 3. In addition, the solid resin tablet 39 is placed in the pot 28 before the resin tablet 39 is melted.

The spring pin 13 includes an exposing pin 30, a flange portion 31, and the to-be-detected pin 15, and has a structure in which the respective members are integrated.

The flange portion 31 is disposed in a hollow portion 32 which is a hollow portion provided in the holder base 9. In addition, the flange portion 31 is mounted to a spring 33 of which one end is fixed to the holder base 9, and the flange portion 31 is biased toward the cavity 11 (lower side in FIG. 2).

The exposing pin 30 is formed integrally with the flange portion 31, and structured to be penetratively inserted into a pin hole 34 of the cavity bar 10. A tip 35 of the exposing pin 30 is a portion that comes into contact with a surface of the sensor element of the substrate 38 with the sensor element. In addition, the tip 35 of the exposing pin 30 also comes into contact with a load sensor to be described below.

As the mold driving device pushes up the second mold 3, the tip 35 of the exposing pin 30 comes into contact with the surface of the sensor element, and the spring pin 13 is pushed up against biasing force of the spring 33. Further, the spring pin 13 (exposing pin 30) is pressed to a position set in accordance with the type of molded product, and at the same position, the tip 35 imparts predetermined pressure to the surface of the sensor element, thereby performing the masking. Further, the position at which the spring pin 13 is pushed up and then stopped is referred to as a "position at the time of resin sealing" hereinafter for convenience.

In addition, the exposing pin 30 is biased by the spring 33 through the flange portion 31, and the exposing pin 30 protrudes to the outside of the cavity 11. That is, in a state in which the tip 35 of the exposing pin 30 is not pushed up, the exposing pin 30 is stopped at a position at which the tip 35 of the exposing pin 30 protrudes to the

outside of the cavity 11. Further, this protruding position is referred to as a "standby position" hereinafter for convenience. In addition, FIGS. 1 to 3, 9, and 10 schematically illustrate the structure of the exposing pin 30, but in an actual apparatus, the tip 35 is structured to protrude more outward than the cavity 11 at the standby position.

As described above, the exposing pin 30 is extended and retracted as the tip 35 is pushed up or the state in which the tip 35 is pushed up is released. In addition, the exposing pin 30 is extended and retracted while sliding along an inner circumferential surface of the pin hole 34.

When the exposing pin 30 is pushed up to the position at the time of resin sealing, a load for pushing back the exposing pin 30 occurs. This load is mainly configured by biasing force of the spring 33, and sliding resistance force generated between the exposing pin 30 and the inner circumferential surface of the pin hole 34.

The load, when the exposing pin 30 is pushed up to the position at the time of resin sealing, corresponds to force for pressing the surface of the sensor element. For this reason, a value of this load is required to be a magnitude of force within an appropriate range in order to manufacture a good molded product.

More specifically, the range may be considered as a range in which a lower limit value is a minimum load by which the resin is not wrapped around the exposed portion of the surface of the sensor element, and an upper limit value is a load which the surface of the sensor element may withstand without being damaged. Further, the range of the lower limit value and the upper limit value may be properly set in accordance with the type of molded product. In addition, it is possible to adopt a value set by including a theoretical value of a withstanding load of the sensor element into an acceptable range.

As illustrated in FIG. 2, the to-be-detected pin 15 is fixedly provided on the flange portion 31, and structured to be penetratively inserted into a pin hole 36 of the holder base 9. The to-be-detected pin 15 is a portion which is detected at a detection position of the light shielding sensor 14 as the position of the tip 37 of the to-be-detected pin 15 is changed in accordance with the extension and retraction movements of the spring pin 13.

The resin sealing apparatus may detect a position of the tip 35 of the exposing pin 30, which is configured integrally with the to-be-detected pin 15, by detecting the position of the tip 37 of the to-be-detected pin 15.

At the position of the spring pin 13 at the time of resin sealing, the tip 37 of the to-be-detected pin 15 is positioned at a position detected by the light shielding sensor 14, but when the state in which the tip 35 of the exposing pin 30 is pushed up is released, the spring pin 13 returns back to the standby position by biasing force of the spring 33, and the tip 37 of the to-be-detected pin 15 returns back to a position that is not detected by the light shielding sensor 14.

Meanwhile, when sliding resistance force is increased due to penetration of resin between the pin hole 34 and the exposing pin 30, the spring pin 13 does not return from the position at the time of resin sealing back to the standby position, but may be stopped in a state of being pushed up. In this case, the tip 37 of the to-be-detected pin 15 is detected by the light shielding sensor 14. That is, the resin sealing apparatus may detect a sliding defect of the exposing pin 30.

In addition, the resin sealing apparatus transmits the detected state of the light shielding sensor 14 through a signal, and outputs the detected state as lighting images of a lamp or character information on a display panel, and as a result, for example, an operator may easily confirm the detected state.

A load measuring loader 40, which measures a load of the spring pin 13, will be described with reference to FIG. 3. The load measuring loader 40 is a member which is loaded between the first mold 2 and the second mold 3 in a state in which the mold is opened after forming the resin sealed package, and measures a load of the exposing pin 30 by pushing up the exposing pin 30.

The load measuring loader 40 includes a base portion 41, and a load detection pin holder 42. The base portion 41 is a portion with which the mold matching surface 5 of the second mold 3 comes into contact, and the base portion 41 includes a base plate 43, and guide portions 44.

The load detection pin holder 42 is a portion which is pushed up by the second mold 3 operated by the mold driving device (not illustrated), the load detection pin holder 42 moves upward through the guide portions 44, and approaches the cavity 11 of the first mold 2. In addition, the load detection pin holder 42 includes a load detection pin 45 as a load sensor, and a detection signal cable 46.

As illustrated in FIG. 4, the load detection pin 45 measures a load when a tip 47 of the load detection pin 45 comes into contact with the tip 35 of the exposing pin 30, and pushes up the exposing pin 30. As the load detection pin 45, an already known pressure sensor may be used.

The load detection pin 45 pushes up the exposing pin 30 to the position at the time of resin sealing, and measures a load occurring in this regard. The measured load corresponds to force of the tip 35 of the exposing pin 30 pressing the surface of the sensor element when the exposing pin 30 is pushed up to the position at the time of resin sealing by the substrate 38 with the sensor element.

Since a load is detected by the load detection pin 45, the resin sealing apparatus may recognize a load obtained in consideration of biasing force of the spring 33, and

sliding resistance force between the exposing pin 30 and the pin hole 34 which is changed as the first mold 2 is continuously used.

As described above, a value of the force (load) of the exposing pin 30 pressing the surface of the sensor element is required to be a magnitude of force within an appropriate range. For this reason, the resin sealing apparatus measures a load of the exposing pin 30 by using the load detection pin 45, and may determine abnormality when the measured value is out of the appropriate range. The abnormality of the measured value is mainly caused by a change in sliding resistance force between the exposing pin 30 and the pin hole 34.

More specifically, a case in which the measured load is below a lower limit value of the appropriated range means a state in which the tip 35 of the exposing pin 30 is in contact with the surface of the sensor element, but a load is not sufficient for masking, or a state in which the exposing pin does not reach the surface of the sensor element.

In addition, a case in which the measured load is above an upper limit value of the appropriated range means a state in which the tip 35 of the exposing pin 30 applies excessive pressure to the surface of the sensor element.

As described above, when the measured load is out of the appropriate range, both of the upper and lower limit values are indexes that represent states associated with manufacture of defective molded resin sealed packages. Therefore, for example, prior to forming a resin sealed package, the operator may confirm whether a sliding defect occurs in the resin sealing apparatus, by measuring a load of the exposing pin 30 by using the load detection pin 45.

In addition, when the load detected by the load detection pin 45 is out of the appropriate range, the resin sealing apparatus may output the detected state as lighting

images of the lamp or character information on the display panel, or may stop an automatic operation, and as a result, for example, the operator may easily confirm the state in which the load of the exposing pin 30 is in an abnormal state.

In addition, an operation in which the load measuring loader 40 is inserted between the first mold 2 and the second mold 3 will be described with reference to FIG. 5. FIG. 5 illustrates a fixed platen 48 to which the first mold 2 is fixed, a movable platen 49 to which the second mold 3 is fixed, and a tie bar 50.

The movable platen 49 is fitted with and mounted to the tie bar 50 so as to be movable upward and downward. The movable platen 49 may be moved upward and downward at a necessary stroke by a lift drive unit (not illustrated) that operates a toggle link through a ball screw by using a servo motor.

When measuring a load by using the load measuring loader 40, a load loader main body 51, which retains the load measuring loader 40, is moved to a side of the resin sealing mold 1. The load loader main body 51 is operated by a servo motor, and a movement position of the load loader main body 51 is controlled.

As illustrated in a lower view in FIG. 5, when the load loader main body 51 reaches a predetermined position, the load loader main body 51 slides the load measuring loader 40, such that the load measuring loader 40 is inserted between the first mold 2 and the second mold 3 in a cantilever state. Thereafter, as described above, the second mold 3, which is moved upward by the movable platen 49, comes into contact with the load measuring loader 40, and as a result, the resin sealing apparatus measures a load

Next, a disposition of an apparatus configuration of the resin sealing apparatus to which the present invention is applied will be schematically described with reference to FIG. 6.

A resin sealing apparatus 52 illustrated in FIG. 6 includes a material supply unit 53, a press apparatus 54 which includes the resin sealing mold 1, an inloader 55, a preheater 56, an unloader 57, the load loader main body 51 which retains the load measuring loader 40, and a storage unit 58. A plurality of press apparatuses 54 is disposed in the resin sealing apparatus 52.

The material supply unit 53 includes a base plate 59, a slit magazine (not illustrated) is mounted on the base plate 59, and the material supply unit 53 sends the slit magazine onto a turntable 60. The slit magazine is a plate-shaped member formed with a plurality of slits, and substrates with a plurality of sensor elements or lead frames 68 are arranged at slit parts.

In addition, the material supply unit 53 includes a tablet loader 61 on which the resin tablets 39 are disposed and which is configured to be movable upward and downward.

The inloader 55 is a device which holds a molding material and transports the molding material to the press apparatus 54 or the preheater 56. The inloader 55 moves to the positions of the turntable 60 and the tablet loader 61, holds the lead frame 68 and the resin tablet 39, and transports the lead frame 68 and the resin tablet 39. The inloader 55 is operated by a servo motor, and a movement position of the inloader 55 is controlled.

The preheater 56 is a device which pre-heats the lead frame 68 prior to the resin sealing, thereby inhibiting a problem with a curvature or the like of the lead frame 68 when forming a resin sealed package.

The unloader 57 is a device which extracts the resin sealed package after releasing the resin sealed package from the mold, and transports the resin sealed package to the storage unit 58. The unloader 57 is operated by a servo motor, and a

movement position of the unloader 57 is controlled.

The storage unit 58 includes a degate unit 62 which removes unnecessary resin such as curl or a runner attached to a molded product immediately after the molded product is released, and a storage box 63 which accommodates the molded product from which the unnecessary resin is removed. As described above, the resin sealing apparatus 52 is configured to manufacture a resin sealed package by using a molding material by a plurality of devices.

FIG. 7 illustrates a movement direction of the press apparatus 54, and movement directions of the inloader 55, the load loader main body 51, and the unloader 57 at the periphery of the press apparatus 54. The inloader 55, the load loader main body 51, and the unloader 57 are configured to be movable in horizontal directions (symbols X1, X2, and X3) in FIG. 7, and in vertical directions (symbols Y1, Y2, and Y3) in which the inloader 55, the load loader main body 51, and the unloader 57 enter the press apparatus 54.

In addition, the respective devices, which enter the press apparatus 54, are stopped at a position corresponding to the resin sealing mold 1. Further, as described in FIG. 5, the load loader main body 51 is configured to slide the load detection loader 40, such that the load detection loader 40 is inserted between the first mold 2 and the second mold 3 in a cantilever state.

Hereinafter, a flow of a method of manufacturing a resin sealed package by using the resin sealing mold 1, and a flow of a method of detecting abnormality of the resin sealing apparatus 52 will be described.

[Resin Sealing Process]

As illustrated in FIG. 8, at the time of resin sealing, the mold matching surfaces of the first mold 2 and the second mold 3 come into contact with each other in order to

be clamped, and the cavity 11 and the resin passageway 12 of the first mold 2 and the pot 28 of the second mold 3 are blocked.

The tip 35 of the exposing pin 30 comes into contact with the sensor element 64 of the substrate 38 with the sensor element, and the spring pin 13 is pushed up. Further, a position, at which the first mold and the second mold are completely clamped, is the position at the time of resin sealing.

In a state of being clamped as described above, the plunger 29 is operated while the resin tablet heated by the pot 28 is melted, and thermosetting resin 65 melted in the pot 28 is extruded.

The melted thermosetting resin 65 is sent to the cavity 11 through the resin passageway 12, and the cavity 11 is filled with the melted thermosetting resin 65. Further, the melted thermosetting resin 65 is cured while pressure of the melted thermosetting resin 65 is maintained, such that the sensor element 64 is partially sealed, and as a result, a resin formed portion 66 is formed as illustrated in FIG. 9.

[Detection by Light Shielding Sensor after Resin Sealing Process]

After the mold is opened and the molded product 67 is extracted, a position of the tip 37 of the to-be-detected pin 15 is detected by the light shielding sensor 14. As illustrated in FIG. 9, in a case in which the spring pin 13 returns back to the standby position, the tip 37 of the to-be-detected pin 15 is not detected by the light shielding sensor 14. That is, it may be confirmed that a sliding defect does not occur due to sliding resistance between the exposing pin 30 and the pin hole 34.

Meanwhile, although not illustrated, in a case in which the spring pin 13 is pushed up to the position at the time of resin sealing and does not return back to the standby position after the mold is opened, the tip 37 of the to-be-detected pin 15 is detected by the light shielding sensor 14. That is, for example, the operator may

confirm that a sliding defect occurs due to sliding resistance between the exposing pin 30 and the pin hole 34. After confirming the detection of the light shielding sensor 14, for example, the operator stops the resin sealing apparatus 52, and performs maintenance and inspection on the first mold 2.

[Measurement of Load by Load Measuring Loader]

After the detection by the light shielding sensor 14, a load of the exposing pin 30 is measured by the load measuring loader 40. As described above, the load is measured by bringing the tip 47 of the load detection pin 45 into contact with the tip 35 of the exposing pin 30, and pushing up the exposing pin 30 (see FIGS. 3 and 4).

When the measured load is a value included in a predetermined appropriate range, it may be determined that the exposing pin 30 may perform masking on a surface of the sensor element 64 while imparting appropriate pressure.

Meanwhile, in a case in which the measured load is below a lower limit value or above an upper limit value of a predetermined appropriate range, there is concern that a defective molded resin sealed package is manufactured, and therefore, for example, the operator stops the resin sealing apparatus 52, and performs maintenance and inspection on the first mold 2.

In a case in which a load is measured by the load measuring loader 40, the load may be evaluated as a numerical value, and as a result, it is possible to more strictly determine whether a sliding defect occurs. For example, the resin sealing apparatus 52 may detect a state in which the spring pin 13 does not completely return back to the standby position from the position at the time of resin sealing after the spring pin 13 is pushed up and thus force for pressing the surface of the sensor element is insufficient. In this state, it is also expected that the tip 37 of the to-be-detected pin 15 cannot be detected by the light shielding sensor 14, and as a result, it can be said that the load

measurement by the load measuring loader 40 is the stricter detection.

[Detection by Light Shielding Sensor after Load Measurement]

After a load is measured by the load measuring loader 40, a position of the tip 37 of the to-be-detected pin 15 is detected again by the light shielding sensor 14. As illustrated in FIG. 10, in a case in which the spring pin 13 returns back to the standby position, the tip 37 of the to-be-detected pin 15 is not detected by the light shielding sensor 14. That is, for example, the operator may confirm that a sliding defect does not occur due to sliding resistance between the exposing pin 30 and the pin hole 34.

Meanwhile, as illustrated in FIG. 11, in a case in which the spring pin 13 is pushed up to the position at the time of resin sealing and does not return back to the standby position after a load is measured by the load measuring loader 40, the tip 37 of the to-be-detected pin 15 is detected by the light shielding sensor 14. That is, for example, the operator may confirm that a sliding defect occurs due to sliding resistance between the exposing pin 30 and the pin hole 34. As described above, according to the resin sealing apparatus 52, the light shielding sensor 14 performs the detection after resin sealing and after a load is measured by the load measuring loader, and as a result, for example, the operator may more sufficiently confirm whether a sliding defect occurs.

As described above, the resin sealing apparatus according to the present invention may appropriately detect whether a sliding defect of the exposing pin occurs in respect to a resin sealed package in which an exposed portion is formed at a surface of an electronic component.

In addition, the method of detecting abnormality of the resin sealing apparatus according to the present invention may appropriately detect whether a sliding defect of the exposing pin occurs in respect to a resin sealed package in which an exposed portion is formed at a surface of an electronic component.

[Description of Main Reference Numerals of Drawings]

- 1: Resin sealing mold
- 2: First mold
- 3: Second mold
- 4: Mold matching surface
- 5: Mold matching surface
- 6: Upper die set
- 7: Upper mold chase
- 8: Support pillar
- 9: Holder base
- 10: Cavity bar
- 11: Cavity
- 12: Resin passageway
- 13: Spring pin
- 14: Light shielding sensor
- 15: To-be-detected pin
- 16: Ejector pin
- 17: Pin plate
- 18: Ejector plate
- 19: Pressing device
- 20: Lower die set
- 21: Lower mold chase
- 22: Support pillar
- 23: Holder base
- 24: Cavity bar

25: Ejector pin

26: Pin plate

27: Ejector plate

28: Pot

29: Plunger

30: Exposing pin

31: Flange portion

32: Hollow portion

33: Spring

34: Pin hole

35: Tip of exposing pin

36: Pin hole

37: Tip of to-be-detected pin

38: Substrate with sensor element

39: Resin tablet

40: Load measuring loader

41: Base portion

42: Load detection pin holder

43: Base plate

44: Guide portion

45: Load detection pin

46: Detection signal cable

47: Tip of load detection pin

48: Fixed platen

49: Movable platen

50: Tie bar

51: Load loader main body

52: Resin sealing apparatus

53: Material supply unit

54: Press apparatus

55: Inloader

56: Preheater

57: Unloader

58: Storage unit

59: Base plate

60: Turntable

61: Tablet loader

62: Degate unit

63: Storage box

64: Sensor element

65: Thermosetting resin

66: Resin formed portion

67: Pressing device

68: Lead frame

[CLAIMS]

[Claim 1]

A resin sealing apparatus comprising:

a first mold including a main body which is formed with a hollow portion, a mold matching surface provided on the main body, a concave cavity portion provided at the mold matching surface to be filled with thermosetting resin, a first through hole which is continuously formed from the concave cavity portion and the hollow portion of the main body, a second through hole which is continuously formed from the hollow portion of the main body so as to be opposite to the first through hole of the main body, a pin flange portion which is disposed in the hollow portion of the main body and biased toward the first through hole by an elastic body, an exposing pin which is provided at the first through hole of the pin flange portion so as to be penetratively inserted into the first through hole, and configured to be extended and retracted while sliding along an inner circumferential surface of the first through hole, a to-be-detected pin which is provided at a side, opposite to the side at which the exposing pin of the pin flange portion is provided, so as to be penetratively inserted into the second through hole, and has a tip configured to protrude to the outside of the second through hole, and a detection sensor unit which is provided at a side opposite to the mold matching surface of the main body, and detects the protrusion of the tip of the to-be-detected pin from the second through hole;

a second mold including a mold matching surface that interposes a base material with an electronic component in cooperation with the mold matching surface of the first mold;

a mold drive unit which enables the first mold and the second mold to approach each other, and clamps the first mold and the second mold by allowing the first mold

and the second mold to approach each other; and

a load measuring loader which includes a detection loader main body that is disposed between the first mold and the second mold and approaches the mold matching surface of the first mold by the second mold pushed by the mold drive unit, and a load sensor unit that is provided on the detection loader main body, and measures a load when the load sensor unit comes into contact with a tip of the exposing pin and pushes the exposing pin.

[Claim 2]

The resin sealing apparatus according to claim 1, wherein, when a load measured by the load sensor unit is out of a predetermined range, a signal indicating that the load is abnormal is generated.

[Claim 3]

The resin sealing apparatus according to claim 1 or 2, wherein, when the detection sensor unit detects the protrusion of the tip of the to-be-detected pin from the second through hole, a signal indicating that the protrusion of the tip of the to-be-detected pin is detected is generated.

[Claim 4]

A method of detecting abnormality of a resin sealing apparatus, which performs masking by biasing a tip of an exposing pin, which slides along an inner circumferential surface of a mold, by an elastic body, and bringing the tip of the exposing pin into contact with a surface of an electronic component of a base material with the electronic component disposed in a cavity portion of the mold, the method comprising:

a load measuring process of measuring a load when pushing the exposing pin into the mold by pressing one end of the exposing pin provided in the mold; and

a detection process of detecting a position of the one end of the exposing pin

after pressing the one end of the exposing pin provided in the mold.

[Claim 5]

The method according to claim 4, wherein the detection process is performed after extracting a molded product, after resin sealing, from the mold, or after the load measuring process.

[Claim 6]

A resin sealing apparatus comprising:

a first mold including a main body which is formed with a hollow portion, a mold matching surface which is provided on the main body, a concave cavity portion which is provided at the mold matching surface to be filled with thermosetting resin, a first through hole which is continuously formed from the concave cavity portion and the hollow portion of the main body, a second through hole which is continuously formed from the hollow portion of the main body so as to be opposite to the first through hole of the main body, a pin flange portion which is disposed in the hollow portion of the main body and biased toward the first through hole by an elastic body, and an exposing pin which is provided at the first through hole of the pin flange portion so as to be penetratively inserted into the first through hole, and configured to be extended and retracted while sliding along an inner circumferential surface of the first through hole;

a second mold including a mold matching surface that interposes a base material with an electronic component in cooperation with the mold matching surface of the first mold;

a mold drive unit which enables the first mold and the second mold to approach each other, and clamps the first mold and the second mold by allowing the first mold and the second mold to approach each other; and

a load measuring loader which includes a detection loader main body that is

disposed between the first mold and the second mold and approaches the mold matching surface of the first mold by the second mold pushed by the mold drive unit, and a load sensor unit that is provided on the detection loader main body, and measures a load when the load sensor unit comes into contact with a tip of the exposing pin and pushes the exposing pin.