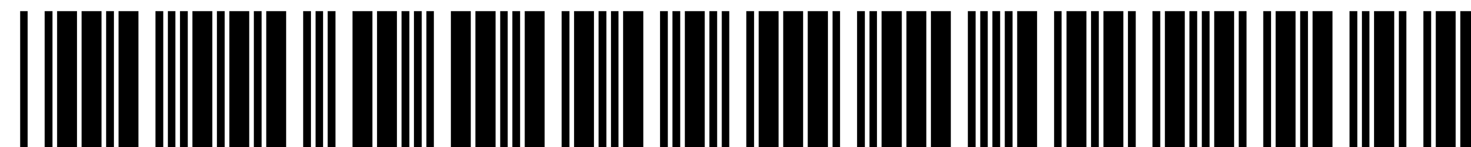

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(45) **Date of Patent: Feb. 23, 2016**

(54) **POWER SUPPLY MODULE**

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(73) Assignee: **CYNTEC Co., Ltd.**, Hsinchu (TW)

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(22) Filed: **May 28, 2012**

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(30) **Foreign Application Priority Data**

Feb. 18, 2008 (TW) .... 97105555 A

(51) **Int. Cl.**

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H05K 1/18	(2006.01)
H01L 23/64	(2006.01)
H01L 25/16	(2006.01)
H01F 27/02	(2006.01)
H05K 3/34	(2006.01)

(52) **U.S. Cl.**

CPC ***H05K 1/181*** (2013.01); ***H01L 23/645*** (2013.01); ***H01L 25/16*** (2013.01); *H01F 27/027* (2013.01); *H01L 2224/48091* (2013.01); *H01L 2224/48227* (2013.01); *H01L 2924/1305* (2013.01); *H01L 2924/13055* (2013.01); *H01L 2924/13091* (2013.01); *H05K 3/3421* (2013.01); *H05K 2201/1003* (2013.01); *H05K 2201/10515* (2013.01); *H05K 2201/10537* (2013.01); *H05K 2201/10924* (2013.01); *Y10T 29/4902* (2015.01)

(58) **Field of Classification Search**

USPC 361/813, 729; 257/666, 676, 704, 784; 336/65, 200; 363/141

See application file for complete search history.

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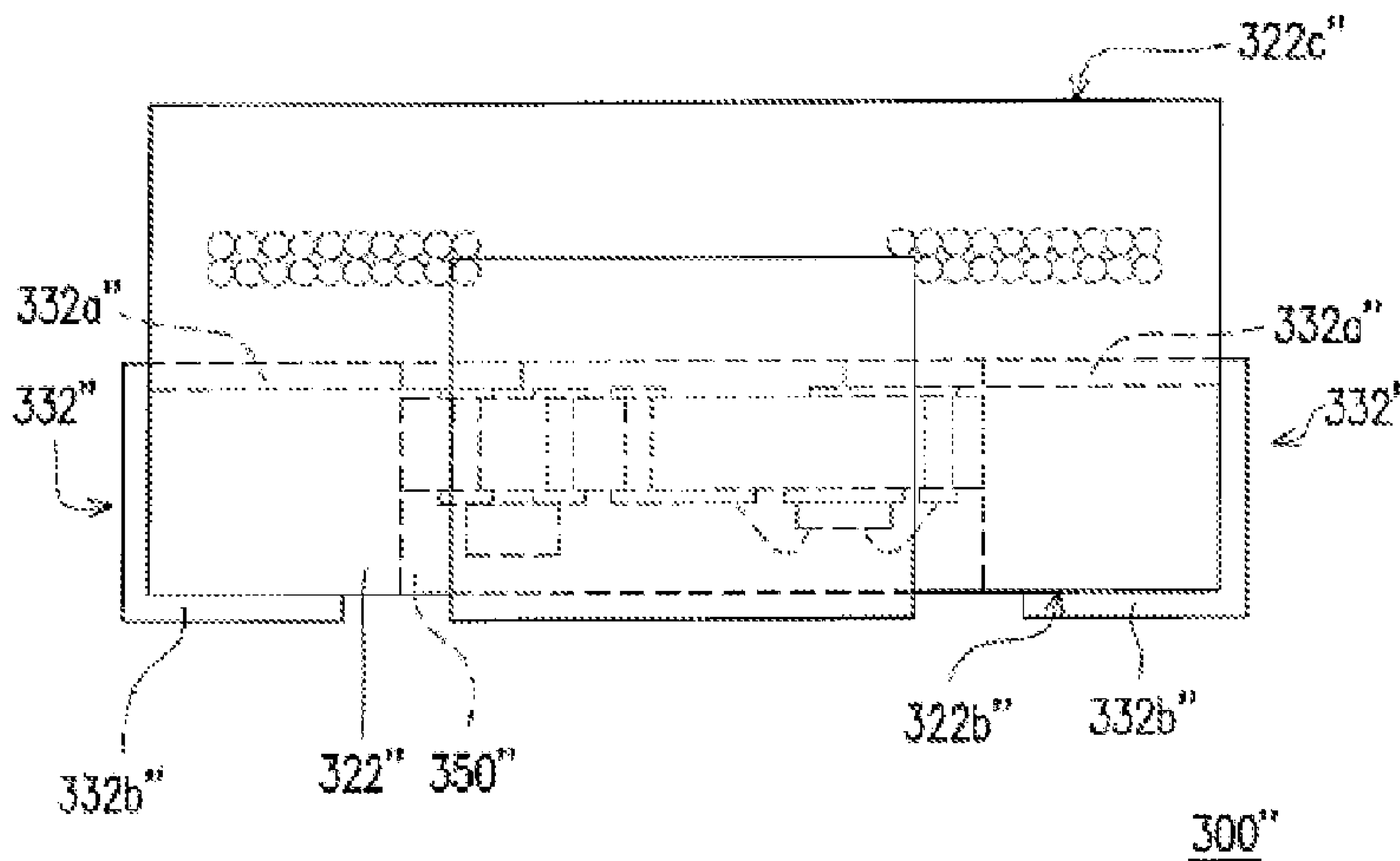
(74) *Attorney, Agent, or Firm* — Min-Lee Teng; Litron Patent & Trademark Office

(57) **ABSTRACT**

A power-supply module includes at least one power-supply component, an inductor and a package. The inductor is disposed over the at least one power-supply components, and the at least a power-supply component and the inductor are disposed within the package. Besides, the power-supply module further comprises a printed circuit board, and the at least one power-supply component and the inductor are mounted to the printed circuit board. Moreover, the inductor comprises a plurality of leads that support the inductor over the at least one power-supply component.

14 Claims, 6 Drawing Sheets



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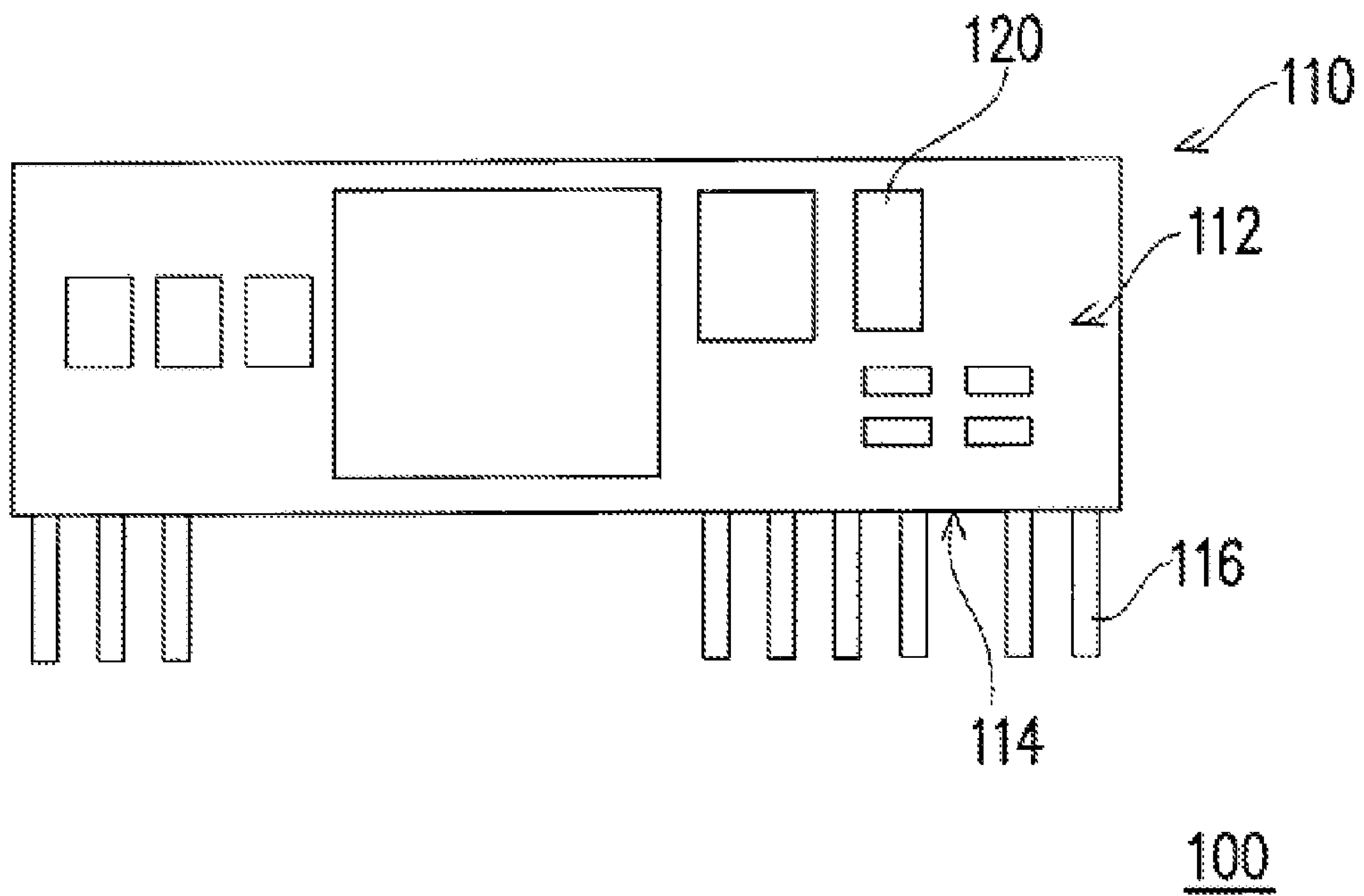

FIG. 1 (PRIOR ART)

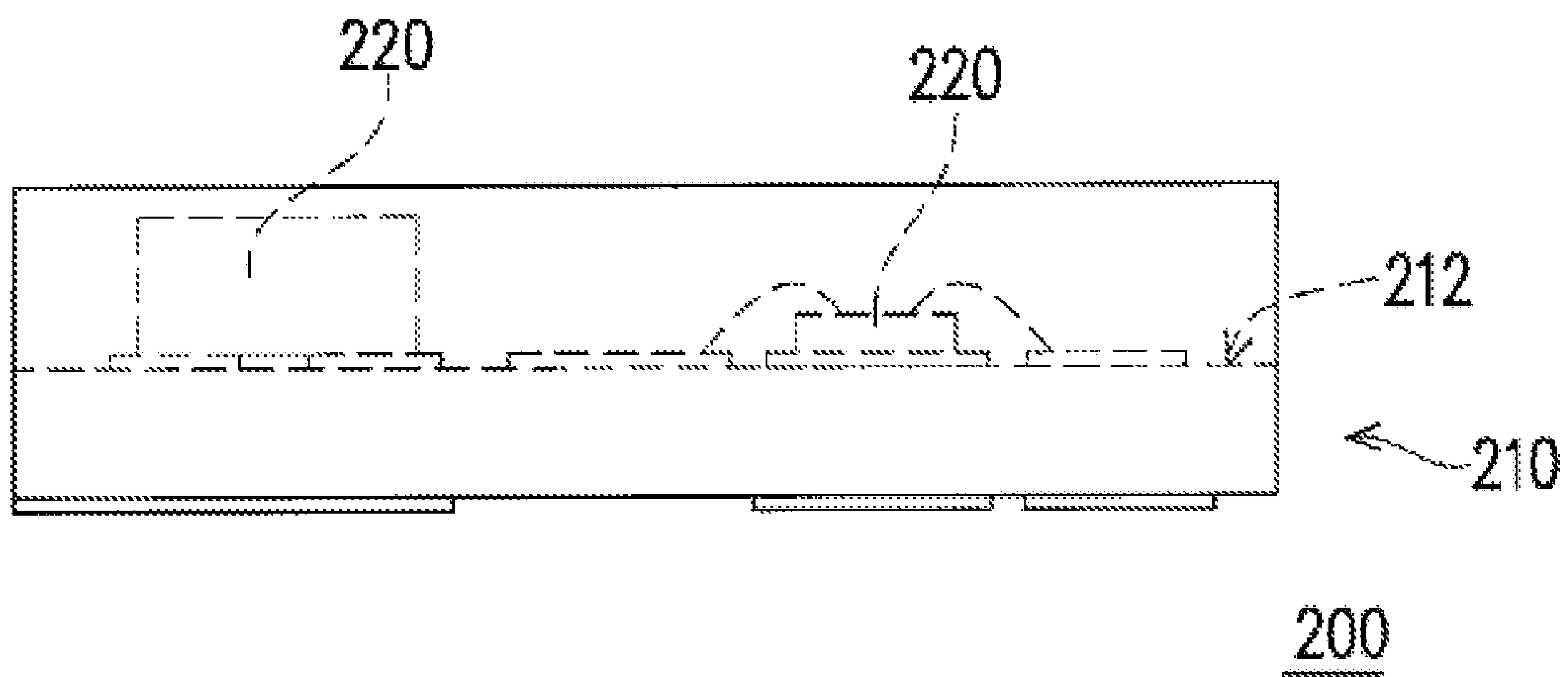

FIG. 2 (PRIOR ART)

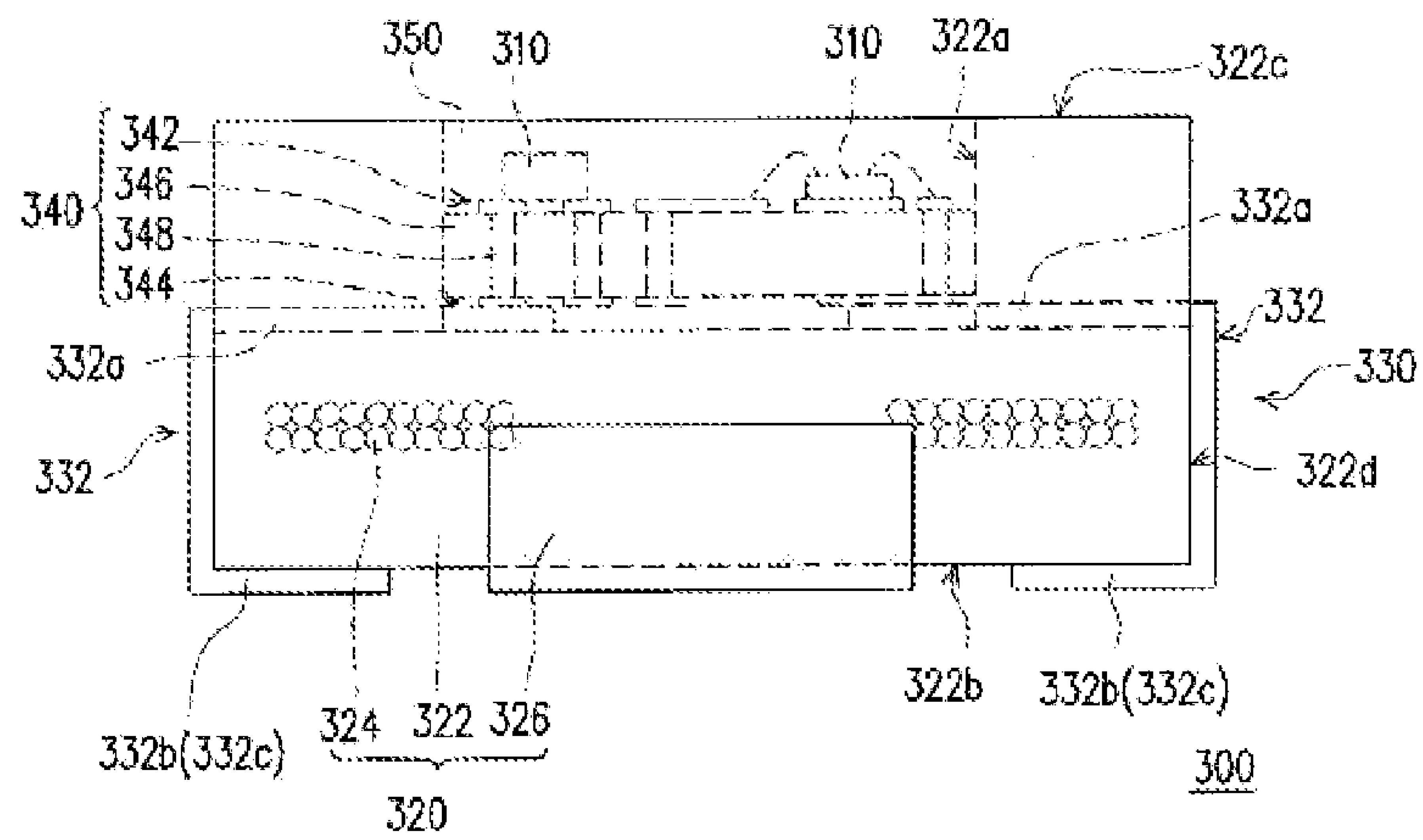

FIG. 3A

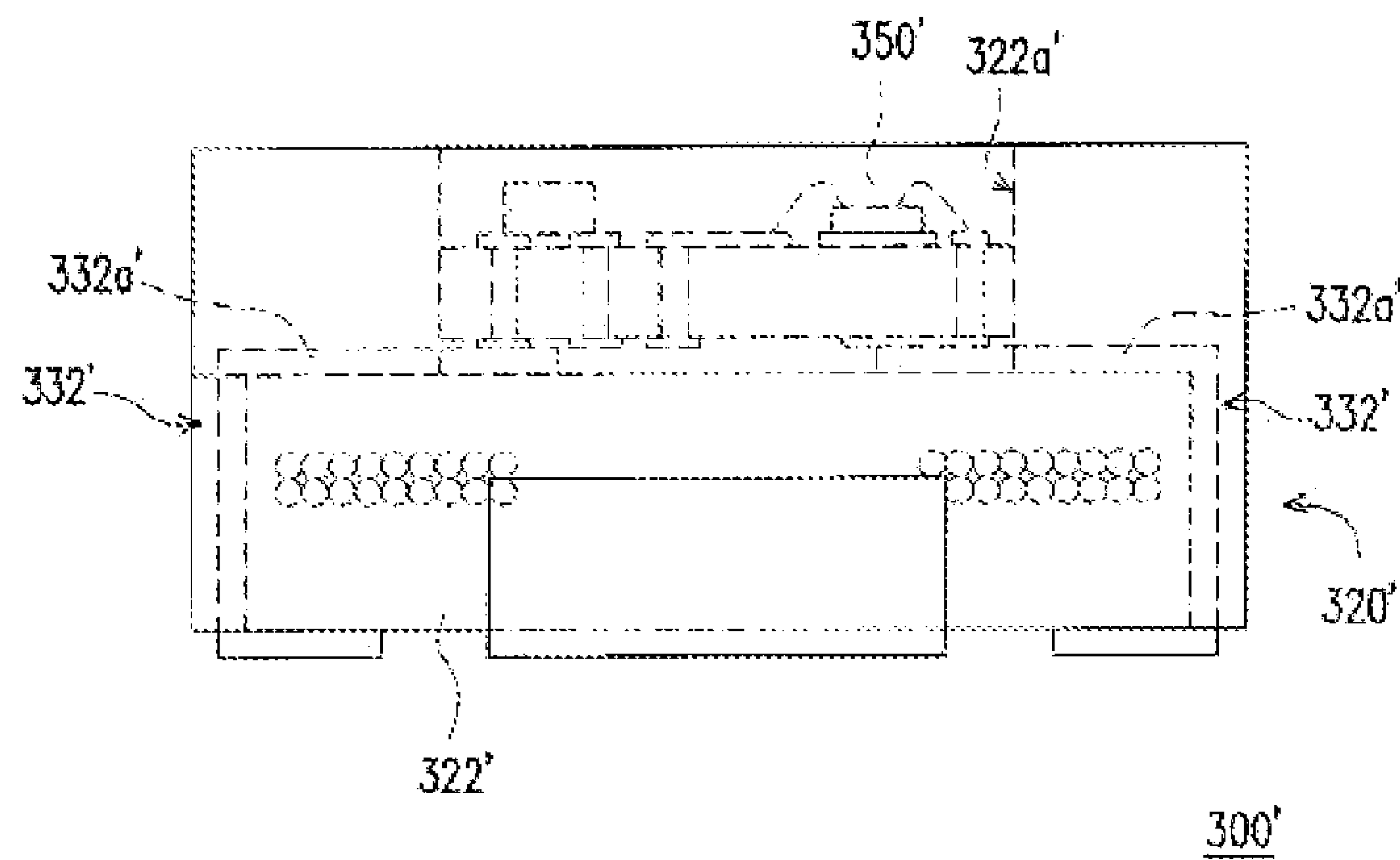

FIG. 3B

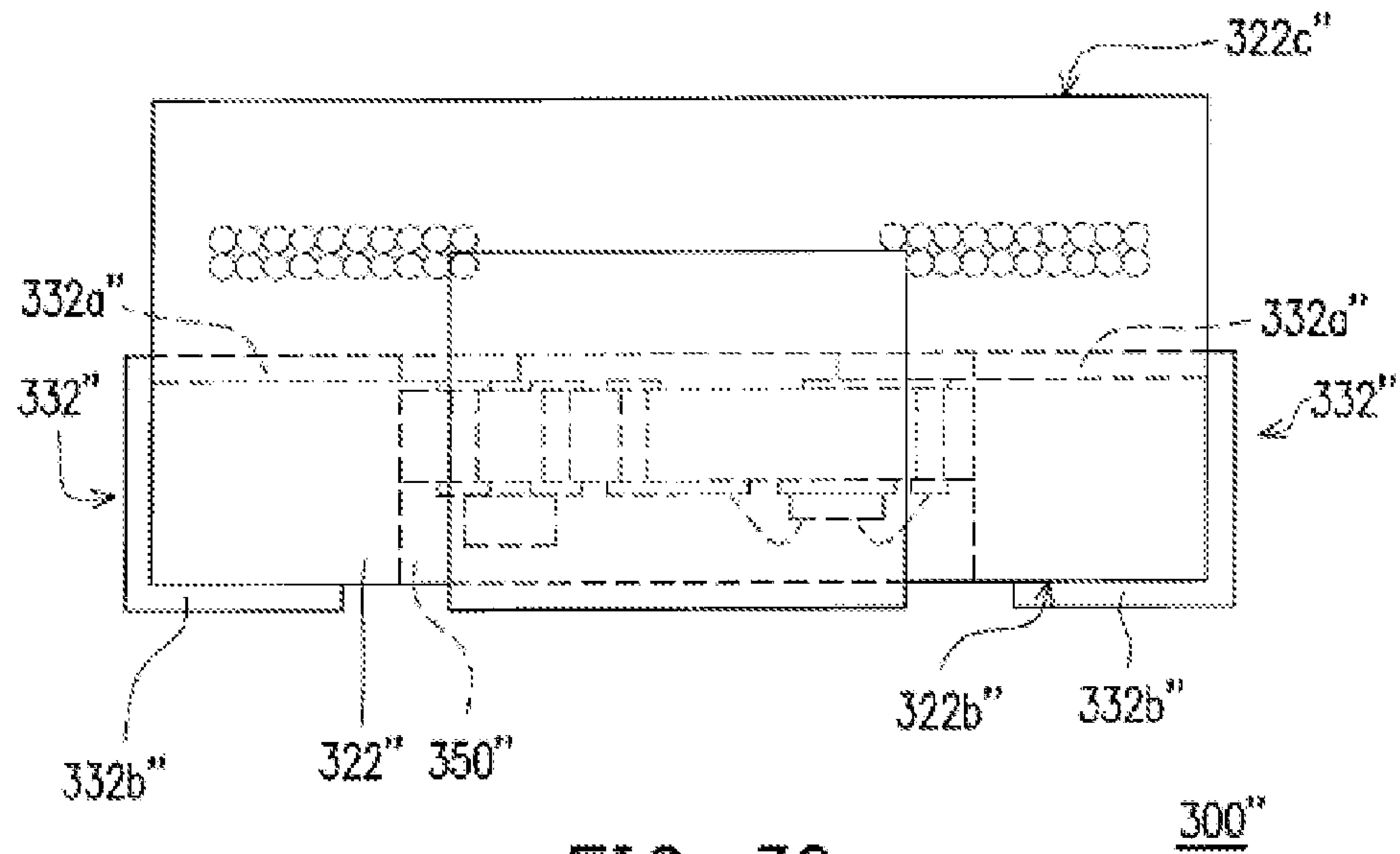

FIG. 3C

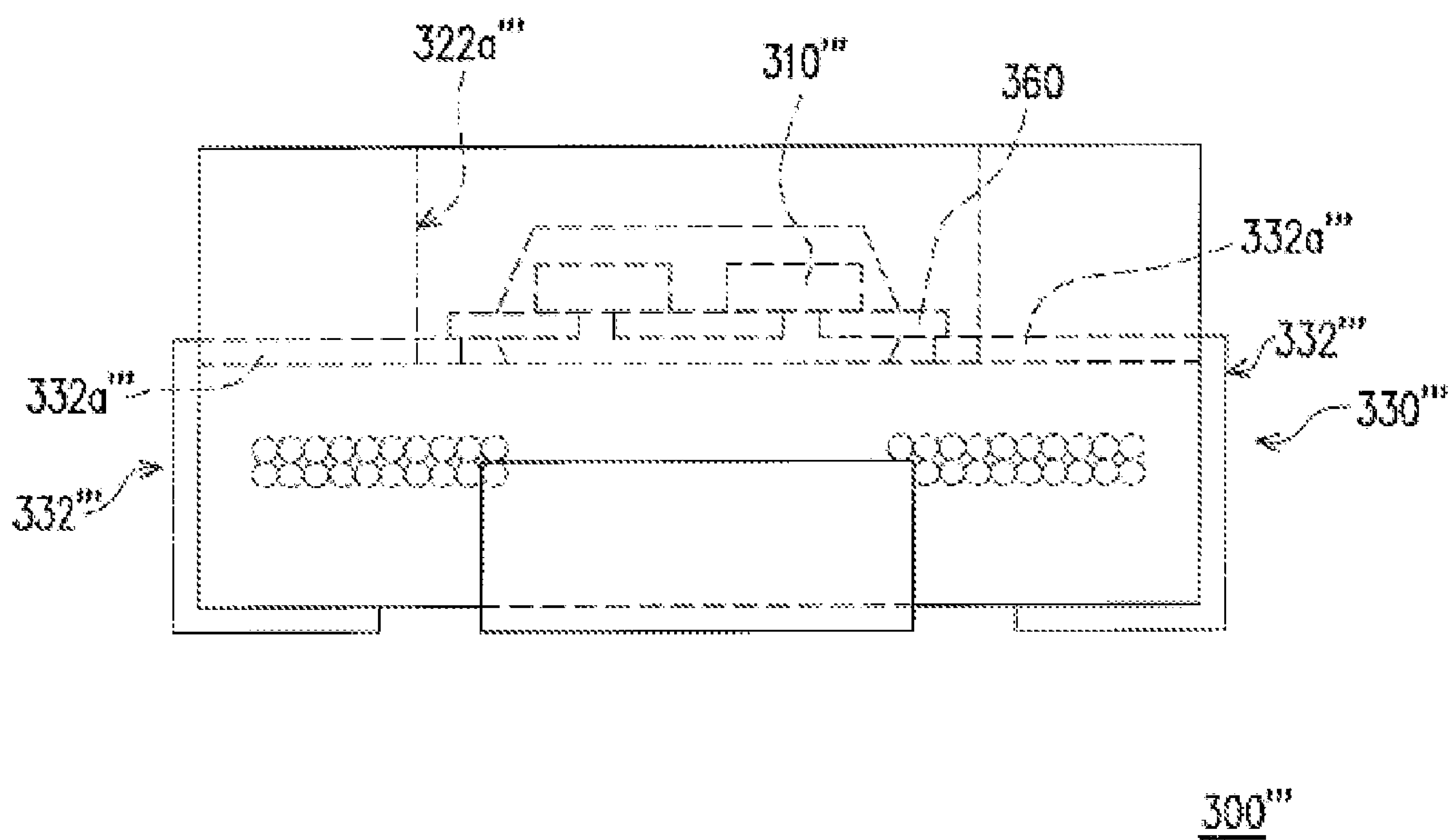

FIG. 3D

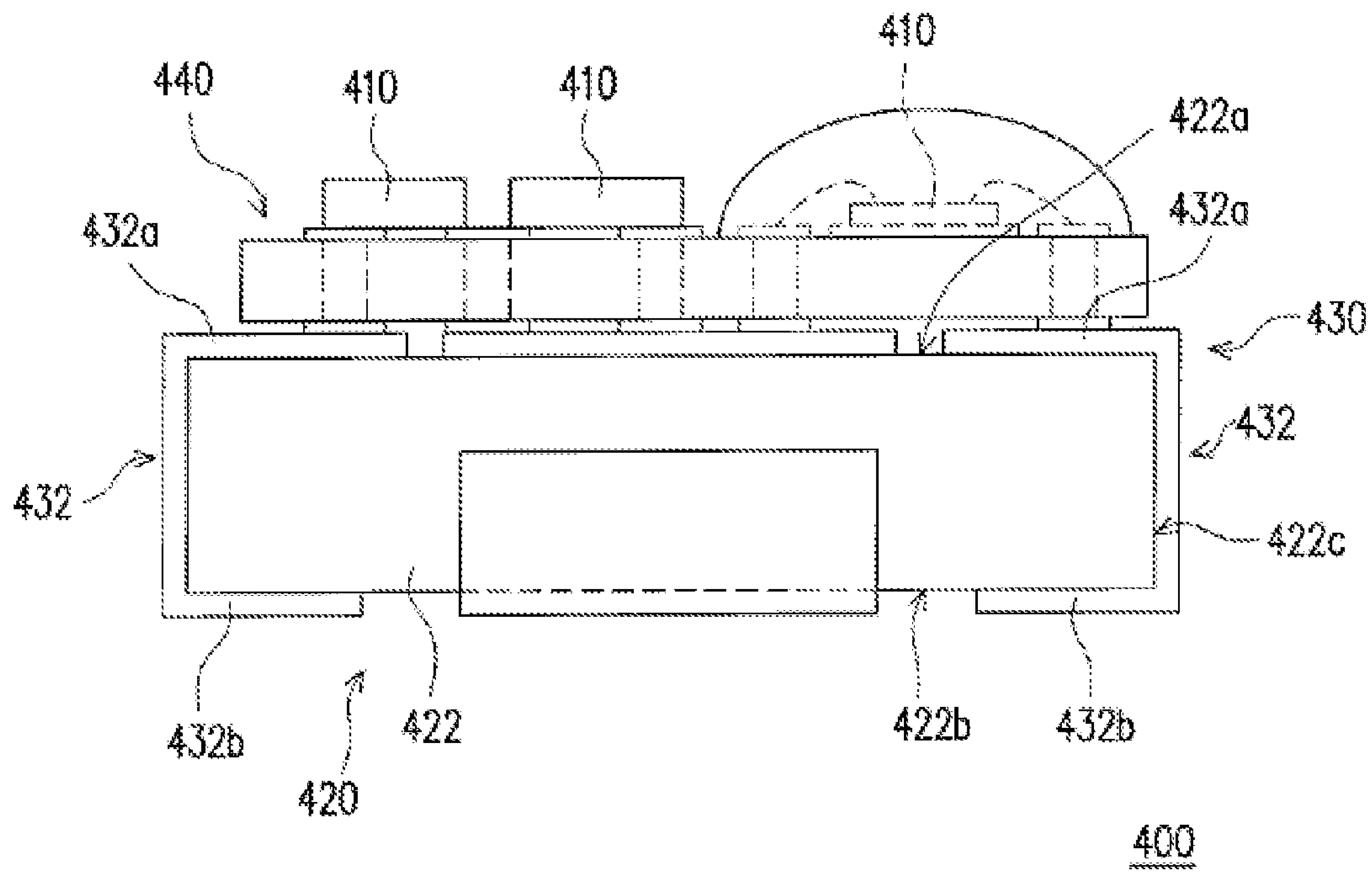

FIG. 4A

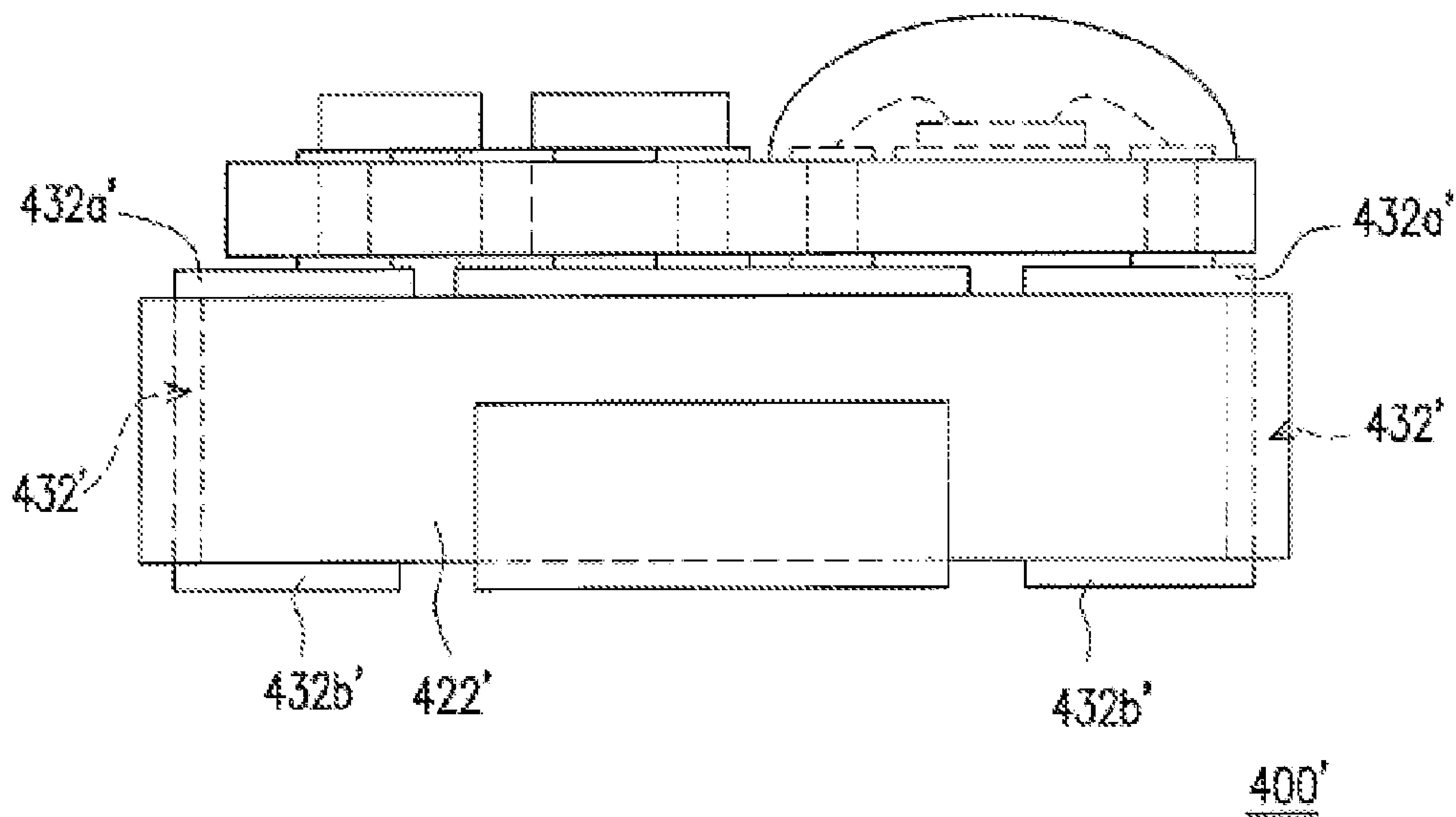

FIG. 4B

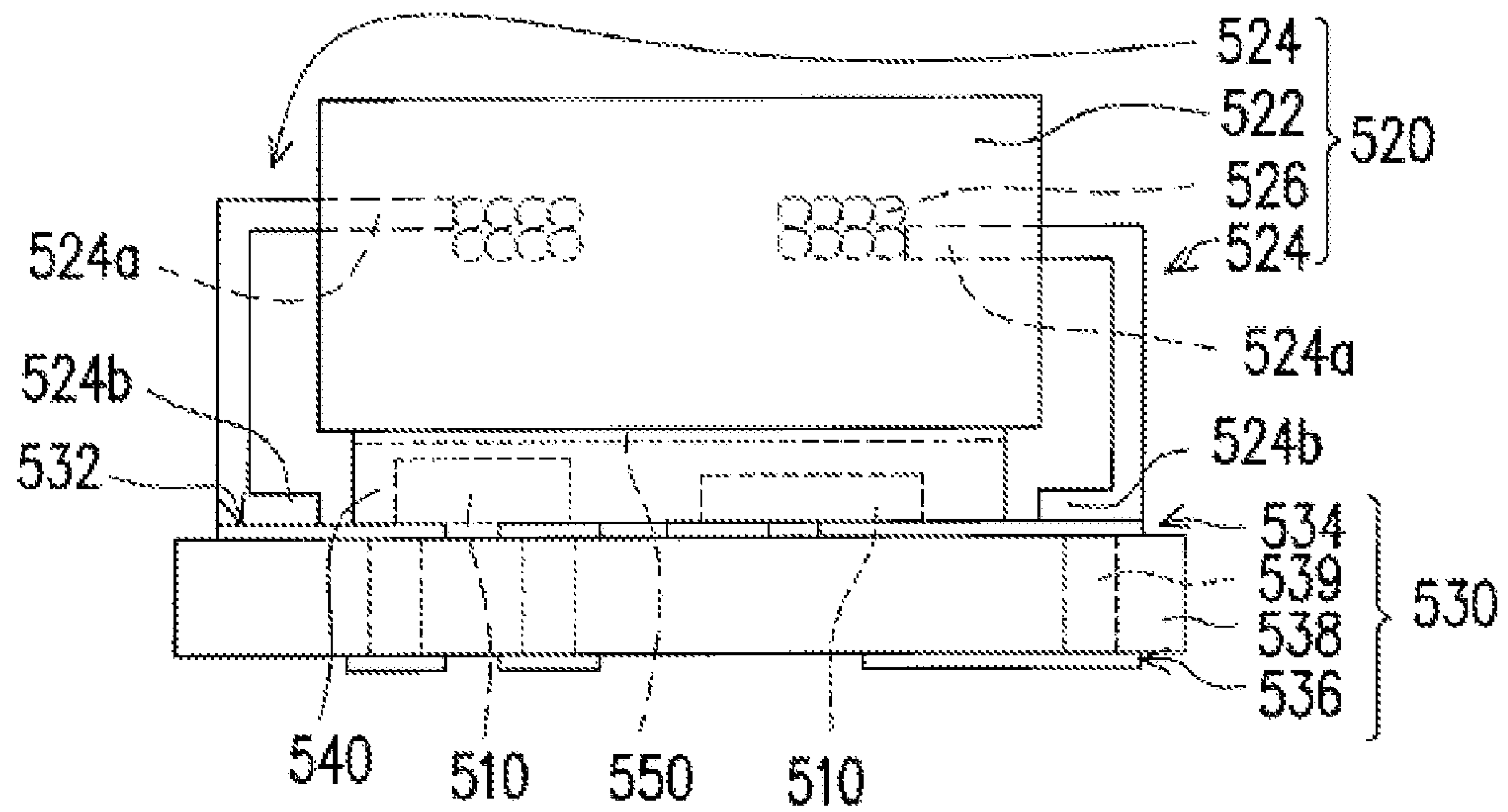

FIG. 5A

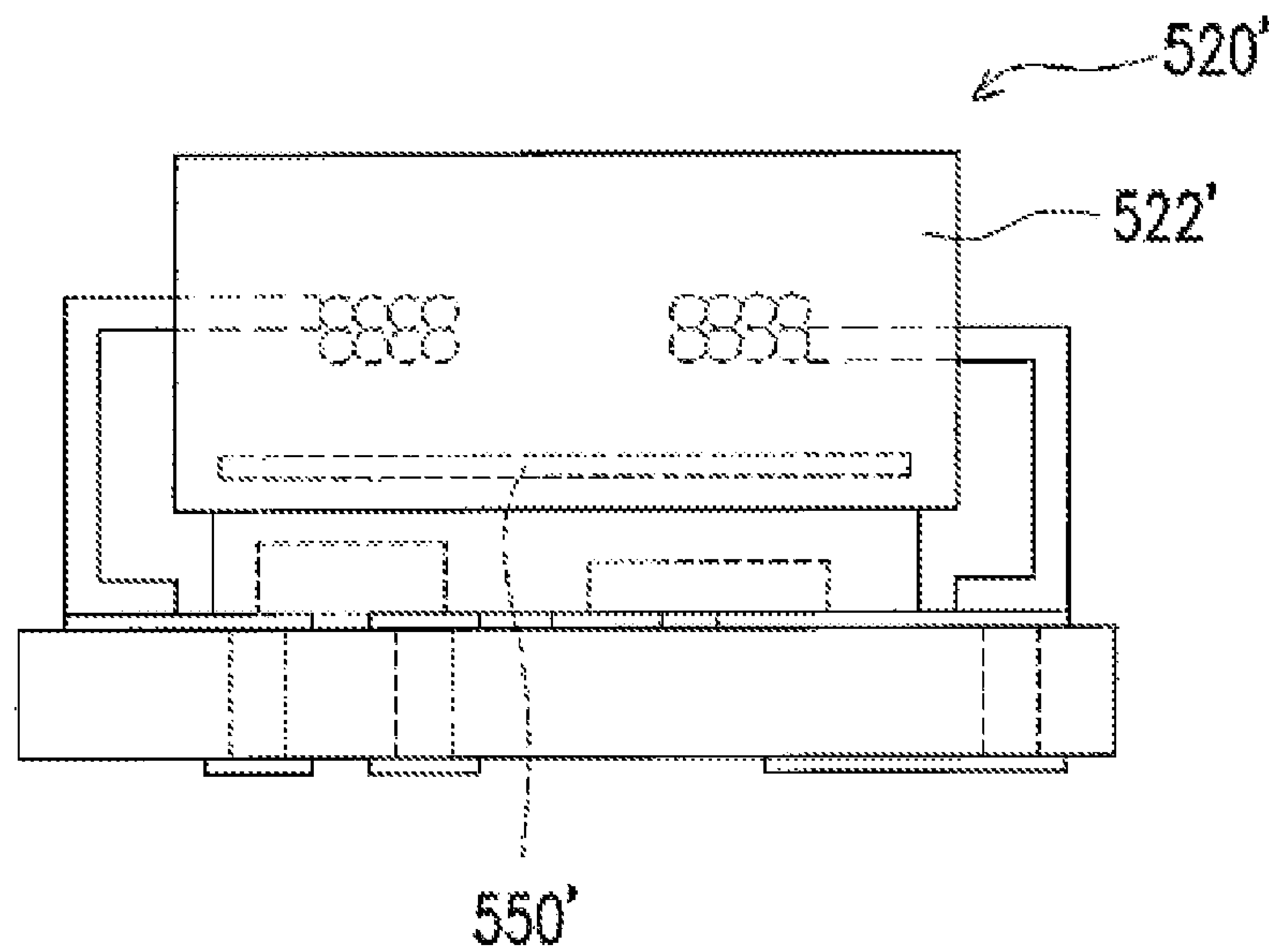

FIG. 5B

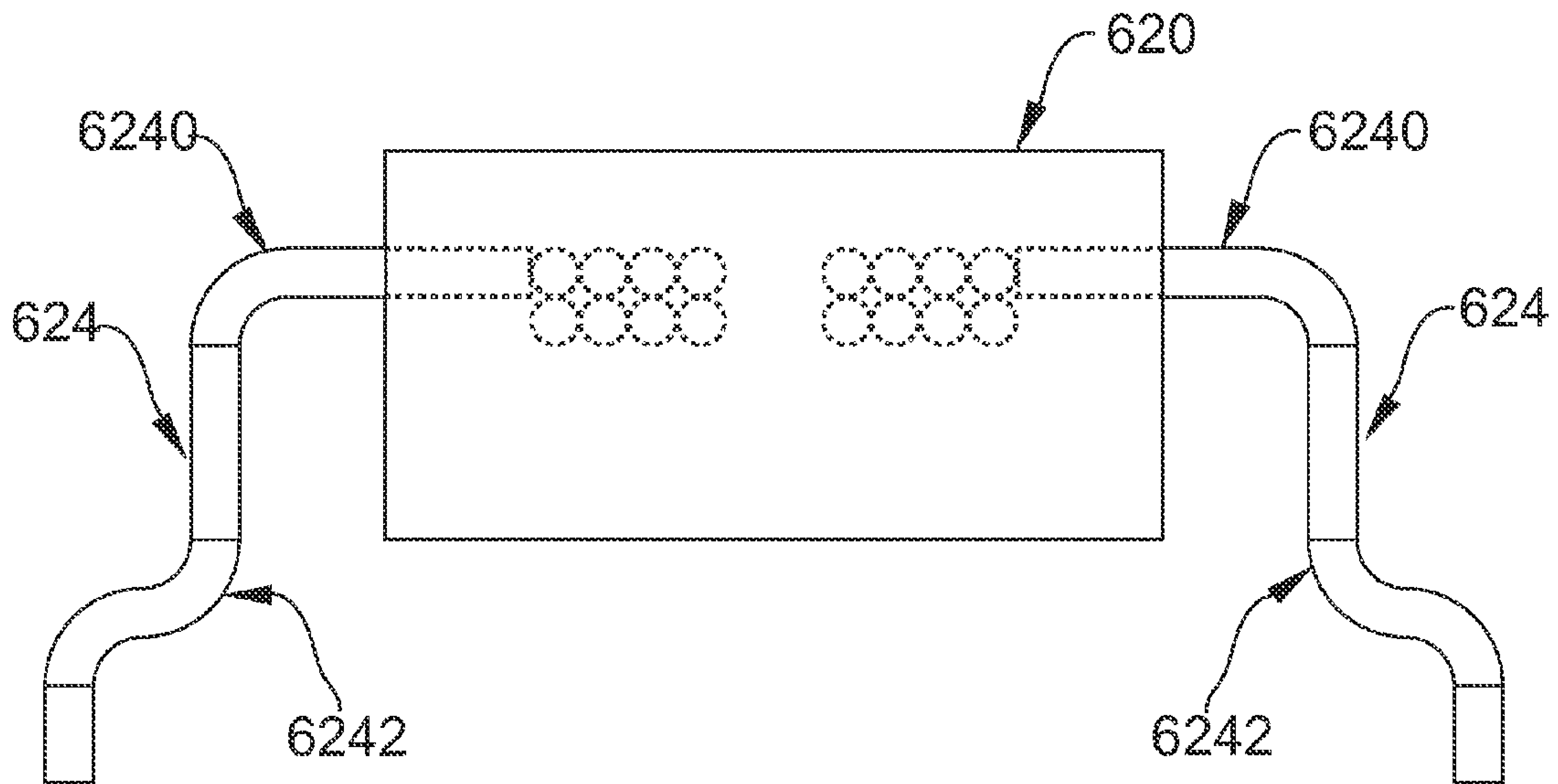

FIG. 6

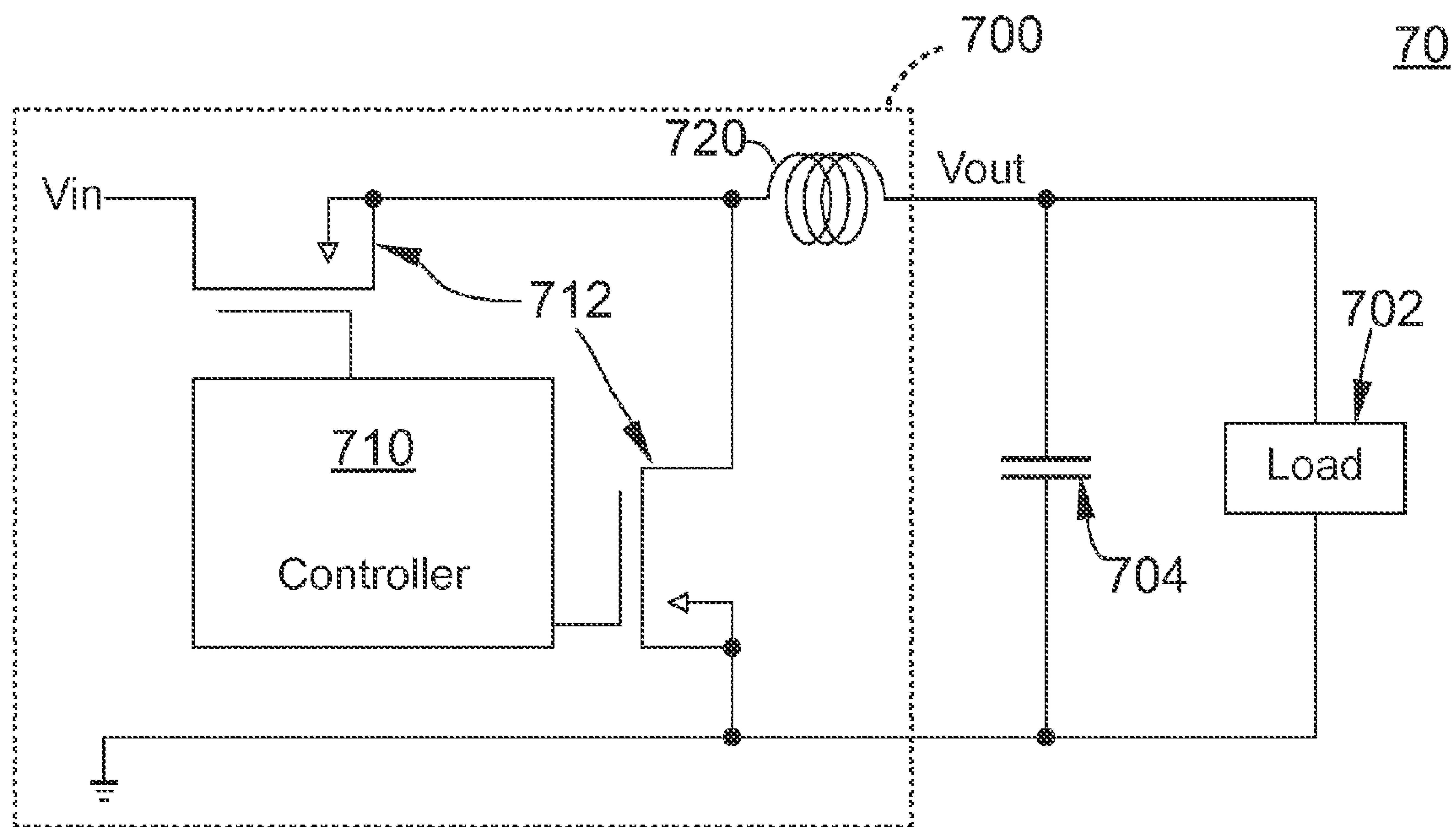

FIG. 7

POWER SUPPLY MODULE

CROSS-REFERENCES TO RELATED APPLICATIONS

This application is a continuation-in-part of U.S. patent application Ser. No. 12/971,671 filed on Dec. 17, 2010, now U.S. Pub. No. 2011/0090648, which is a divisional of U.S. patent application Ser. No. 12/143,143 filed on Jun. 20, 2008, now U.S. Pub. No. 2009/0207574, now abandoned, which claims priority of Taiwan application Ser. No. 97105555 filed on Feb. 18, 2008. The entirety of the above-mentioned patent applications are hereby incorporated by reference herein and made a part of specification.

BACKGROUND OF THE INVENTION

I. Field of the Invention

The present invention relates to a package structure. More particularly, the present invention relates to an electronic package structure.

II. Description of the Prior Art

Electronic package structures are formed by complicated package processes. Different electronic package structures have different electrical performances and capacities of heat dissipation, and therefore a designer may select an electronic package structure with a desired electrical performance and capacity of heat dissipation according to a design requirement.

FIG. **1** is a schematic diagram of a conventional electronic package structure. Referring to FIG. **1**, the conventional electronic package structure **100** includes a printed circuit board (PCB) **110** and a plurality of electronic elements **120**. The electronic elements **120** are disposed on a surface **112** of the PCB **110** and electrically connected to the PCB **110**. The PCB **110** has a plurality of pins **116** extending out from another surface **114** of the PCB **110** to be electrically connected to an electronic device, for example, a motherboard (not shown).

FIG. **2** is a schematic diagram of another conventional electronic package structure. Referring to FIG. **2**, the conventional electronic package structure **200** includes a circuit substrate **210** and a plurality of electronic elements **220**. The electronic elements **220** are disposed on a surface **212** of the circuit substrate **210**, and electrically connected to the circuit substrate **210** via a wire bonding technology, a flip-chip bonding technology or a surface mount technology. Moreover, the conventional electronic package structure **200** may be electrically connected to an electronic device, for example, a motherboard (not shown), via a solder paste or a plurality of solder balls (not shown).

It should be noted that the electronic elements **120** of the conventional electronic package structure **100** are all disposed on the surface **112** of the PCB **110**, and the electronic elements **220** of the conventional electronic package structure **200** are all disposed on the surface **212** of the circuit substrate **210**. Therefore, in the conventional electronic package structures **100** and **200**, spatial utilization of the PCB **110** and the circuit substrate **210** is relatively low, and sizes of the conventional electronic package structures **100** and **200** are relatively great.

SUMMARY OF THE INVENTION

In accordance with the present invention, an electronic package structure can achieve a relatively high utilization of an internal space thereof, so that a size of the electronic package structure can be reduced.

In one embodiment of the present invention, an electronic package structure includes at least a first electronic element, a second electronic element and a first lead frame. The second electronic element includes a body having a cavity. The first electronic element is disposed in the cavity. The lead frame has a plurality of leads. Each of the leads has a first end and a second end, and the first end of at least one of the leads extends to the cavity to electrically connect the first electronic element.

In one embodiment of the present invention, an electronic package structure includes at least one first electronic element, a second electronic element and a lead frame. The second electronic element includes a body having a first surface. The lead frame has a plurality of leads. Each of the leads has a first end and a second end. The first ends are disposed on the first surface, and the first electronic element is disposed on the first surface and electrically connected to at least one of the leads.

In one embodiment, an electronic package structure includes a circuit substrate, at least one first electronic element and a second electronic element. The circuit substrate has a first surface. The first electronic element is disposed on the first surface of the circuit substrate and electrically connected to the circuit substrate. The second electronic element is disposed above the first surface of the circuit substrate and includes a body and a plurality of leads. Each of the leads has a first end and second end, and the second end of each of the leads extends out from the body to electrically connect the circuit substrate. The first electronic element is located among the body of the second electronic element, the first surface of the circuit substrate and the leads.

In the above embodiments of the present invention, since the first electronic element can be disposed in the cavity of the second electronic element or on the second electronic element, or the second electronic element can be stacked on the first electronic element, compared to the conventional electronic package structures, utilization of an internal space of the electronic package structure is relatively high.

In order to make the aforementioned and other objects, features and advantages of the present invention comprehensible, a preferred embodiment accompanied with figures is described in detail below.

The detailed technology and above preferred embodiments implemented for the present invention are described in the following paragraphs accompanying the appended drawings for people skilled in this field to well appreciate the features of the claimed invention.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing aspects and many of the accompanying advantages of this invention will become more readily appreciated as the same becomes better understood by reference to the following detailed description when taken in conjunction with the accompanying drawings, wherein:

FIG. **1** is a schematic diagram of a conventional electronic package structure.

FIG. **2** is a schematic diagram of another conventional electronic package structure.

FIG. **3**A is a schematic diagram of an electronic package structure according to a first embodiment of the present invention.

FIG. **3**B is a schematic diagram of another electronic package structure according to the first embodiment of the present invention.

FIG. **3**C is a schematic diagram of another electronic package structure according to the first embodiment of the present invention.

FIG. **3**D is a schematic diagram of still another electronic package structure according to the first embodiment of the present invention.

FIG. **4**A is a schematic diagram of an electronic package structure according to a second embodiment of the present invention.

FIG. **4**B is a schematic diagram of another electronic package structure according to the second embodiment of the present invention.

FIG. **5**A is a schematic diagram of an electronic package structure according to a third embodiment of the present invention.

FIG. **5**B is a schematic diagram of another electronic package structure according to the third embodiment of the present invention.

FIG. **6** is a side view of an embodiment of an inductor, which can be used in the electronic package structure as shown in FIGS. **3**A-**5**B.

FIG. **7** is a schematic diagram of an embodiment of a system that incorporates one of the electronic package structures as shown in FIGS. **3**A-**5**B.

DETAILED DESCRIPTION OF THE INVENTION

The detailed explanation of the present invention is described as following. The described preferred embodiments are presented for purposes of illustrations and descriptions, and they are not intended to limit the scope of the present invention.

First Embodiment

FIG. **3**A is a schematic diagram of an electronic package structure according to a first embodiment of the present invention. Referring to FIG. **3**A, the electronic package structure **300** includes at least one first electronic element **310** (two first electronic elements are illustrated in FIG. **3**A), a second electronic element **320** and a first lead frame **330**. The electronic package structure **300** is generally applied to a power-supply module, a voltage regulator module, a network adapter, a graphics processing unit, a DC/DC converter or a point-of-load (POL) converter. Each of the first electronic elements **310** can be a power-supply component such as a logical control element (a controller), a driving element, a metal-oxide-semiconductor field effect transistor (MOSFET), an insulated gate bipolar transistor (IGBT), a diode or a passive element. The passive element can be a capacitor, an inductor with lesser inductance, or a resistor.

The second electronic element **320** includes a body **322** having a cavity **322***a*. The first electronic elements **310** are disposed in the cavity **322***a*. In the embodiment, the body **322** of the second electronic element **320** has a first surface **322***b*, a second surface **322***c* opposite to the first surface **322***b* and a side surface **322***d*. The cavity **322***a* sinks in a direction from the second surface **322***c* towards the first surface **322***b*. The side surface **322***d* connects the first surface **322***b* and the second surface **322***c*. Besides, the second electronic element **320** can be an energy-storage element used for storing electric energy. In detail, the second electronic element **320** further includes a coil **324** and a plurality of first external electrodes **326**. The coil **324** is disposed within the body **322**. The first external electrodes **326** are respectively connected to two opposite ends of the coil **324**, and extend outside the body **322** to locate on the first surface **322***b* and the side surface **322***d*.

The body **322** comprising a magnetic body encloses the coil **324**. The second electronic element **320** can be an inductive element, such as an inductor, with a greater inductance and a greater size than the first electronic elements **310**.

The first lead frame **330** has a plurality of leads **332**. Each of the leads **332** has a first end **332***a* and a second end **332***b*, and the first end **332***a* of each of the leads **332** can be embedded in the body **322** and extends to the cavity **322***a* for electrically connecting to the first electronic elements **310**. The second end **332***b* of each of the leads **332** is disposed on the first surface **322***b* of the body **322** to form a second external electrode **332***c*, and a part of each of the leads **332** connecting the first end **332***a* and the second end **332***b* is disposed on the side surface **322***d* of the body **322**.

In the present embodiment, the electronic package structure **300** further includes a platform, such as a circuit substrate **340**, and an insulating encapsulant **350**. The circuit substrate **340** is disposed in the cavity **322***a* of the body **322**. The first electronic elements **310** can be disposed on the circuit substrate **340** and electrically connected to the circuit substrate **340**. The circuit substrate **340** is electrically connected to the first end **332***a* of each of the leads **332** extending to the cavity **322***a*. The first electronic elements **310** may be electrically connected to the circuit substrate **340** via a wire bonding technology, a flip-chip bonding technology or a surface mount technology. The circuit substrate **340** has a first circuit layer **342**, a second circuit layer **344**, a dielectric layer **346** disposed between the first circuit layer **342** and the second circuit layer **344**, and at least a conductive channel **348**. The first electronic elements **310** are disposed on the first circuit layer **342**, and the conductive channel **348** penetrates the dielectric layer **346** for electrically connecting the first circuit layer **342** and the second circuit layer **344**. It should be noted that the circuit board **340** of the electronic package structure **300** may be omitted according to a design requirement of a designer, though it is not illustrated.

Moreover, the insulating encapsulant **350** is disposed in the cavity **322***a* and encapsulates the first electronic elements **310** and the circuit substrate **340** for protecting the first electronic elements **310** and the circuit substrate **340**, and enhancing a whole mechanical strength of the electronic package structure **300**.

Since the first electronic elements **310** and the circuit substrate **340** are disposed in the cavity **322***a* of the second electronic element **320**, compared to a conventional electronic package structures of FIG. **1** and FIG. **2**, utilization of an internal space of the electronic package structure **300** is relatively high, and the first electronic elements **310** and the circuit substrate **340** can be protected by the cavity **322***a*. Besides, since the insulating encapsulant **350** is disposed in the cavity **322***a*, material of the insulating encapsulant **350** can be directly filled into the cavity **322***a* without aiding of extra mold during formation of the insulating encapsulant **350**.

FIG. **3**B is a schematic diagram of another electronic package structure according to the first embodiment of the present invention. Referring to FIG. **3**A and FIG. **3**B, a difference between the electronic package structure **300'** and the electronic package structure **300** is that a part of each lead **332'** connecting a first end **332***a'* and a second end **332***b'* penetrates a body **322'**. Besides, the insulating encapsulant **350** of the electronic package structure **300** is different from a magnetic encapsulant **350'** of the electronic package structure **300'**. The magnetic encapsulant **350'** is disposed in a cavity **322***a'* of the body **322'**. Therefore, if a second electronic element **320'** is an inductive element, an inductive characteristic of the second electronic element **320'** influenced by the cavity **322'** then can

be compensated by the magnetic encapsulant **350'**. It should be noted that a part of each of the leads **332** connecting the first end **332***a* and the second end **332***b* may also penetrate the body **322** according to a design requirement, though it is not illustrated.

FIG. **3**C is a schematic diagram of another electronic package structure according to the first embodiment of the present invention. Referring to FIG. **3**A and FIG. **3**C, a difference between the electronic package structure **300"** and the electronic package structure **300** is that a cavity **322***a"* of a body **322"** sinks in a direction from a first surface **322***b"* towards a second surface **322***c"*. It should be noted that an insulating encapsulant **350"** can be substituted by a magnetic encapsulant according to a design requirement, and a part of each lead **332"** connecting a first end **332***a"* and a second end **332***b"* may also penetrate the body **322"** according to a design requirement, though it is not illustrated.

FIG. **3**D is a schematic diagram of still another electronic package structure according to the first embodiment of the present invention. Referring to FIG. **3**A and FIG. **3**D, a second lead frame **360** is applied in the electronic package structure **300'"** for substituting the circuit substrate **340** of the electronic package structure **300** according to a design requirement. A plurality of first electronic elements **310'"** are disposed on the second lead frame **360** and electrically connected to the second lead frame **360**. The second lead frame **360** is electrically connected to a first end **332***a'"* of each lead **332'"** of a first lead frame **330'"** that extends to a cavity **322***a'"*.

Second Embodiment

FIG. **4**A is a schematic diagram of an electronic package structure according to a second embodiment of the present invention. Referring to FIG. **4**A and FIG. **3**A, a difference between the electronic package structure **400** of the second embodiment and the electronic package structure **300** of the first embodiment is that a body **422** of a second electronic element **420** does not have the cavity **322***a*. In detail, a first end **432***a* of each lead **432** of a lead frame **430** is disposed on a first surface **422***a* of a body **422**, and a plurality of first electronic elements **410** are disposed on the first surface **422***a* and electrically connected to the leads **432**. Moreover, a second end **432***b* of each of the leads **432** is disposed on a second surface **422***b* of the body **422** opposite to the first surface **422***a*, and a part of each of the leads **432** connecting the first end **432***a* and the second end **432***b* is disposed on a side surface **422***c* of the body **422**.

Furthermore, a platform, such as a circuit substrate **440**, is disposed on the first surface **422***a* and electrically connected to the leads **432**, and the first electronic elements **410** are disposed on the circuit substrate **440** and electrically connected to the circuit substrate **440**. It should be noted that the circuit substrate **440** of the electronic package structure **400** may be omitted according to a design requirement of the designer, or the circuit substrate **440** may be substituted by a lead frame, though it is not illustrated.

FIG. **4**B is a schematic diagram of another electronic package structure according to the second embodiment of the present invention. Referring to FIG. **4**A and FIG. **4**B, a difference between the electronic package structure **400'** and the electronic package structure **400** is that a part of each lead **432'** connecting a first end **432***a'* and a second end **432***b'* penetrates a body **422'**.

Third Embodiment

FIG. **5**A is a schematic diagram of an electronic package structure according to a third embodiment of the present invention. Referring to FIG. **5**A, in the electronic package structure **500** of the present embodiment, a plurality of first electronic elements **510** are disposed on a first surface **532** of a platform, such as a printed circuit board or a circuit substrate **530** as shown in FIG. **5**A, and electrically connected to the circuit substrate **530**. A second electronic element **520** is disposed above the first surface **532** of the circuit substrate **530**. The first electronic elements **510** are located between a body **522** of the second electronic element **520** and the first surface **532** of the circuit substrate **530**, and the first electronic elements **510** are located between leads **524** of the second electronic element **520**. In other words, in the present embodiment, the second electronic element **520** covers the first electronic elements **510**. Besides, an insulating encapsulant **540** is disposed between the second electronic element **520** and the circuit substrate **530** and encapsulating the first electronic elements **510** for protecting the first electronic elements **510** and enhancing a whole mechanical strength of the electronic package structure **500**. Alternatively, the insulating encapsulant **540** can also be disposed to encapsulate at least part of the circuit substrate **530**, the first electronic elements **510** and the second electronic element **520**, or completely encapsulate all of them. Moreover, the circuit substrate **530** may further include at least a conductive channel **539**, and each of the conductive channels **539** penetrates a dielectric layer **538** for electrically connecting a first circuit layer **534** and a second circuit layer **536**. At least one of the conductive channels **539** (for example, the two conductive channels **539** located at a left side of FIG. **5**A) is located below at least one of the first electronic elements **510** (for example, the first electronic element **510** located at the left side of FIG. **5**A), so that heat generated by the first electronic element **510** located at the left side may be quickly transmitted to where is outside the electronic package structure **500** via the two conductive channels **539** located at the left side. A second end **524***b* of each of the leads **524** of the second electronic element **520** extends out from the body **522** to electrically connect the circuit substrate **530**. The second electronic element **520** may be an inductive element including a coil **526**. The body **522** which is a magnetic wrap wraps the coil **526**, and a first end **524***a* of each of the leads **524** is connected to one of two opposite ends of the coil **526**.

Still referring to FIG. **5**A, an embodiment of a method for manufacturing the electronic package structure **500** is described.

First, the plurality of first electronic elements **510** and any other components of the electronic package structure **500** are mounted to the circuit substrate **530**, the bottom pads of the components are soldered to corresponding pads of the circuit substrate.

Next, the upper pads (if any are present) of the components are wire bonded to corresponding pads of the circuit substrate **530**.

Then, the leads **524** of the second electronic element **520** are shaped, and the second electronic element **520** is mounted to the circuit substrate **530**, e.g., by soldering the leads to corresponding pads of the circuit substrate.

Next, the insulating encapsulant **540** is formed between the second electronic element **520** and the circuit substrate **530** and encapsulating the first electronic elements **510** by conventional methods. Alternatively, the insulating encapsulant **540** can also be formed to encapsulate at least part of the circuit substrate **530**, the first electronic elements **510** and the second electronic element **520**, or completely encapsulate all of them by conventional methods, such as injection molding of epoxy resin.

Then, the leads (not shown in FIG. **5**A) of the electronic package structure **500** are shaped, and the electronic package structure can be tested and shipped to customers.

It should be noted that the electronic package structure **500** further includes an electromagnetic-interference-shielding element (EMI-shielding element) **550** covering the first electronic elements **510**. In the present embodiment, the EMI-shielding element **550** is disposed on the body **522** of the second electronic element **520**, and is located between the body **522** of the second electronic element **520** and the circuit substrate **530**. Therefore, during operation of the electronic package structure **500**, it may be reduced by means of the EMI-shielding element **550** that electrical signals transmitted in the circuit substrate **530** is interfered by a magnetic force generated by the second electronic element **520** which functions as an inductive element.

FIG. **5**B is a schematic diagram of another electronic package structure according to the third embodiment of the present invention. Referring to FIG. **5**A and FIG. **5**B, a difference between the electronic package structure **500'** and the electronic package structure **500** is that an EMI-shielding element **550'** of the electronic package structure **500'** is disposed in a cavity **522'** of a second electronic element **520'**.

FIG. **6** is a side view of an embodiment of a second electronic element such as an inductor **620**, which can be used in the aforementioned electronic package structure. Each of the leads **624** is extensions of the inductor winding and has two bends **6240** and **6242**. For example, the angles of the bends **6240** and **6242** can be between approximately 30 and 90 degrees. Furthermore, although not shown, the bottoms of the leads **624** can also be bent at an approximately 90 degree angle to increase the mounting stability of the inductor **620**. Moreover, although only two leads **624** are shown, the inductor **620** can have more than two leads (e.g., four leads), to increase the mounting stability of the inductor, to reduce the lead resistance, etc.

FIG. **7** is a schematic diagram of an embodiment of a system **70**, which can incorporate one or more embodiments of the aforementioned electronic package structure; for example, the electronic package structure can be a power-supply module **700** as shown in FIG. **7**, where the module **700** includes a buck converter.

In addition to the module **700**, the system **70** includes an apparatus, such as a load **702**, which receives a regulated voltage Vout from the module, and a filter capacitor (C) **704**. Examples of the load **702** include an integrated circuit such as a processor or memory. In operation, a power-supply component, such as the controller **710** as shown in FIG. **7**, controls the other power-supply component, such as the transistors **712** as shown in FIG. **7**, to alternately couple an input voltage Vin and reference voltage (e.g., ground) to a phase inductor **720** in a manner that generates the regulated voltage Vout from Vin.

Still referring to FIG. **7**, alternate embodiments of the system **70** are contemplated. For example, embodiments described above in conjunction with FIGS. **3**A-**5**B can be applicable to the system **70**. Furthermore, although described as a buck converter, the module **700** can include any other type of power supply such as a buck-boost converter. Moreover, the module **700** can include additional components such as a filter inductor coupled between the phase inductor **720** and the load **702**. In addition, although described as being external to the module **700**, the filter capacitor **704** can be part of the module.

In summary, in the aforementioned embodiments of the present invention, since the first electronic elements can be disposed in the cavity of the second electronic element or can be disposed on the second electronic element, or the second electronic element can be stacked on the first electronic elements, compared to the conventional electronic package structures, utilization of an internal space of the electronic package structure is relatively high, so that a size of the electronic package structure can be reduced.

It will be apparent to those skilled in the art that various modifications and variations can be made to the structure and method of the present invention without departing from the scope or spirit of the invention. In view of the foregoing, it is intended that the present invention cover modifications and variations of this invention provided they fall within the scope of the following claims and their equivalents.

What is claimed is:

1. A power-supply module, comprising:
- at least one power-supply component;
- an inductor disposed over the at least one power-supply component, wherein the inductor has a magnetic body and a coil encapsulated in the magnetic body, wherein the magnetic body encloses the coil therein and contiguously extends into the hollow space formed by the coil, wherein the magnetic body further contiguously extends to a first lateral side of the at least one power-supply component;
- a package, wherein the at least one power-supply component and the inductor are disposed within the package, wherein the package comprises epoxy resin to encapsulate the at least one power-supply component and the inductor; and
- a first lead frame, wherein a first portion of the first lead frame is disposed between the at least one power-supply component and the inductor inside the package, and a second portion extending from the first portion of the first lead frame is disposed on a top or bottom surface of the package for connecting with an external circuit.

2. The power-supply module as claimed in claim **1**, wherein the magnetic body further contiguously extends to a second lateral side of the at least one power-supply component.

3. The power-supply module as claimed in claim **1**, wherein the at least one power-supply component comprises a plurality of electrical components that are electrically connected.

4. The power-supply module as claimed in claim **1**, wherein the at least one power-supply component comprises a controller.

5. The power-supply module as claimed in claim **1**, wherein the at least one power-supply component comprises a transistor.

6. The power-supply module as claimed in claim **1**, wherein the at least one power-supply component comprises a resistor.

7. The power-supply module as claimed in claim **1**, wherein the at least one power-supply component comprises a capacitor.

8. The power-supply module as claimed in claim **1**, further comprising:
- a platform, wherein the at least one power-supply component and the inductor are mounted to the platform.

9. The power-supply module as claimed in claim **1**, further comprising:
- a printed circuit board, wherein the at least one power-supply component and the inductor are mounted to the printed circuit board.

10. The power-supply module as claimed in claim **1**, wherein the at least one power-supply component comprises a plurality of electrical components, further comprising: a

circuit substrate disposed between the plurality of electrical components and the inductor, wherein the plurality of electrical components and the inductor are electrically connected to the circuit substrate.

11. A power-supply module, comprising:

an electronic module comprising at least one power-supply component;

an inductor disposed over the electronic module, wherein the inductor has a magnetic body and a coil encapsulated in the magnetic body, wherein the magnetic body encloses the coil therein and contiguously extends into the hollow space formed by the coil, wherein the magnetic body further contiguously extends to a first lateral side of the electronic module;

a package, wherein the electronic module and the inductor are disposed within the package, wherein the package comprises epoxy resin to encapsulate the electronic module and the inductor; and

a first lead frame, wherein a first portion of the first lead frame is disposed between the electronic module and the inductor inside the package, and a second portion extending from the first portion of the first lead frame is disposed on a top or bottom surface of the package for connecting with an external circuit.

12. The power-supply module as claimed in claim **11**, wherein the second portion of the lead frame extends from the first portion to said top or bottom surface of the package through a third portion of the lead frame disposed on a lateral surface of the package.

13. The power-supply module as claimed in claim **11**, wherein the second portion of the lead frame extends from the first portion to said top or bottom surface of the package through a third portion of the lead frame disposed inside the package.

14. The power-supply module as claimed in claim **11**, further comprising a second lead frame having a third portion disposed between the at least one power-supply component and the inductor inside the package, and a fourth portion extending from the third portion is disposed on the same surface on which the second portion of the first lead frame is disposed.

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